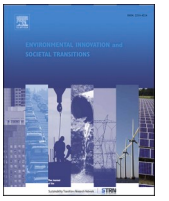
Environmental Innovation and Societal Transitions 46 (2023) 100694



Contents lists available at ScienceDirect

Environmental Innovation and Societal Transitions

journal homepage: www.elsevier.com/locate/eist



Research article



A psychometric approach to assess justice perceptions in support of the governance of agricultural sustainability transitions

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ARTICLE INFO

Keywords:
Agriculture
Distributive justice
Procedural justice
Recognitional justice
Sustainable governance
Transitions

ABSTRACT

There is consensus that we need sustainability transitions and increasing acknowledgement that such transitions should be conducted in a just manner. However, what exactly a 'just transition' means and how this should be brought about is less clear. Attempts to examine the justice of transitions to date primarily rely on normative interpretations of what justice means. Using the English agricultural transition as a case, we develop an instrument that builds on the underlying dimensions of justice evaluations to provide a tool for decision-makers to gain insights into societal perceptions of what a just agricultural transition means to them. When adapted, this instrument is also valuable for sustainability transitions in other sectors. We establish adequate construct reliability and validity for a number of constructs such as Equality, Entitlement, and Merit as Principles of Procedural Justice, whilst others such as the different Topics of Distributional Justice will need further refinement.

1. Introduction

There is consensus that we need sustainability transitions across societal domains in order to address challenges of climate change, biodiversity loss, environmental degradation, and growing inequality. An expanding field of research examines how these kinds of transitions can be achieved, and increasingly attention is turned to their political nature (Köhler et al., 2019). It is acknowledged that transition processes are inherently disruptive, considerably altering or destructing old systems altogether (Kivimaa et al., 2021) and that not everyone will benefit from this (Leach et al., 2007; Meadowcroft, 2011). However, so far, this acknowledgement has not translated into a clear understanding of how to govern transitions in a way that takes account of the justice implications of this nature of transition (Avelino et al., 2016; Köhler et al., 2019).

The agricultural sector has been highlighted as one of the societal domains that requires a sustainability transition (El Bilali, 2020; FAO et al., 2021; Young Park et al., 2021), because currently dominant agricultural practices considerably contribute to climate change, biodiversity loss, environmental degradation, and social inequality (Awuchi et al., 2020; Cadieux and Slocum, 2015; IPCC, 2019; Mares and Peña, 2011). These practices are in part a result of the agricultural policies that incentivise particular ways of farming. Therefore, a change in the policies that shape agricultural practices is needed (FAO et al., 2021; Pe'er et al., 2020). Simultaneously,

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https://doi.org/10.1016/j.eist.2023.100694
Received 31 August 2022; Received in revised form 14 January 2023; Accepted 16 January 2023
Available online 20 January 2023
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agriculture is under increasing pressure from multiple environmental and demographic changes (e.g. IPBES, 2019; IPCC, 2021; UNEP, 2021).

As early as the 1970s, labour organisations have highlighted that these kinds of transitions should be conducted in a socially just way (Cha, 2020; Galgóczi, 2020; Newell and Mulvaney, 2013; Sabato and Fronteddu, 2020). This call for a just transition has also been incorporated in multiple international agreements and declarations such as the Paris Agreement (UN, 2015), the International Labour Organization's Guidelines for a Just Transition (ILO, 2015), the Silesia Declaration on Solidarity and Just Transition (UNCCC, 2018), the European Green Deal (European Commission, 2019), and the draft text for the post-2020 global biodiversity framework (UNEP, 2020). This reflects the insight that transitions can only be sustainable if they are designed in a socially just way (Wang and Lo, 2021). However, none of these documents set out a clear definition of what is meant by a just transition (Jenkins et al., 2020; Velicu and Barca, 2020), nor do they provide a blueprint of how to achieve this. In addition, in these agreements, and in the scientific literature alike, the idea of just transitions has primarily been connected to climate change and energy transitions (Bennet et al., 2019; Cha, 2020; Kaljonen et al., 2021). Only recently have researchers highlighted the need to broaden the application of just transition thinking to agricultural transitions (Aubert et al., 2021; Blattner, 2020; Carlisle et al., 2019; Dale, 2020; Hebinck et al., 2021; Hedberg, 2021; Murphy et al., 2022; Stevis, 2021; Tschersich and Kok, 2022; Young Park et al., 2021). It remains unclear what a just agricultural transition looks like and how to achieve it.

Furthermore, these international agreements, and many scientific articles alike, do not recognize that justice has no universally agreed meaning. Perceptions of what is, or is not, just are entrenched in individual values and societal norms (Rasinski, 1987; Sikor et al., 2014) and views on how justice should be prioritized and enacted through policies vary (Burchardt and Craig, 2008). It is therefore a highly normative concept (Smaal et al., 2020; Wang and Lo, 2021; Wijsman and Berbés-Blázquez, 2022; Wolff, 2008). However, without having a clear idea of what is perceived as a just transition, it will be very difficult to achieve it (Cadieux and Slocum, 2015; Piachaud, 2008).

As societal perceptions of injustice are motivators for political protest (Rothmund et al., 2016; Wieliczko et al., 2021), and thus undermine the sustainability of any transition (Herrero et al., 2020; Markard et al., 2020; Martin and Islar, 2020; Meadowcroft, 2011), we argue that for the governance of transitions societal justice perceptions are of central importance. Efforts to create sustainability transitions have already resulted in societal unrest. In relation to agricultural policy changes, large scale protests in the Netherlands (Gijs, 2022), India (Bhatia and Katakam, 2021), and France (Chiarello and Libert, 2019) provide prime examples of the need for a better understanding of societal justice perceptions to underpin transition policy development. In order to be able to take societal justice perceptions into consideration in the governance of transitions, we need to know what these perceptions are (Schlosberg, 2013). Whilst there exist several tools to assess general justice perceptions (Harding et al., 2021; Heyen et al., 2021; Liebig et al., 2015, 2016; Rasinski, 1987) and environmental attitudes (Bernstein and Szuster, 2019; Bouman et al., 2018; Franzen and Vogl, 2013; Milfont and Duckitt, 2010), to the best of our knowledge there does not exist an instrument through which justice perceptions in the context of transitions can be assessed. Therefore, this study aims to develop such an instrument. The research questions that guide our development of this instrument are: what are the underlying dimensions that people base their normative justice evaluations on and can these be used to assess societal perceptions of what a just transition means to a specific society? To answer these questions, we take England as a case study as it is currently in the midst of designing a post-Brexit agricultural transition that moves away from the EU's Common Agricultural Policy (CAP) in which farmers receive subsidies based on the amount of land that they manage (European Parliament, 2020) toward a system that pays farmers public money for the provisioning of public goods (DEFRA, 2020a).

In doing so, this paper contributes to the transition literature by broadening the notion of just transitions to the agricultural context and by providing an operationalisation that can acknowledge the normative nature of justice. Beyond that, we provide policy makers with a tool that can inform the governance of sustainability transitions. Whilst individual perceptions of a just transition will ultimately vary, this tool gives insights into the general direction of the justice perceptions that are present in society, thereby helping governments to take account of the justice implications of transitions and minimize resistance to transition pathways.

2. Dimensions of justice perceptions

As justice and just transitions are normative concepts, it is not surprising that there are a myriad of theories and interpretations of these concepts. In this section, it is not our aim to review all normative conceptions of justice. Instead, we focus on the underlying dimensions and interconnected sub-dimensions that are generally used to make normative claims of justice. We draw on insights from political philosophy, social psychology, environmental justice, food justice, and social justice literature. Within these strands of literature, there are generally three overarching dimensions of justice that are brought forward: distributional justice, procedural justice, and recognitional justice (Bennett et al., 2019; Heffron and McCauley, 2018; Martin, 2017). These three dimensions are widely applied and recognized in the sustainability transition literature (Kaljonen et al., 2021). Several authors mention restorative justice (Hazrati and Heffron, 2021; Robinson and Carlson, 2021; Van Ness and Strong, 2010) and cosmopolitan justice (Jayapalan and Ganesh, 2019; McCauley et al., 2019; Sunio, 2021) as additional justice dimensions. We have decided to integrate the arguments used in these two additional justice dimensions into the dimensions of distributional and recognitional justice, as the underlying sub-dimensions and constructs of restorative and cosmopolitan justice arguments relate to who (and at what geographical scale) should be recognized and on what grounds costs and benefits should be distributed. Equally, the categorization of the sub-dimensions within the three justice dimensions as presented below is based on our understanding of whether a specific sub-dimension primarily relates to argumentations around the distribution of costs and benefits, procedural aspects, or who should receive moral consideration.

2.1. Distributional justice

Distributional justice encompasses perceptions of the justice of how costs and benefits of decisions are distributed within society (Martin, 2017; Rothmund et al., 2016). This includes four sub-dimension: a) *Topics of Distributional Justice* – i.e. whether people think that the right kinds of costs and benefits are considered (Kaljonen et al., 2021; Newell and Mulvaney, 2013; Schlossberg, 2013), b) *Mechanisms of Distributional justice* – i.e. whether the policy instruments used to distribute the costs and benefits are perceived as just (Sterner and Robinson, 2018; Wieliczko et al., 2021), c) *Principle of Distributional Justice* – i.e. whether the underlying principle that is used to decide who should receive what kind of costs and benefit is considered just (Bennett et al., 2019; Jasso et al., 2016; Picachaud, 2008), and d) *Viewpoint of Justice* – i.e. what is used as a vantage point to judge distributional impacts (Schuitema et al., 2011; Schuitema and Bergstad, 2019).

In relation to agricultural transitions, the potential *Topics of Distributional Justice* that have been brought forward can broadly be categorized through the constructs of environmental and socio-environmental costs and benefits such as environmental pollution and access to nature (Martin, 2017; Schlosberg, 2013), food costs and benefits such as food prices and nutritional quality (Cadieux and Slocum, 2015; Holt-Giménez and Shattuck, 2011; Smaal et al., 2020), and economic costs and benefits such as job loss and creation of new jobs (Carlisle et al., 2019; Hedberg, 2021; Newell and Mulvaney, 2013), all of which incorporate both monetary and non-monetary aspects. The *Mechanisms of Distributional Justice* can be categorized along constructs related to the type of policy instruments: financial incentives, financial disincentives, regulations, and guidance and information (Pacheco-Vega, 2020; Sterner and Robinson, 2018). The *Principles of Distributional Justice* can be classified through the constructs of Equality - i.e. distribution so that everyone receives an exactly equal share, Equity and Need - i.e. distribution according to means and need, Entitlement - i.e. distribution according to historic position or right, and Merit - i.e. distribution according to effort (Bennett et al., 2019; Liebig et al., 2016; Piachaud, 2008; Rasinski, 1987; Rothmund et al., 2016). Finally, the *Viewpoint of Justice* in this context can be categorized as Intrapersonal, where people base their perception of justice on how the transition affects them personally compared to how their own life was before the transition, and Interpersonal, where people base their perception of justice on how the transition affects themselves in comparison to how it affects others (Schuitema et al., 2011; Schuitema and Bergstad, 2019). Theoretically, an agricultural transition will thus be perceived as just in terms of distributional justice if it addresses the right selection of topics, through the right kind of policy instruments, with the right underlying principle of distribution, and if the individual is impacted by the change in the right way according to the person making the justice evaluation.

2.2. Procedural justice

Procedural justice encompasses two sub-dimensions: *Degree of Involvement* – i.e. conceptions of the degree of stakeholder involvement in decision making and implementation, and *Principles of Procedural Justice* – i.e. the underlying principles that are used to decide who should get how much influence in the process (Kaljonen et al., 2021; Sabato and Fronteddu, 2020; Vermunt and Steensma, 2016). The *Degree of Involvement* can range from no stakeholder involvement at all to joint government-stakeholder decision-making (Arnstein, 1969; Hurlbert and Gupta, 2015). The *Principles of Procedural Justice* are the same as the principles of distributional justice, but applied to the transition process: Equality – i.e. everyone has the same opportunity to be involved and the same degree of influence in the process, Equity and Need – i.e. those who need it receive support to take part and those who have most at stake receive most influence, Entitlement – i.e. those who have traditionally been most influential in the agricultural sector receive most influence in the transition process based on their historic role, and Merit – i.e. experts receive most influence in the process based on their expertise (Bennett et al., 2019; Liebig et al., 2016; Piachaud, 2008). Theoretically, an agricultural transition will thus be perceived as just in terms of procedural justice if it has the right degree of stakeholder involvement and uses the right underlying principle to decide who should have most influence in the process according to the person making the justice evaluation.

2.3. Recognitional justice

Recognitional justice relates to perceptions on who or what should receive moral consideration in the transition. This includes four sub-dimensions: a) *Stakeholder Inclusion* – i.e. what stakeholders should be considered, b) *Social Inclusion* – i.e. what societal vulnerable groups should be considered, c) *Geographical Scale of Justice* – i.e. what geographical scale should be taken into account, and d) *Knowledge Types* – i.e. what types of knowledge should be recognized as legitimate to build decisions on (Burchardt and Craig, 2008; Kaljonen et al., 2021; Martin et al., 2016; Stevis and Felli, 2020; Velicu and Barca, 2020). *Stakeholder Inclusion* relates to what interests of (potentially impacted) groups should be considered. This could also be extended to include interests of future generations and/or multi-species (Celermajer et al., 2021; Fitz-Henry, 2021; Schlosberg, 2013; Schuitema and Bergstad, 2019; Wieliczko et al., 2021). In the agricultural context, this can then be captured by the constructs of Agricultural, Forestry, and Landowner Interests, Environmental and Future Generations' Interests, Social Interests, and Economic Interests. *Social Inclusion* relates to what societal vulnerable groups should be considered, including the recognition of their cultural practices, pre-existing rights, and identities (Bennett et al., 2019; Crowe and Li, 2020; Smaal et al., 2020). Broadly speaking we can capture these through the constructs of Minorities, Children and Disabled People, and Women. The *Geographical Scale of Justice* can be seen as a scale ranging from local to global and describes the geographical breadth that should be recognized when considering potential costs and benefits and stakeholders to include (Sabato and Fronteddu, 2020; Smaal et al., 2020; Stevis and Felli, 2020; Wieliczko et al., 2021). Finally, *Knowledge Types* in the agricultural context can be broadly categorized as recognizing Scientific Knowledge and/or Local/Traditional Knowledge (Kaljonen et al., 2021; Martin et al., 2016). Theoretically, an agricultural transition will thus be perceived as just in terms of recognitional justice if it considers the

right kind of stakeholders at the right geographical scale, and if decisions are based on the right type of knowledge.

All three of the justice dimensions, as summarized in Fig. 1, are interlinked and influence each other. They can all be an end in and of themselves, but to create an overall just perception of an agricultural transition all three need to be perceived as just (Burchardt and Craig, 2008; Heffron and McCauley, 2018; Martin, 2017; Vermunt and Steensma, 2016).

3. Methods

We chose England as the context for the development of our instrument because an agricultural transition is currently taking place there. This transition has been described by some as "a massive field experiment for CAP reform" (Hill, 2020), indicating that it can function as an example of a transition pathway for other countries to learn from. The main pillar of this transition is a move away from direct payments to farmers based on the amount of land that they manage to payments for efforts undertaken to provide specific public goods such as clean water, clean air, and thriving wildlife (DEFRA, 2020a). This policy shift sits in a wider context of changes to the UK Agriculture Act, (environmental) regulations, available agricultural grants and schemes, and trade agreements (Agriculture Act, 2020; DEFRA2020b; DEFRA, 2021a; DIT, 2022; Environment Act, 2021).

3.1. Instrument development

The questionnaire was designed following broadly the steps as suggested by Robinson (2018). Initial questions and items were generated based on the above operationalisation of the just transition concept. We also aimed to make the items relevant to the English context. Two one-hour workshops were conducted by the lead author, one with six environmental governance researchers and one with five agricultural innovation researchers. These workshops were used to refine the preliminary items by discussing their clarity, whether they captured the various justice aspects, and to identify any missing relevant aspects. After these workshops, the question order and survey layout was designed in Qualtrics Survey Software based on the guidelines by Dillman et al. (2014). The preliminary items were piloted through five cognitive interviews with people from the general public (age range 39–68, three female, two male) and a quantitative pilot with 81 participants (staff and students at [blinded for peer review]). Based on the interview feedback and pilot results, we modified some of the items and shortened the overall questionnaire, resulting in the following instrument:

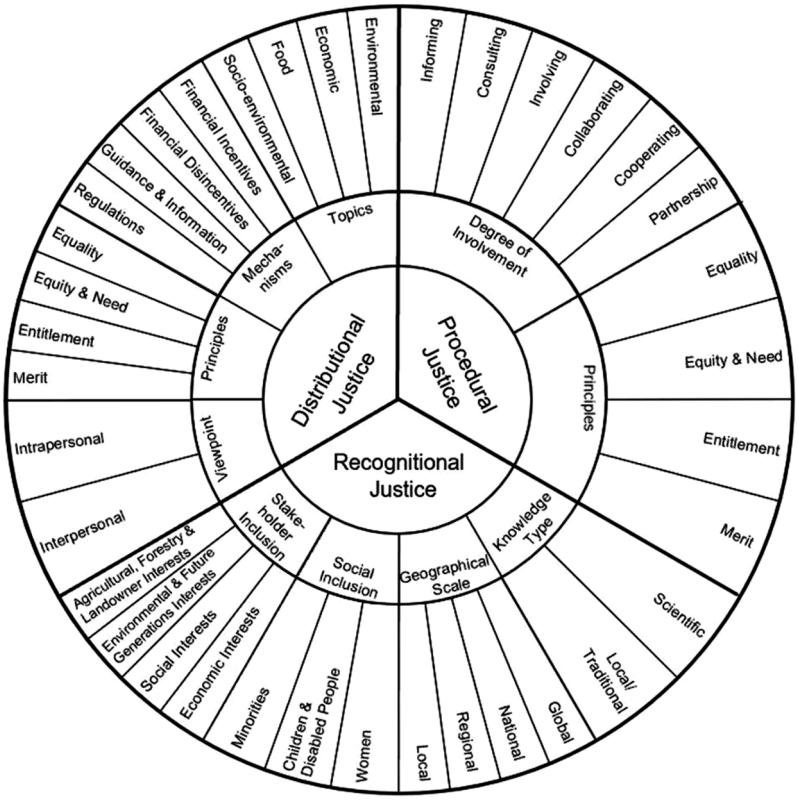


Fig. 1. Proposed underlying dimensions of perceptions of just agricultural transitions.
The inner circle presents the three overarching justice dimensions. Consequent outer circles represent sub-dimensions and their constructs.

3.1.1. Assessing perceptions of distributional justice

Perceptions on *Topics of Distributional Justice* were assessed using 12 items that respondents had to rank from most to least important. This was the only rank-order question; for all other items the respondents were asked to answer on a seven-point Likert Scale. We chose to have this question as rank-order because in the pilot stage we identified that all items were generally perceived as very important and we were not able to capture prioritization of the topics in case of trade-offs between them. By having this question as a rank-order question, we were able to assess relative importance of the topics to each other. Topics covered were based on aspects that are discussed in the agricultural transition, food justice, and environmental justice literature (e.g. Cadieux and Slocum, 2015; Carlisle et al., 2019; Holt-Giménez and Shattuck, 2011; Schlossberg, 2013) and that were identified in the workshops. Exact wording of these and all other items can be found in Appendix A Table A.1.

Perceptions on *Mechanisms of Distributional Justice* – i.e. Financial (dis)incentives, Regulations, and Guidance and Advice, were assessed with 25 items which were developed based on currently existing and proposed policy instruments. These were derived from policy documents (e.g. Agriculture Act, 2020; DEFRA, 2020a, 2020b, 2020c, 2021b; HM Government, 2018), public debates on how to potentially create change in the agricultural sector (e.g. UK Parliament, n.d.; DEFRA, 2018), and the workshops. For the wording of the items, we aimed to capture the mechanism behind the policy instrument, rather than exact details, to be able to cover as broad a range as possible in the types of policy instruments that could be deployed in support of agricultural transitions. For each of these items, respondents were asked to indicate to what extent they agreed or disagreed that the guidance of agricultural change by the government would be just if this policy instrument were to be implemented.

Perceptions on the *Principles of Distributional Justice* were assessed using 12 items, three for each principle. These items were inspired by the Basic Social Justice Orientation Scale (Liebig et al., 2016) and the work by Rasinski (1987) and Bennet et al. (2019) but adapted to agricultural transitions and our conceptualisation of the distributional principles. Here, respondents were asked to indicate the extent to which they agreed or disagreed that a certain way of distributing cost and benefits of agricultural change is just.

Perceptions on the *Viewpoint of Justice* were assessed with six items that were inspired by the work of Schuitema and Bergstad (2019) and Schuitema et al. (2011) and adapted to the context of agricultural transitions. Here, respondents were asked to indicate how important or unimportant they find it for the justice of agricultural transitions how they themselves are impacted by the consequences of the changes compared to how others are impacted.

3.1.2. Assessing perceptions of procedural justice

Perceptions on the *Degree of Involvement* were assessed using six items, inspired by Arnstein's (1969) classic typology of citizen participation. Respondents were asked for each of the items to indicate to what extent they agreed or disagreed that they were important for the justice of agricultural change.

Perceptions on the *Principles of Procedural Justice* were assessed similarly as the perceptions on the *Principles of distributional justice* with 12 items, but now applied to what principle is just in deciding who should have most influence in the process of designing agricultural transitions.

3.1.3. Assessing perceptions of recognitional justice

Perceptions on *Stakeholder Inclusion* were assessed with 24 items. Each item described a different potential type of stakeholder group and respondents were asked to indicate to what extent the interests of these specific stakeholders should be taken into account in order for the agricultural transition to be just. To reflect the English context, the type of stakeholders listed was based on self-proclaimed stakeholders who are publicly listed as having given input to the process leading up to the UK Agriculture Act (UK Parliament, 2020) and consultation on proposed post-Brexit agricultural policy (DEFRA, 2018). If this survey is to be used in a different context, this list should be revised to reflect the potential stakeholders in that specific setting. In addition, we added future-generations, nature, farm-animals, and wild-animals to this list to reflect the scientific debate of these stakeholders deserving moral consideration (Celermajer et al., 2021; Fitz-Henry, 2021) and we allowed respondents to add any additional stakeholders if they wished to do so. Following typical groupings of different stakeholder interests this approach meant that we included seven items for Agricultural, Forestry, and Landowner Interests, six items for social interests, five items for economic interests, and six items for environmental and future generations' interests.

Perceptions on *Social Inclusion* were assessed with eight items. Here, we focussed on specific societal groups that are generally considered to be vulnerable and therefore might require additional consideration. We included three items for Minorities, two items for Children and Disabled People and two items for Sexes. Initially we only included 'women' as an item, but following the pilot we also added an item for 'men' in this question as all participants in the cognitive interviews indicated that they found it strange that women were listed but not men.

Perceptions on the *Geographical Scale of Justice* were assessed with four items, one for each geographical scale ranging from local-regional-national-global. The wording of these items were specified for the English context and should be adapted if the survey is used in a different setting. The respondents were asked to indicate how important or unimportant they find it for the justice of agricultural transitions that potential consequences at each geographical scale are taken into account.

Perceptions on the recognition of *Knowledge Types* were assessed with two items: one for Scientific Knowledge and one for Local/Traditional Knowledge adapted from the Food and Agriculture Organization of the United Nations' (FAO, 2004) definition. Respondents also had the opportunity to add additional knowledge types if they wished to do so. The respondents were asked to indicate how much or little the government should take these types of knowledge into consideration for decision-making to be just.

For all questions, all items were shown in random order to minimize systemic bias resulting from item-ordering (Wilson and Lankton, 2012; Wilson et al., 2017). We further also included questions related to the respondents' background and we asked

respondents to indicate how important or unimportant they find it that agricultural transitions are just.

3.2. Data collection and sample

Data were collected using an online survey, which was distributed to a Qualtrics panel of adults (18+) living in England. We aimed to collect a representative sample with a sample size of 400, taking account of age, gender, education, income, and distribution across England. Attempted responses were terminated when a quota in a certain group was met ($n = 8023$), when the respondent was younger than 18 ($n = 62$), or when they were speeding through the survey ($n = 526$). Further responses were excluded based on duplication ($n = 176$), straight lining ($n = 183$), or partial response ($n = 3755$). The survey was live collecting responses between January – April 2022, until a representative sample of 400 was reached. See Appendix A Table A.2. for a breakdown of our sample distribution compared to the English population distribution and [blinded for peer review] for access to the full dataset and a representation of the full survey layout.

3.3. Data analysis

As this study represents the development of a new instrument, we took a combined explorative and confirmative approach, following broadly the steps as suggested by Boateng et al. (2018), Robinson (2018), and Spector (1992). All analyses were conducted in RStudio version 1.4.1717 (Rstudio Team, 2021) using the packages lavaan (Roseel, 2012) and psych (Revelle, 2022).

First, we examined mean values, standard deviations, Mardia's skewness and kurtosis, and the Henze-Zirkler multivariate normality test to determine whether the normality assumption was met, which was not the case. We also examined the suitability of the data for factor analysis with the Kaiser-Meyer-Olkin (KMO) test, where values above 0,70 indicate that the data are suitable (Worthington and Whittaker, 2006; Watkins, 2018).

Second, we assessed Cronbach alpha and conducted EFA. Cronbach alpha is a measure of scale reliability (internal consistency reliability), with values of 0,70 or above generally stated as the cut-off value, but with some room for leeway (Bagozzi and Yi, 2012; Taber, 2018). EFA can be used to empirically identify the factor structure, which is especially useful when aiming to examine the latent factors that account for shared variance between items. We used common factor analysis, MinRes as estimation method as this does not require the fulfilment of specific distributional assumptions, and oblimin as factor rotation method as the nature of the constructs makes it highly likely that the factors are correlated (Worthington and Whittaker, 2006; Watkins, 2018). Our goal with this part of the analysis was to identify whether the factors that we expected to be present in the data based on theoretical understanding of the dimensions, sub-dimensions, and constructs related to perceptions of justice would appear or whether the empirical data would suggest potentially alternative factors. As criteria for factor retention we used a combination of the Kaiser's criterion (where factors with an Eigenvalue of <1 are retained), examination of the scree plot, parallel analysis, and theoretical sense (Kahn, 2006). Criteria used to determine item deletion or retention were based on item loadings and cross-loadings, as well as Cronbach alpha if item is dropped (Worthington and Whittaker, 2006). This was an iterative process in which individual items were retained or deleted, followed by another EFA and examination of Cronbach alpha values, until a stable, satisfactory factor structure was identified.

Third, we conducted Confirmatory Factor Analysis (CFA) and examined the average variance extracted (AVE) to assess construct validity, with AVE values of 0,50 or higher considered being acceptable (Hair et al., 2019; Lockwood et al., 2015). We used a robust version of the maximum likelihood estimator with scaled test statistics (equal to Yuan Bentler) and robust standard errors (Huber--White) (Maydeu-Olivares, 2017; Rosseel, 2014). To assess construct reliability we examined Raykov's rho coefficient, where values should ideally be above 0,70 (Hair et al., 2014; Peterson and Kim, 2013; Raykov, 2001). To assess discriminant validity we examined the Fronell-Larcker Criterion, where the square root of AVE of a construct needs to exceed the correlation of the construct with the other constructs (Mat Roni and Djajadikerta, 2021).

In the instances where the EFA models differed from what we had expected based on theory, we compared CFA models following the factor structure as identified through the EFA with CFA models following the factor structure as proposed by prior theoretical assumptions. In the next step, we continued with the CFA model that performed best in terms of AVE and construct reliability.

For three of the sub-dimensions, *Topics of Distributional Justice, Geographical Scale of Justice*, and *Knowledge Types*, we did not conduct EFA and CFA as this was deemed inappropriate based on how the question and items related to these sub-dimensions were designed. Instead, for the items related to *Topics of Distributional Justice* and the items related to *Geographical Scale of Justice* we conducted the Friedman Test to determine whether there was a significant difference between the ranking or rating of the items (Pimentel et al., 2016), Kendall's W to assess the strength of the difference (Field, 2005), and the Wilcoxon Signed Rank Test to identify which items grouped together, i.e. did not have a significant difference between them (Smalheiser, 2017). For the items related to *Knowledge Types* we only conducted the Wilcoxon Signed Rank test as there were only two items to examine. For all three sub-dimensions we also examined mean values and standard deviations, and for the *Knowledge Types* items we examined a combined frequency table.

Finally, to illustrate the usefulness of this tool in a policy context and to give results on which justice constructs and sub-constructs are important in the English case, we created summated rating scales for the sub-constructs and constructs by calculating the weighted summated mean (DiStefano et al., 2009; Robinson, 2018).

4. Results

4.1. Reliability and validity of developed scales

We present here the results of the final EFA models that we took forward for further analysis followed by the CFA results.

4.1.1. Distributional justice constructs

Principles of Distributional Justice (KMO= 0,81). As the items related to the constructs of Equity and Need and Entitlement were unstable, the final EFA model that we took forward for further analysis only consisted of the Equality and Merit items. Including only these items resulted in a two-factor solution. Both factors together explained 43% of variance, with the Equality factor explaining 24% of variance and the Merit factor explaining 18% of variance. Cronbach alpha was 0,72 (95% CI= 0,68 – 0,77) for the Equality factor and 0,63 (95% CI= 0,57 – 0,69) for the Merit factor.

Mechanisms of Distributional Justice (KMO= 0,91). The EFA revealed a different structuring of the items than what we had anticipated based on the theory: rather than items grouping together based on policy instrument type, they grouped together based on their policy focus, with three main themes which make theoretically sense: a focus on the Environment and Animal Welfare, a focus on Social Support, and a focus on Reducing Agriculture. Three items were excluded based on their poor factor loadings and reliability scores. One of these items was a reversed item and the data indicated that the respondents did not realize this. The three factors together explained 44% of variance, with the Environment and Animal Welfare factor explaining 23% of variance, the Social Support factor explaining 12%, and the Reducing Agriculture factor explaining 9%. Cronbach alpha was 0,89 (95% CI= 0,88 – 0,91) for the Environment and Animal Welfare factor, 0,79 (95% CI= 0,76 – 0,82) for the Social Support factor, and 0,76 (95% CI= 0,72 – 0,79) for the Reducing Agriculture factor. Due to the alteration in what we are assessing, we will henceforward refer to this sub-dimension as *Policy Focus of Distributional Justice*.

Viewpoint of Distributional Justice (KMO= 0,80). As conducting EFA with MinRes as estimation method was not appropriate here, we used WLS as estimation method for this construct. The EFA revealed a different factor structure than we had anticipated based on the theory. On closer examination of the item wordings this structure was logical, but assesses a different aspect than we intended: instead of assessing intrapersonal versus interpersonal viewpoints, the factors as revealed by the EFA assess perceptions on personal impact: whether an agricultural transition results in improvement of the own situation (Self-Improvement) or whether it does not make one's own position worse (Not-Worsening). These two factors, which we took forward in further analysis, together explained 0,65% of variance, with the Self-Improvement factor explaining 21% of variance and the Not-Worsening factor explaining 43% of variance. Cronbach alpha was 0,73 (95% CI= 0,68 – 0,78) for the Self-Improvement factor and 0,86 (95% CI= 0,84 – 0,88) for the Not-Worsening factor. Due to the alteration in what we are assessing, we will henceforth refer to this sub-dimension as *Personal Impact*.

4.1.2. Procedural justice constructs

Principles of Procedural Justice (KMO= 0,82). The final EFA model that we took forward for further analysis was exactly as expected based on the theory. This four-factor solution together explained 56% of variance, with the Equality factor explaining 15%, the Equity and Need factor explaining 10%, the Entitlement factor explaining 17%, and the Merit factor explaining 15%. Cronbach alpha was 0,79 (95% CI= 0,75–0,82) for the Equality factor, 0,63 (95% CI= 0,56–0,69) for the Equity and Need factor, 0,83 (95% CI= 0,80–0,86) for the Entitlement factor, and 0,81 (95% CI= 0,78–0,84) for the Merit factor.

Degree of Involvement (KMO= 0,91). EFA revealed that there was only one factor. Based on the theory we had expected that there would be at least two factors (with items expressing activities with lower degrees of involvement and those expressing higher degrees of involvement creating separate factors). However, as all items were expressions of different kinds of stakeholder involvement, it is also theoretically sensible to address all these items under a single sub-dimension of *Degree of Involvement*, where agreeing more with an item indicates being in favour of higher degrees of involvement. This single-factor solution explained 62% of variance and Cronbach alpha was 0,91 (95% CI= 0,89 – 0,92).

4.1.3. Recognitional justice constructs

Subject of Justice – Stakeholder Inclusion (KMO= 0,94). The final EFA model that we took forward for further analysis was a reduced version from what we had expected based on theory. It was a two-factor solution with a reduced number of items which together explained 45% of variance. One factor related to Farmer, Environmental, & Future Generations' Interests and explained 22% of variance, whilst the other factor related to Social and Economic Interests and explained 23% of variance. Cronbach alpha was 0,85 (95% CI= 0,82 - 0,87) for the Farmers, Environment, & Future Generations' Interests factor, and 0,85 (95% CI= 0,83 – 0,87) for the Social and Economic Interests Factor.

Subject of Justice – Social Inclusion (KMO= 0,89). The final EFA model was exactly as we expected based on the theory. It provided a three-factor solution which together explained 76% of variance. The factor related to Minorities explained 31% of variance, the factor related to Children and Disabled People explained 20% of variance, and the factor related to Sexes explained 25% of variance. Cronbach alpha was 0,88 (95% CI= 0,86–0,90) for the Minorities factor, 0,84 (95% CI= 0,80–0,87) for the Children and Disabled People factor, and 0,88 (95% CI= 0,86–0,91) for the Sexes factor.

4.1.4. CFA results

For all models where the EFA suggested a different factor structure than what was expected based on theory, the CFA model following the EFA factor structure outperformed the CFA model following the factor structure based on theory, apart from the model

Table 1
CFA model results with weighted summated means, standard deviation, completely standardized factor loadings (λ), Z-values, Cronbach's Alpha (α), and α if an item is dropped.

Item code	Dimensions, Sub-Dimensions, Constructs, & Items	M*	SD	λ**	Z-value	α if item is dropped
	Perceptions of Distributional Justice					
	Policy Focus[b]					
	To guide agricultural change in a way that is just, the government needs to…					
	Environment & Animal Welfare (α= 0,89)	1,56	0,87			
M_FD_1	*… set penalties on environmentally harmful practices.*			0,65	[a]	0,88
M_FD_2	*… set taxes on pesticides, fungicides, and herbicides.*			0,60	11,17	0,89
M_GI_1	*… support farmers and farm workers with advice and guidance to use more sustainable practices.*			0,68	10,40	0,88
M_GI_2	*… provide information to consumers on the environmental impact of specific types of food and food waste.*			0,70	11,55	0,88
M_GI_4	*… provide positive recognition for environmentally friendly farmers (e.g. through sustainability certificates).*			0,67	9,38	0,88
M_R_1	*… set strict environmental regulations.*			0,67	11,25	0,88
M_R_2	*… ban the use of environmentally harmful substances such as herbicides, pesticides, and fungicides.*			0,68	10,51	0,88
M_R_3	*… set legally binding targets for the maximum level of harmful substances in the soil, air, and water.*			0,64	9,69	0,88
M_R_6	*… set strict environmental regulations on imported food.*			0,58	10,99	0,89
M_R_7	*… create strict regulations for animal welfare.*			0,72	9,63	0,88
M_R_8	*… create strict regulations for the preventive use of antibiotics for farm animals.*			0,52	8,71	0,89
M_R_10	*… set regulations so that negative environmental impacts are compensated by improving the environment elsewhere.*			0,62	10,26	0,88
	Social (α= 0,79)	1,31	0,92			
M_FI_1	*… pay farmers public money to provide public goods (e.g. clean water, thriving wildlife, etc.).*			0,58	[a]	0,77
M_FI_3	*… provide subsidies or similar financial support to people who can't afford to buy sufficient food.*			0,59	7,30	0,76
M_FI_6	*… pay grants to farmers for innovation and adaptation to the change.*			0,65	8,90	0,76
M_FI_7	*… financially support farmers and farm workers who lose their job due to the change.*			0,69	7,74	0,74
M_GI_3	*… provide training to farmers and farm workers who want to stop farming and move to a different job.*			0,61	7,60	0,76
M_GI_5	*… support farmers and farm workers with training to move to a different job when they lose their job due to the change.*			0,63	6,64	0,76
	Reducing Agriculture (α= 0,76)	−0,50	1,30			
M_FI_4	*… buy out farmers from their farms to reduce the number of agricultural businesses in the country.*			0,84	[a]	0,62
M_FI_5	*… pay older farmers to stop farming so that younger farmers can take over.*			0,49	8,95	0,77
M_R_4	*… exclude land from agricultural use.*			0,57	10,94	0,74
M_R_9	*… revoke farm licenses to reduce the number of farms.*			0,78	15,83	0,64
	Principles of Distributional Justice[b]					
	Change in agriculture is just if…					
	Equality (α= 0,72)	0,52	1,21			
DP_Equal_1	*… everyone carries the same amount of costs to create the change, regardless of their circumstances.*			0,69	[a]	0,64
DP_Equal_2	*… everyone receives the same amount of benefits from the change, regardless of their circumstances.*			0,61	7,75	0,68
DP_Equal_3	*… it distributes the costs and benefits of the change so that everyone carries the same costs and benefits.*			0,76	8,52	0,59
	Merit (α= 0,63)	1,04	0,95			
DP_M_1	*… those who put more effort into the change receive more of the benefits of the change.*			0,61	[a]	0,50
DP_M_2	*… those who put in least effort to bring about the change carry most of the costs of the change.*			0,53	7,19	0,57
DP_M_3	*… it distributes the costs and benefits of the change based on the efforts that people undertake to create the change.*			0,67	9,03	0,52
	Personal Impact[c]					
	Changes in agriculture…					
	Self-improvement (α= 0,73)	0,88	1,15			
VJ_Intra_2	*… improve my living circumstances compared to what they were before.*			0,95	[a]	0,55
VJ_Inter_2	*… improve my living circumstances in comparison to others.*			0,61	6,26	0,60
	Not-worsening (α= 0,86)	1,34	1,09			
VJ_Intra_1	*… do **not** make my position in life worse than it was before.*			0,85	[a]	0,80
VJ_Intra_3	*… do **not** make my living circumstances worse than they were before.*			0,79	15,57	0,82
VJ_Inter_1	*… do **not** make my own living circumstances worse than those of others.*			0,78	14,25	0,82
VJ_Inter_3	*… do **not** affect my living circumstances more negatively than those of others.*			0,71	11,80	0,84
	Perceptions of Procedural Justice					
	Degree of involvement[b] ***(α = 0,91)***	*1,41*	*0,99*			
	For agricultural change to be just, the government needs to …					
DI_1	*… inform stakeholders about the decisions government is taking.*			0,75	[a]	0,89
DI_2	*… invite stakeholders to express their views on government decisions before the decisions are taken.*			0,83	16,16	0,89

(*continued on next page*)

Table 1 (*continued*)

Item code	Dimensions, Sub-Dimensions, Constructs, & Items	M*	SD	λ**	Z-value	α if item is dropped
DI_3	*…invite stakeholders to give advice on what decisions the government should take.*			0,79	11,95	0,89
DI_4	*… involve stakeholders in the decision-making and implementation of decisions.*			0,81	13,83	0,89
DI_5	*…actively include stakeholders in setting the goals for change.*			0,78	13,67	0,89
DI_6	*…make decisions jointly with the stakeholders.*			0,76	9,92	0,89
	Principles of Procedural Justice[b]					
	An agricultural change process is just when…					
	Equality (α= 0,79)	0,78	1,22			
PP_Equal_1	*… everyone is involved in the same way, regardless of how much they will be affected by the change.*			0,70	[a]	0,74
PP_Equal_2	*… everyone's views are taken into account in the same way.*			0,73	11,64	0,71
PP_Equal_3	*… everyone has the same influence over decision-making.*			0,80	8,96	0,69
	Equity & Need (α= 0,63)	0,79	1,03			
PP_EN_1	*… those stakeholders who do not have sufficient resources to take part receive support to participate.*			0,41	[a]	0,66
PP_EN_2	*… the views of stakeholders who will be most affected by the change are taken into account most.*			0,74	5,99	0,34
PP_EN_3	*… those stakeholders who have more at stake in the change receive most influence on decision-making.*			0,68	3,65	0,54
	Entitlement (α= 0,83)	0,64	1,14			
PP_Ent_1	*…the views of those who have historically been influential in agriculture are taken into account most.*			0,74	[a]	0,79
PP_Ent_2	*…those who have historically been most influential in agriculture have most influence on decision-making.*			0,81	12,38	0,76
PP_Ent_3	*… those who have historically been most influential in agriculture receive most opportunities to be involved.*			0,81	13,08	0,74
	Merit (α= 0,81)	1,08	1,04			
PP_M_1	*… experts on agriculture have most influence in deciding the direction of change.*			0,77	[a]	0,74
PP_M_2	*… the views of experts on agriculture are taken into account most.*			0,73	12,77	0,75
PP_M_3	*…experts on agriculture have most influence on decision-making.*			0,79	12,53	0,72
	Perceptions of Recognitional Justice					
	Stakeholder Inclusion[d]					
	In order for agricultural change to be just, to what extent should the interests of the following stakeholders and the way they may be affected by the change be taken into account?					
	Agricultural Interests (α= 0,76)	0,81	0,85			
SJ_1	*Farmers*			0,49	[a]	0,74
SJ_4	*Agricultural educational institutions*			0,70	6,83	0,70
SJ_5	*Commoners (people who have the right to let their livestock graze on common/shared land)*			0,56	6,42	0,74
SJ_18	*Stakeholders focusing on social wellbeing of farmers*			0,78	7,27	0,66
SJ_19	*Stakeholders focusing on food availability, affordability, and nutritional quality*			0,60	7,35	0,71
	Environmental & Future Generations' Interests (α= 0,84)	1,17	0,94			
SJ_6	*Environmental organisations*			0,65	[a]	0,82
SJ_15	*Stakeholders focusing on animal welfare*			0,70	12,77	0,82
SJ_21	*Future generations*			0,61	10,31	0,83
SJ_22	*Farm-animals*			0,71	11,02	0,81
SJ_23	*Wild-animals*			0,70	11,42	0,81
SJ_24	*Nature*			0,73	11,27	0,80
	Social Interests (α= 0,74)	0,55	0,93			
SJ_13	*Stakeholders focusing on historical heritage*			0,67	[a]	0,66
SJ_14	*Stakeholders focusing on human health*			0,64	11,12	0,69
SJ_16	*Stakeholders focusing on recreation (e.g. access to land for walking or quality of water for swimming)*			0,63	13,51	0,68
SJ_17	*Stakeholders focusing on interests of rural life*			0,63	10,74	0,68
	Economic Interests (α= 0,79)	0,24	0,94			
SJ_7	*Supermarkets*			0,70	[a]	0,73
SJ_8	*Agricultural consultants*			0,65	11,38	0,77
SJ_9	*Trade organisations*			0,62	10,16	0,75
SJ_10	*Fertiliser and seed/crop industry*			0,69	14,00	0,76
SJ_20	*Stakeholders focusing on food processing and packaging*			0,64	9,45	0,75
	Social inclusion[d]					
	In order for agricultural change to be just, to what extent should the interests of the following societal groups and the way they may be affected by the change be taken into account?					
	Minorities (α= 0,88)	−0,18	1,39			
SI_3	*Transgender*			0,81	[a]	0,86
SI_4	*Ethnic minorities*			0,90	20,10	0,81
SI_5	*Religious minorities*			0,84	20,00	0,83
	Children & Disabled People (α= 0,84)	0,43	1,33			
SI_6	*Children/Youth*			0,82	[a]	0,71
SI_7	*Disabled people*			0,88	17,09	0,73
	Sexes (α= 0,88)	0,35	1,30			
SI_1	*Women*			0,92	[a]	0,82
SI_2	*Men*			0,86	20,55	0,76

[*] Weighted summated mean; calculated with the completely standardized factor loadings.
[**] Completely standardized factor loadings derived from a confirmatory factor analysis based on Yuan-Bentler correction for multivariate non-normality. All factor loadings are significant at p <0,001.
[a] Z-values were not calculated as unstandardized loading of this indicator was set to 1,0 to control construct variance.
[b] Items have been measured on a 7-point Likert Scale, where −3 = Strongly disagree, −2 = Disagree, −1 = Somewhat disagree, 0 = Neutral, 1 = Somewhat agree, 2 = Agree, 3 = Strongly agree.
[c] Items have been measured on a 7-point Likert Scale, where −3 = Very Unimportant, −2 = Unimportant, −1 = Somewhat unimportant, 0 = Neutral, 1 = Somewhat important, 2 = Important, 3 = Very important.
[d] Items have been measured on a 7-point Likert Scale, where −3 = Not at all, −2 = Very little, −1 = Little, 0 = To a moderate extent, 1 = High, 2 = Very High, 3 = Highest priority.

for *Stakeholder Inclusion*. For the CFA model for *Stakeholder Inclusion* an adapted version of the theory-based model performed best. This model excluded items referring to stakeholders who do not clearly fit into a single construct (e.g. landowners or general society). Below we describe the results for the best performing CFA models.

All items had highly significant (p<0,001) completely standardized factor loadings between 0,41 – 0,95, with the majority exceeding 0,60. Details are shown in Table 1. Appendix A Table A.5. provides the construct correlations, AVEs and composite reliability (CR) estimates. Due to the low AVE and CR values for the construct of Merit (AVE= 0,36; CR= 0,62) in the sub-dimension *Principles of Distributional Justice* we exclude this construct from further analysis. For all others the Cronbach alpha and construct reliability estimates equal or exceed 0,65, with only the reliabilities for the construct of Equity and Need in the sub-dimension *Principles of Procedural Justice* falling below 0,70 (α= 0,63; CR= 0,65). These results indicate good reliability and convergent validity of our instrument. However, the AVE for the Equality *Principle of Distributional Justice* (AVE= 0,47), the three *Policy Focus* constructs (AVE= 0,41 for Environment and Animal Welfare; AVE= 0,39 for Social Support; AVE= 0,47 for Reducing Agriculture), the Equity and Need Principle of Procedural Justice (AVE= 0,40), and the four *Stakeholder Inclusion* constructs (AVE= 0,41 for Agricultural Interests; AVE= 0,47 for Environmental and Future Generations' Interests; AVE= 0,41 for Social Interests; AVE= 0,44 for Economic Interests) fall below the generally accepted minimum threshold of 0,50. In addition, the Fronell-Larcker Criterion indicates discriminant validity for all constructs except the constructs of Agricultural Interests, Social Interests, and Economic Interests in the sub-dimension of *Stakeholder Inclusion*. These results indicate that further research is required to improve the items used to assess these constructs.

4.2. Differences in justice perceptions of topics of distributional justice, geographical scale of justice, and knowledge types

Topics of Distributional Justice. The Friedman test showed that the items assessing perceptions related to the Topics of Distributional Justice were statistically significantly different, $\chi^2(11)$= 544, p<0,001, but the effect size is small (W = 0,12). Pairwise Wilcoxon signed rank test in combination with an assessment of the correlation matrix (see Appendix A Fig. A.1. and Table A.3. for details) revealed that there is some variation between these items but that there is no clear pattern visible. The topic 'food is affordable' received the highest mean rank (M = 8,31), closely followed by 'food is sufficiently available for all' (M = 8,30). The topic 'public access to nature is increased' received the lowest mean rank (M = 4,55). Further research is needed to indicate whether there really is no clear pattern or whether this result was caused by other aspects such as item formulation and question type. Because of this we excluded this sub-dimension from further analysis.

Geographical Scale of Justice. The Friedman test showed that the items assessing perceptions related to the Geographical Scale of Justice were statistically significantly different, $\chi^2(3)$= 113, p<0,001, but the effect size is small (W = 0,09). Pairwise Wilcoxon signed rank test revealed that only the item corresponding to a global scale differed significantly from the other items, with the global scale receiving less consideration (M = 1,29, compared to local M = 1,86, regional M = 1,83, and national M = 1,87) (see Appendix A Fig. A.2. and Table A.4. for details).

Knowledge Types. Pairwise Wilcoxon signed rank test revealed that there is a statistically significant difference between perceptions on Scientific Knowledge and Local/Traditional Knowledge (p<0,001), with Local/Traditional knowledge being valued higher than Scientific Knowledge. Table 2 indicates however that most respondents (62,75%) perceive the inclusion of both of these knowledge types simultaneously as important for the justice of agricultural transitions.

Table 2
Combined frequency of required degree of consideration of knowledge types for a just perception of an agricultural transition.

		Scientific Knowledge							
		Not at all	**Very little**	**Little**	**Moderate**	**High**	**Very high**	**Highest priority**	**TOTAL**
Local knowledge	**Not at all**	0,25%	0,25%	0,25%	0,00%	0,25%	0,00%	0,00%	**1,00%**
	Very little	0,50%	0,00%	0,00%	0,50%	0,00%	0,00%	0,00%	**1,00%**
	Little	0,25%	0,50%	1,00%	1,25%	0,75%	0,50%	0,00%	**4,25%**
	Moderate	0,00%	0,00%	1,00%	10,25%	3,25%	1,50%	0,25%	**16,25%**
	High	0,00%	0,50%	0,75%	7,75%	14,75%	4,25%	0,75%	**28,75%**
	Very high	0,00%	0,25%	0,50%	3,75%	11,00%	9,50%	6,00%	**31%**
	Highest priority	0,25%	0,00%	0,00%	1,00%	3,75%	8,00%	4,75%	**17,75%**
	TOTAL	**1,25%**	**1,50%**	**3,50%**	**24,50%**	**33,75%**	**23,75%**	**11,75%**	**100%**

4.3. Justice perceptions in the English context

Combining the results of our English sample into a summated scale based on weighted means can give us an insight into what the English society perceives as important for the justice of an agricultural transition and thereby support the governance of such a transition. Here we only included the constructs that showed adequate reliability and validity in the preceding analysis, but once the instruments to assess the other constructs have been improved through future research, they can be used in a similar manner.

As Fig. 2 and Table 1 show, in regard to distributional justice, our study indicates that a distribution of costs and benefits based on the Equality principle (weighted $M = 0{,}52$), with a focus on policy instruments that target Environmental and Animal Welfare improvement (weighted $M = 1{,}56$) as well as the provisioning of Social Support to farmers and consumers (weighted $M = 1{,}31$), and which does Not-Worsen peoples living circumstances (weighted $M = 1{,}34$) will likely be regarded as just by the English society. Note however that we were not able to adequately assess other *Principles of Distributional Justice*, which leaves open the possibility that the other principles could potentially be regarded as more just than the Equality principle.

In regard to procedural justice, our results indicate that using a combination of the Equality, Entitlement and Merit principles as inclusion criteria will likely be regarded as just, with most emphasis being placed on Merit (weighted $M = 1{,}08$, compared to weighted $M = 0{,}78$ for Equality and weighted $M = 0{,}64$ for Entitlement). Furthermore, including stakeholders in the governance process of the agricultural transition (weighted $M = 1{,}41$) increases perceptions of the justice of the transition.

In regard to recognitional justice, our results indicate that, in order to increase perceptions of justice, the consequences of the

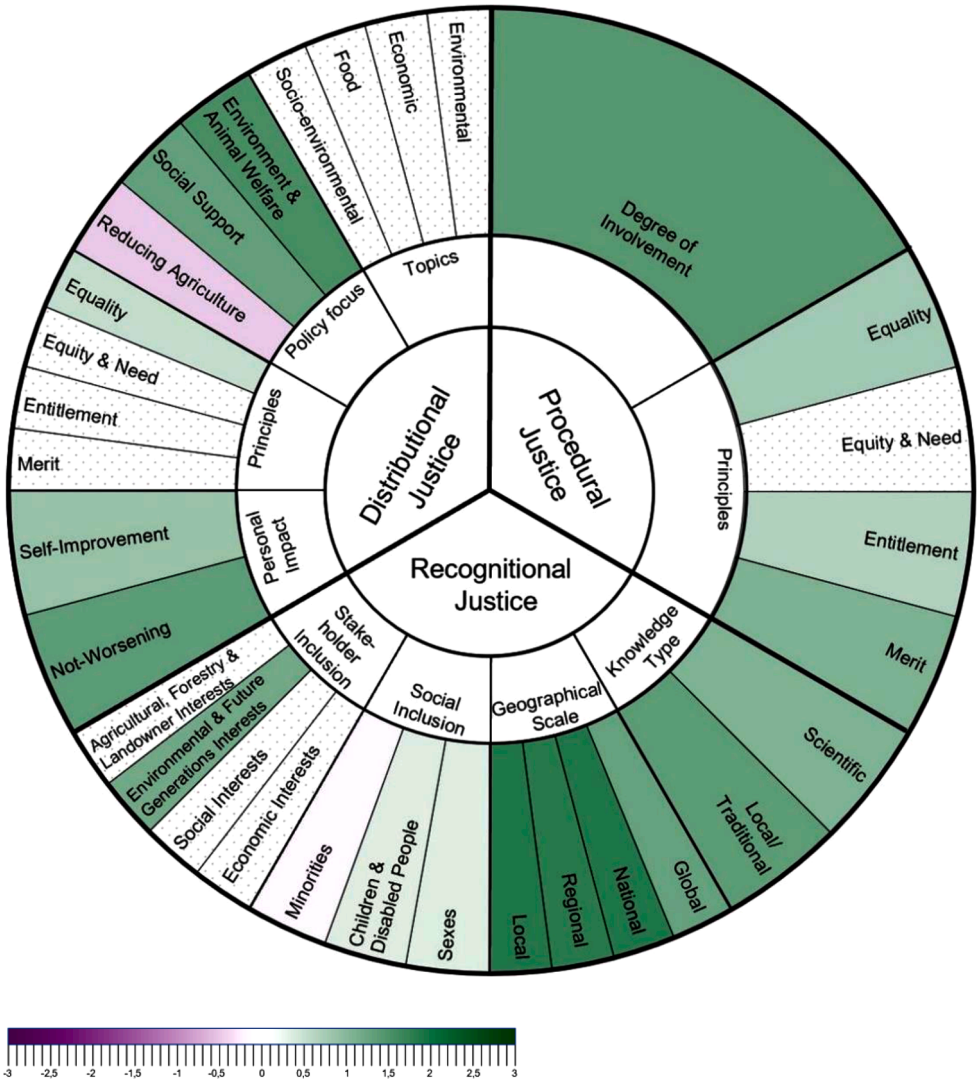


Fig. 2. Summary of the underlying dimensions of English Justice Perceptions on Agricultural Transitions based on weighted summated means. Scale ranging from −3 (not at all important) to 3 (highly important).
Nb.: Constructs marked with a dotted pattern are constructs that need further development.

transition for Children and Disabled People (weighted $M = 0,43$) as well as Sexes (i.e. women and men in general) (weighted $M = 0,35$) should receive specific consideration and attention should be paid to the interests of stakeholders representing the Environment and Future Generations (weighted $M = 1,17$) when making decisions in relation to the agricultural transition. Note here that we were not able to adequately assess perceptions on potential other stakeholder interests, so that we cannot make any statements related to those. In addition, whilst the general consequences need to be considered on all *Geographical Scales*, the Local, Regional, and National scale should be given most attention and during the decision-making process both Scientific and Local/Traditional Knowledge should be considered, with most emphasis being placed on Local/Traditional Knowledge.

Overall, the majority of our respondents thought that the justice of agricultural transitions is to some degree important: 34,00% found it very important, 33,50% found it important, and 16,00% found it somewhat important. The other respondents saw it either as neutral (11,25%), somewhat unimportant (0,75%), unimportant (0,75%), or very unimportant (3,75%), indicating that paying attention to justice perceptions in the governance of an agricultural transition in England is a valuable undertaking.

5. Discussion

In this study we aimed to develop an instrument that can assess societal justice perceptions in relation to agricultural transitions by gaining insight into the underlying dimensions on which people base their justice evaluations. Rather than abiding by a predefined, normative interpretation of what justice is, we built our instrument around central dimensions, sub-dimensions, and constructs on which interpretations of justice are generally based. As the results section showed, we were able to develop an instrument that assesses several constructs with adequate reliability and validity: a) in relation to distributional justice we were able to assess perceptions on the principle of Equality, the policy foci of Environment and Animal Welfare, Social Support, and Reducing Agriculture, and the personal impacts of Self-Improvement and Not-Worsening, b) in relation to procedural justice we were able to assess perceptions on the principles of Equality, Entitlement, and Merit, and the Degree of involvement, and c) in relation to recognitional justice we were able to assess perceptions on the inclusion of interests of Environmental- and Future Generations' stakeholders, the social inclusion of Minorities, Children and Disabled People, and Sexes, as well as the Geographical Scale that should be considered and the Knowledge Types on which decisions should be built.

For five of these constructs, related to the sub-dimensions of *Policy Focus* and *Personal Impact*, the empirical material suggested different constructs than what we had initially intended. For the sub-dimension of *Policy Focus* we had set out to assess the sub-dimension of *Policy Mechanism* with related policy instrument types as constructs. This could be an indication that policy focus is perceived as being more important for justice perceptions than the type of policy instrument that is used to fulfil a certain policy focus, as our respondents focused on that aspect of the items when answering. However, to gain more clarity in this regard it would be valuable for the further development of this instrument if a set of items would be developed that separate out the policy instrument type from the policy focus and vice versa. We had not done that here as we aimed to include policy instruments that are actually being discussed for use to bring about agricultural transitions and because making this separation would mean a considerable increase in length of the instrument. In regard to the *Personal Impact* sub-dimension and its related constructs we had originally intended to assess the *Viewpoint of Distributional Justice* (Intrapersonal versus Interpersonal). From previous studies that are not related to agriculture we know that this distinction plays a role in perceptions of justice in relation to environmental policies (Schuitema et al., 2011; Schuitema and Bergstad, 2019). Further development of our instrument should thus focus on developing items that can more clearly make a distinction between the *Viewpoint of Distributional Justice* and *Personal Impact* in order for both of these sub-dimensions to be captured.

For one of the sub-dimensions, *Degree of Involvement*, we were able to assess the general direction of degree of involvement, but were unable to capture a gradient of detailed levels of involvement. One potential reason for this is that for people who do not work with governance processes on a regular basis it could be difficult to grasp some of the implications and nuances between the items that we had formulated. As insights into perceptions on a detailed gradient of involvement would provide additional information that is highly relevant for the governance of agricultural transitions, we suggest that future research should focus on developing a number of items for each potential level of stakeholder involvement where the implications and differences between them from a practical point of view are clearer.

There were also a number of constructs that we were unable to reliably assess with the items that we have developed: the *Distributional Principles* of Equity and Need, Entitlement, and Merit, the *Procedural Principle* of Equity and Need, constructs related to *Distributional Topics*, and the *Inclusion of Stakeholders* with Agricultural Interests, Social Interests, and Economic Interests. In regard to the three *Inclusion of Stakeholders* constructs, we suspect that by aiming to include all potential stakeholders in an English agricultural context for inclusiveness reasons we made it difficult for respondents to grasp how all these different kinds of stakeholders relate to an agricultural transition. This in turn makes it difficult to develop a perception on whether these interests should be considered. We suspect that the reason why we were able to reliably assess the construct of *Environmental and Future Generations' Interests* is that the kinds of stakeholders under that construct are more generally known and it is therefore easier to understand how they might be impacted by an agricultural transition, even if one knows little about agriculture. In future developments of our instrument, the issues with the items related to the other constructs could be potentially remedied either by giving short explanations as to how these different stakeholders relate to an agricultural transition, or alternatively, items could be used that provide more descriptive accounts of the kinds of broader interests that certain types of stakeholders typically represent. The former comes at a cost of considerably lengthening the instrument and difficulties in describing complex links and interactions in a very brief manner, whilst the latter comes at a cost of reducing inclusiveness in the setup of the instrument and thereby risks leaving potential interests out based on predetermined normative assumptions. In regard to the three constructs related to the *Distributional Principles* and the one construct related to *Procedural Principles* that we were not able to reliably assess, we want to highlight that these are basic justice constructs that

have been assessed reliably by previous studies in relation to justice in general (Bennet et al., 2019; Liebig et al., 2016; Rasinski, 1987). It can thus be argued that the adaptation of the items that we did in order to apply these constructs to the agricultural transition context has caused this lack of reliability and validity and future research should therefore focus on revising the wording of these items. In regard to the *Topics of Distributional Justice* we were not able to identify a clear pattern between the different kinds of topics. Further research is required to examine whether this lack of pattern was a consequence of the way we designed the question related to this sub-dimension or whether there really is no clear pattern for this sub-dimension in the English context.

There are also a number of limitations with this study that should be considered. Firstly, several of the items that we used in this instrument were specifically designed to fit within the English context and need to be revised when this study is conducted elsewhere. Secondly, in order to be able to include the variety of sub-dimensions and constructs that we did, there were some aspects that we were not able to take into account. For example, the importance of contextual factors that influence perceptions of justice in a specific situation, trade-offs between the constructs and relative importance if either-or-decisions have to be made, as well as potential changes in perceptions when specific kinds of costs and benefits at specific price points (monetary or otherwise) are considered. These are all aspects that are likely not possible to assess through an instrument like the one we have developed (Liebig et al., 2015). We therefore advise that when this instrument is used to support governance decisions it is accompanied by further, in-depth, assessments in which these kinds of aspects can be captured. Examples of methods that can be used for this include in-depth interviews, discrete choice experiments, or factorial surveys. This will also help in addressing potential biases when using this instrument as a result of the specific aspects that were included or excluded respectively. Thirdly, whilst we aimed to be comprehensive and inclusive in the sub-dimensions which we examined in this study, we do not claim that our instrument is exhaustive. Potential other constructs that could be more explicitly included in future development of this instrument include retributive justice and the timescale of justice (Heffron, 2021; Wenzel and Okimoto, 2016). An effort could also be made to capture the difference in justice perceptions in relation to taking certain decisions or actions versus the justice of not taking them. This could then incorporate perceptions of injustice in relation to the current system and taking a business-as-usual pathway (Buchel et al., 2022; Ciplet, 2022; Gliessman and Fergusonm 2021; Sanderson Bellamy et al., 2021). In addition, the underlying dimensions of justice perceptions that we described and aimed to assess here is primarily based on literature and insights from a western worldview. Future research should therefore also focus on examining how these dimensions might differ in other cultural settings (Álvarez and Coolsaet, 2020; Dhawan, 2012; Krishnan, L., 1992; Winter, 2020) and adapt the instrument based on that prior to applying it in these contexts.

In relation to the use of this tool to support the governance of agricultural sustainability transitions, we showed with an example of the English case that it can provide practical input into the decision-making process surrounding the agricultural transition pathway. Our visualization of the results in Fig. 2 showed that an agricultural transition that is designed together with stakeholders, building on both scientific and local/traditional knowledge, with a main policy focus on the environment and animal welfare, whilst including social support to farmers and consumers to adapt to the transition, and especially considering impacts on a local, regional, and national scale will likely resonate well with the justice perceptions of the English society. A focus on reducing agricultural practices, on the other hand, will likely not receive broad public support. These results align with earlier research by de Boon et al. (2022a). Building the governance of the agricultural transition around these justice perceptions of the English society, will make the transition more acceptable for society and will thereby reduce potential barriers to the implementation of the required changes (Markard et al., 2020; Martin and Islar, 2020; Meadowcroft, 2011; Rothmund et al., 2016). However, when applying this tool to support the governance of agricultural transitions in this way, it is important to be aware that justice perceptions are not static. What is regarded as just at one point in the transition may be regarded as unjust in another stage of the transition, for example when unanticipated consequences of earlier decisions become visible (de Boon et al., 2022b). This instrument should therefore be used multiple times throughout the transition to monitor if perceptions change and the governance system and processes need to be flexible and adaptable to react to potential changes, thereby preventing setting static boundaries to what a just transition entails. In addition, whilst this tool can be used to increase the likelihood that the transition and the measures to bring about the transition are accepted by the society within which the transition takes place, adapting the design of a transition to the outcomes of this tool does not make the transition just per se. Perceptions of justice are always subjective and by designing a transition around the outcomes of this tool, the transition becomes shaped around the normative majority views of a specific society. It does not incorporate justice perceptions from people outside the specific society within which the tool is applied, even though they may still be affected by the transition (Tschersich and Kok, 2022).

Because this instrument is built on general underlying dimensions of normative claims of justice, it can be used beyond the agricultural transition context and has value for the governance of sustainability transitions more generally. The operationalization of the various sub-dimensions and constructs will need to be adapted to fit to the specific transition that is under consideration, but their abstract form can be maintained. The instrument can therefore function as a first step to address the 'moral vacuum in transition research' (Köhler et al., 2019) and enable more critical considerations of the underlying principles and values that tend to be taken for granted in specific transition pathways (Wigboldus et al., 2021).

6. Conclusion

There is consensus that there is a need for transitions toward more sustainable practices across societal domains. We are increasingly becoming aware that these kinds of transitions are normative, political processes and that we therefore need to consider the moral, justice implications that lay within them. However, it is much less clear what exactly a just transition is and how this should be accomplished. In the just transition literature more broadly, and in the agricultural context specifically, the dominant approach has become to prescribe a specific notion of justice and then assess whether or not this notion of justice is adhered to (e.g. Bennet et al., 2019; Blattner, 2020; Heyen et al., 2021; Sunio, 2021; Tribaldos and Kortetmäki, 2022; Wieliczko et al., 2021). This is also reflected in

the practices of a wide variety of movements advocating for just transitions (Velicu and Barca, 2020). But this approach neglects to acknowledge that justice itself is a highly normative and political concept and that by predefining what it ought to mean we impose specific valuation systems on society rather than gaining an insight into societal understandings of justice and just transitions. However, it is precisely this insight that could help us better understand potential resistance to transitions and to reduce this resistance by taking these societal perceptions of justice better into account in the governance of transitions (Redpath et al., 2013; Sikor et al., 2014). In this paper we therefore examined what the underlying dimensions are based on which people make normative justice evaluations and whether these can be used to assess societal perceptions of what a just transition means to a specific society. By doing so, and with a focus on agricultural transition as a case study, we took a first step in developing an instrument that can assess perceptions of justice in relation to agricultural transitions without imposing a predefined notion of justice, but instead making use of the underlying dimensions on which perceptions of justice are built. Due to its foundation in these underlying dimensions of justice evaluations, when adapted, this instrument can also be used to inform the governance of transitions in other sectors. It is not the aim of this instrument to de-politicize or eliminate the normative nature of justice, but rather to identify the (plurality of) normative views that are present in a given society, identifying where there are shared perceptions and where there are contrasting views. In doing so, it can provide insights in how the dominant predefined notions of justice that are used in the scientific literature and beyond relate to societal justice perceptions and highlight whose and what notions of justice are currently excluded. Further research is required to improve this instrument and test it in different contexts, but we hope that this study will inspire other researchers to become more aware of the implications of predefining justice and give decision-makers a tool through which they can better understand societal justice perceptions in relation to transitions.

Ethics approval statement

This study received ethical approval by the University of Reading.

Data availability

The data that support the findings of this study are openly available from the University of Reading Research Data Archive at https://doi.org/10.17864/1947.000413.

Submission declaration and verification

We confirm that our work is original. Our manuscript has not been published, nor is it currently under consideration for publication, elsewhere.

Funding details

School of Agriculture, Policy and Development, University of Reading.

CRediT authorship contribution statement

Auvikki de Boon: Conceptualization, Methodology, Investigation, Formal analysis, Writing – original draft, Writing – review & editing, Data curation, Visualization. **Sabrina Dressel:** Supervision, Formal analysis, Writing – review & editing. **Camilla Sandström:** Supervision, Writing – review & editing. **David Christian Rose:** Supervision, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

We would like to thank all workshop participants, pilot participants, and survey participants for their time and contribution to this study and the two anonymous reviewers for their valuable comments on the manuscript.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.eist.2023.100694.

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2023-03-01
Elsevier
https://doi.org/10.1016/j.eist.2023.100694
de Boon A, Dressel S, Sandström C, Rose DC. (2023) A psychometric approach to assess justice perceptions in support of the governance of agricultural sustainability transitions. Environmental Innovation and Societal Transitions, Volume 46, March 2023, Article number 100694

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