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Justice in social housing: Towards a people-centred energy renovation process

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ABSTRACT

The annual renovation rate of the existing housing stock must increase rapidly to reach climate neutrality by 2050. This transition will require major investments but will also need to be affordable for everyone. Affordability is especially relevant for vulnerable and low-income households, many of which live in social housing in the Netherlands. Previous studies show that such a transition faces justice issues but this paper argues that a more pluralistic justice approach is needed, which also studies the interrelations between the justice dimensions. A multidimensional perspective is used based on five interrelated justice dimensions: distribution, recognition, participation, capability, and responsibility. Empirical data were collected by interviewing members of tenant associations and employees from social housing associations in the Netherlands on their experiences with, and views on, justice aspects in the energy renovation process. The data analysis shows that the multidimensional justice perspective can be applied to implement a broader and more pluralistic perspective on justice principles. These insights can be a starting point for achieving a more just energy renovation process in social housing, especially for addressing the needs of vulnerable households. Moreover, the results point out that all five dimensions are important to take into account in all stages of the energy renovation process, that they are strongly interlinked, and should not be addressed separately. The developed recommendations can be used by policymakers, and tenant and social housing associations.

1. Transition to a climate neutral social housing stock

To address climate change, the European Union (EU) intends to reach climate neutrality by 2050, and aims at a 55% reduction of greenhouse gas emissions by 2030 compared to 1990 levels [1]. Households are responsible for almost 30% of the CO_2 emissions in Europe [2], and 20% in the Netherlands [3]. This is mainly due to an energy-inefficient housing stock [1]. Nevertheless, 85–95% of these buildings will still be in use in 2050, which means that this inefficient housing stock needs to be renovated to reach the climate goals [1]. Despite this urgency, the annual energy renovation rate is only 1% at this time in the EU [1], and the implementation rate of deep energy renovations in Europe is only 0.2% at this time [1]. The latter are renovations that reduce the energy consumption by at least 60% [1] by implementing measures such as insulation, high-efficiency glazing, efficient heating and ventilation systems, and renewable energy production [4]. In an effort to face this challenge, the EU has implemented a new strategy in 2020 to boost energy renovations, 'A Renovation Wave for Europe'. In this strategy, they aim to double the renovation rates by 2030, which must result in 35 million renovated buildings in Europe [1] and 1.5 million renovated dwellings in the Netherlands [5].

One of the main priorities in the EU's new renovation strategy is the necessity for a just transition towards a climate neutral Europe by 2050 [1,6]. The EU expresses affordability as one of the key principles for this, especially for vulnerable and low-income households [1]. The reason for this is that energy poverty is a growing problem in the EU; nearly 34 million Europeans (7.6%) were unable to keep their home adequately heated in 2018 [6]. Therefore, the European Commission recommends that countries specifically address vulnerable households as a priority in their national long-term energy renovation strategies [6]. Energy poverty is also a growing issue in the Netherlands, particularly among

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low-income households. This group lives, largely, in social housing as this sector provides affordable housing for those with lower incomes [7]. The Dutch housing stock has the highest share of social housing in Europe [8], namely 29.6% [9] compared to a European average of 10.7% in 2018 [10]. This gives them a strong position in the Dutch housing sector, compared internationally, and makes the social housing sector a crucial sector to address to realise a fair transition towards a climate neutral housing stock by 2050.

Implementing energy renovations in social housing has the potential to lower the energy costs for their tenants [6]. However, some households experience a rise in their living costs after the renovation because the energy savings do not cover the rent increase after renovation [11,12]. This can worsen the vulnerability to energy poverty and inequality in the future [13,14]. In addition, energy renovations are not always socially accepted by tenants because they do not suit their wishes and needs concerning improving their living conditions [15]. Moreover, tenants are often hardly involved in the decision-making process of the renovation plans at this time [16,17]. The plans are often developed from the urgency to meet the climate goals, and are merely technology-driven and often introduced top-down [16–18]. As a result, energy renovations in social housing do not always have a positive outcome for their residents.

Regarding these distributional and procedural issues in the energy renovation process of social housing, a fair transition towards a climate neutral housing stock touches upon important issues of justice. This is especially relevant in the case of social housing, as a large amount of vulnerable households live there. Justice perspectives have received much interest in previous literature regarding environmental and climate issues. Early environmental justice studies focused on inequities in environmental burdens such as toxic burdens, air pollution, and landfills in the political issues in the 1950s and 1960s [19–21]. Since then, the scope of these studies has expanded to a wider range of environmental problems [22], such as the accessibility of green spaces in cities [20,23,24], the global burdens and benefits of climate change [21,25], the acceptance of renewable energy [26–28], and energy security [29]. However, there are only a few studies related to household energy renovations. For instance, Gillard, Snell and Bevan [30] and Sovacool [31] studied energy justice in the context of fuel poverty and domestic retrofits in the UK. Sovacool et al. [14] investigated energy justice issues of household low carbon innovations in the UK, such as energy services contracting, electric vehicles, solar photovoltaics and low carbon heating. In the Netherlands, Breukers et al. [15] performed a study on justice issues in a sustainable neighbourhood transformation, but they mainly focused on the initiative phase of the development and investigated a single case-study in Eindhoven. Overall, justice studies in the context of domestic energy renovations are rare, and do not capture justice aspects in the whole energy renovation process of social housing, which will therefore be the focus of this paper.

In the past, justice studies were mainly focused on distributional issues, but the scope of justice has widened [14,32]. For example, to include recognition of the various needs, rights, and experiences of different groups (especially socially deprived people); the degree and nature of participation of individuals in the decision-making process [30,33]; the responsibility for all nations to protect the natural environment [34,35]; and the capability of the people involved [36,37]. The growing attention to issues of recognition, participation, capability, and responsibility, is especially important in the case of social housing because of the presence of a large number of vulnerable people. Those justice issues are highly interrelated: effective participation requires a capability to do so and requires recognition of such difficulties by others. Participation may be needed for circumventing negative distributional effects and for catering to demands for being heard. However, this interrelation of the different justice dimensions has not received much attention yet in literature. Therefore, we opt for a multidimensional view on justice in this study, which also examines the relations between the justice dimensions.

Comparable to Breukers et al. [15] we use the framework of Davoudi and Brooks [22] for studying multiple dimensions of justice. The framework is a pluralistic framework which covers five dimensions of justice, being distribution, recognition, participation, capability, and responsibility. The framework is used to gain further insight on the five justice dimensions as a framework, with special attention given to the interrelations between these dimensions for the case of energy renovations by social housing associations in the Netherlands. The findings are used to develop recommendations for a more people-centred energy renovation process for social housing. This study will contribute to the knowledge base of the use of a multidimensional justice framework in the context of the entire energy renovation process of social housing, and provides more insight into the interrelations between the different justice dimensions. As far as we know, the paper is the first attempt to study those interrelations systematically, laying the ground for further research.

This paper attempts to determine the relevance and nature of the justice dimensions and the interactions between them, for the case of energy renovations in social housing. This will be done through the following research questions:

1. *What are the experiences with, and views on, the justice dimensions and their interrelations (distribution, recognition, participation, capability, and responsibility) of members of tenant associations and employees of social housing associations in the energy renovation process of social housing in the Netherlands?*
2. *How can a multidimensional justice perspective be used for a more people-centred energy renovation process in social housing?*
3. *What lessons can be gathered, and what recommendations can be developed for a more just energy renovation process in social housing?*

To address these research questions, this paper proceeds as follows: It first assesses the context of social housing in the Netherlands, followed by a literature review on justice perspectives in Section 3. The research design is discussed in Section 4. In Section 5, the results are presented of the interviews with members of tenant associations (TAs) and employees of social housing associations (SHAs) in the Netherlands on their experiences with, and views on, justice aspects in the energy renovation process and their interrelations. In Section 6, lessons and recommendations are presented, and in Section 7, we offer a discussion of the framework and draw conclusions.

2. Social housing in the Netherlands

2.1. Characteristics of Dutch social housing

In the mid-1990s, Dutch SHAs became privatized but they continued to carry out their social task [38,39]. Dutch social housing is characterized by housing rented out under rent regulation and aims at affordable housing for low-income households: at least 80% needs to be assigned to households with a yearly income below € 39,055, up to 10% to households with an income between € 39,055 and € 43,574, and up to 10% can be allocated to other target groups. The maximum rent is € 737 [reference date 2020, 40]. Fig. 1 presents the composition of the Dutch housing stock in 2018 and reveals that 35.3% are rent-regulated dwellings, which are mostly owned by SHAs [9,41].

The energy performance of the existing housing stock in the Netherlands is being regulated through energy labels as a result of the European Energy Performance of Buildings Directive [EPBD, 42]. Dwellings with an A - energy label are the most energy efficient and dwellings with a G – energy label are the least energy efficient (see Table 1). In the Dutch Climate Agreement [5], it was agreed that the social housing stock will have an average B energy label in 2021, which will result in a 33% reduction of CO_2-emissions compared to 2008 levels [5]. Aedes, the Dutch association of SHAs, states that this will probably be achieved [43]. However, there are no specific goals yet for 2030 and

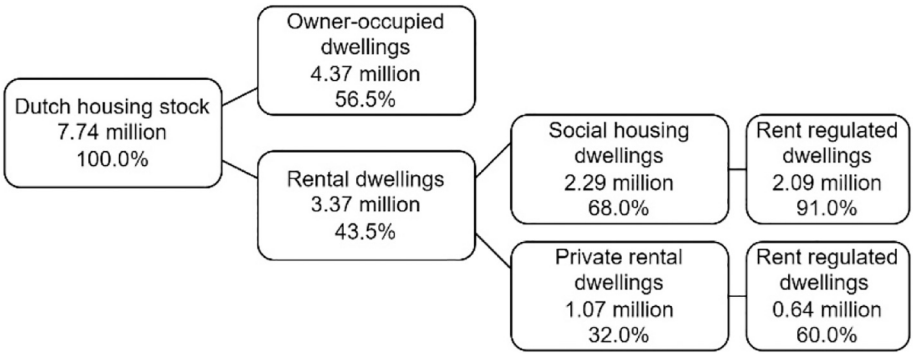

Fig. 1. Composition of the Dutch housing stock in 2018 [9,41].

Table 1
Primary fossil energy consumption per energy label [45].

Energy label	Primary fossil energy consumption in kWh/m^2·yr
A++++	≤0.00
A+++	0.01–50.00
A++	50.01–75.00
A+	75.01–105.00
A	105.01–160.00
B	160.01–190.00
C	190.01–250.00
D	250.01–290.00
E	290.01–335.00
F	335.01–380.00
G	≥380.00

2050. Fig. 2 demonstrates the distribution of the energy labels in the Dutch housing stock in 2018, and reveals that the social housing stock has the lowest share of highly energy efficient houses (9% A - energy label). Every year, SHAs make performance agreements ('prestatieafspraken') with local municipalities and TAs on social housing policy [44] such as where and when energy renovations will take place.

To reach the climate goals, the SHAs will need to rapidly broaden the implementation of deep energy renovations in their dwellings and not limit themselves to more straightforward traditional energy measures with lower energy savings. However, the financial feasibility for SHAs are often an issue in the case of deep renovations, and deep renovations can often not be covered by additional rental incomes, and keep the rents affordable at the same time [39,46]. Although SHAs can receive support from national subsidy schemes in the Netherlands for deep energy renovations [Renovatieversneller, 47], the budget is very limited. As a result, SHAs mainly invest in more straightforward traditional energy measures with lower energy savings [48]. This creates a lock-in for the transition to a climate neutral social housing stock and makes deep renovations hard to implement for SHAs. This limited investment potential of SHAs is reinforced by an additional property tax ('verhuurdersheffing') SHAs have had to pay since 2013, which is based on the value of their dwellings. This tax was initially introduced to generate additional revenues for the state to encounter the financial crisis, but has gained a more permanent status. SHAs and municipalities deeply resented the tax because of its negative effects on the investment capacity of SHAs [49]. Overall, this tax has resulted in less investment potential for SHAs for the decarbonisation of their housing stock and higher rents for low-income households.

With the introduction of the new Dutch Housing Act [Woningwet 2015, 44], SHAs need the approval of the tenants when they want to renovate more than ten dwellings. In that case, 70% of the tenants have to agree with the renovation plans that go beyond maintenance work like painting, replacement of window frames, and repairs [50]. Tenant agreement is not always easy to accomplish [15,51], but it paves the way for tenant participation. Traditionally, tenant associations are the most common structures for tenant participation [52]. In the Netherlands, TAs have several legal rights: the right to receive information, to consult with the SHA, to advice the SHA, to put topics on the agenda at board meetings of the SHA, to invite experts to participate in the consultation with the SHA, and they are entitled to an expense allowance from the SHA [50]. In addition, tenant representatives are the local consultation partner of the municipality and the SHA on the performance agreements of public social housing policy on a local level [44]. Overall, tenants have several legal rights in the participation process of energy renovations in social housing in the Netherlands.

3. Justice in the energy renovation process

As discussed in the introduction, the scope of inquiry of justice studies is being widened from a focus on distributional issues in the past to more pluralistic multidimensional justice frameworks [14,15,32]. The five justice dimensions distribution, recognition, participation, capability, and responsibility are found to be relevant in previous justice

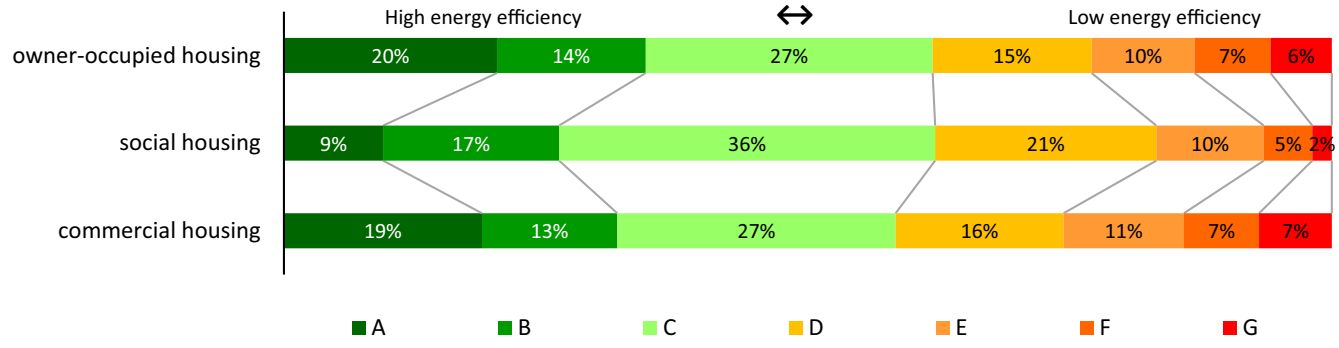

Fig. 2. Distribution of energy labels in the Dutch housing stock in 2018 for owner-occupied, social, and commercial housing [9].

studies. These dimensions are discussed in more detail in the sections below.

The dimension *distribution* is defined in this study as a fair and equal distribution of financial and non-financial costs and benefits between the SHA and the tenants. However, what is fair and just can be different for every individual, which calls for a pluralistic view. Distribution is an important issue to address in the context of energy renovations, because of the high number of vulnerable people living in social housing. Vulnerable people can experience even more inconvenience and difficulties during the renovation process due to their disabilities, and are also often less capable to participate in the energy renovation process to express their needs. In addition, energy renovations have the potential to reduce living costs but in some cases costs increase because the energy savings do not cover the rent increase after renovation [11,12]. This can worsen the financial situation of tenants, especially those with a low income.

As well as the distribution of costs and benefits, the dimension recognition has been highlighted as an equally important issue concerning justice [e.g. 33,53,54]. This dimension is defined as acknowledging the various needs, rights, and experiences of different tenants in the energy renovation process, when involving them in the energy renovation process. However, it is more than acknowledging the presence of vulnerable groups, but also seeking to recognise the diversity within these groups [30] and to avoid certain people being ignored or misrepresented [22,30,54]. The dimension recognition is an important issue to address because previous studies have demonstrated that SHAs have difficulties in recognising and involving tenants equally in the renovation process [15,16,55,56]. This is especially true for vulnerable households, which are less present and potentially less recognised. In this study, vulnerable people are defined as people who have a reduced self-reliance because of financial problems (very low income or unemployed), psychiatric problems, intellectual disability, dementia, addiction problems, physical problems, and/or have to deal with social exclusion [57]. Due to the changed Dutch healthcare system, increasingly more vulnerable people live independently instead of in an institution. As a result, the group of vulnerable households has increased in the social housing stock [58] which makes this an important group to recognise in the energy renovation process. Yet, previous literature has generally avoided this discussion on the issues of vulnerability in low-carbon transitions [59].

Strongly associated with recognition is the dimension *participation*, *which* is strongly interlinked with procedural justice. It is about information access, decision-making, and legal rights of individuals and groups in decision-making processes [30]. An important distinction is between consultation of tenants and tenants having actual decision-making power in the participation process [16–18,60,61]. Tenant participation in social housing is included in multiple studies, but at this time, tenants are often still only informed about the renovation plans after they are developed. This leads to very little room for changes or suggestions from the tenants [16,17]. Hence, acquiring empirical insights on the usefulness of different participation approaches to stimulate a greater diversity of participating tenants, is of great importance to adopt a more just energy renovation process.

Davoudi and Brooks [22] broadened the justice framework by adding the dimension *capability* [15]. This dimension originates from the capability approach developed by Martha Nussbaum [62–64] and Amartha Sen [65,66] and has been applied and discussed in many studies since then. According to Robeyns [37], the approach has emerged as a 'theoretical framework about wellbeing, freedom to achieve wellbeing, and all the public values in which either of these can play a role, such as development and social justice' [37, pg 23]. Kimhur [36] applied the capability approach to housing policy and stresses that participatory housing planning may fail to stimulate capability enhancement, because of a focus on physical needs and because of structural barriers to capability enhancement. Deprived people experience less freedom to pursue life in a valuable way through self-chosen functioning, which extends to processes of participation. At present, there exists very little research on this topic in the context of housing [36] and especially on energy renovations in social housing.

The dimension *responsibility* is another dimension studied in justice studies [e.g. 15,22,34,35]. This dimension is defined as taking responsibility for other humans, society, and non-human nature at individual and collective levels. In the case of energy renovations in social housing, this means that SHAs are responsible for offering well-maintained, affordable social housing for low-income households but also for facilitating a fair participation process for tenants. Climate change introduces an extra responsibility for SHAs and tenants to reduce energy [15]. However, people's capability to carry responsibility can be constrained by their vulnerabilities and capabilities [22]. This demonstrates that the dimension capability is strongly interrelated with the dimension of responsibility and is an especially a difficult issue for vulnerable households.

These reported five justice dimensions are found to be highly relevant in the context of the energy renovation process of social housing. This is because many vulnerable households live there, which makes a broader view on justice more relevant considering that the dimensions recognition, capability, and responsibility are specifically important for this group, next to the more common justice dimensions of distribution and participation. In addition, our review demonstrates that the interrelations between these dimensions are also important but this is not studied in detail in previous work. Therefore, we will use the environmental justice framework of Davoudi and Brooks [22] with the five justice dimensions as a framework for our study (presented in Fig. 3). It offers a comprehensive and pluralistic view on justice aspects, allowing for a study of positive and negative interaction effects between the different justice dimensions, especially related to vulnerable households. The five dimensions have been demonstrated as suitable for empirical use and, as we will show, can be used to determine in what ways the justice dimensions are co-extant, interconnected, and mutually reinforcing [30]. Their relevance is demonstrated in a study by Breukers et al. [15] on sustainable neighbourhood development in the Netherlands. Our study will continue to build on the knowledge base developed in this study, and extend it by not only focusing on one neighbourhood, but adopting a more general approach by interviewing TAs and SHAs about their experiences. In addition, our study will not only cover the initiative phase of the development but the entire energy renovation process, and also will investigate the interrelations of the five justice dimensions in more depth.

4. Research methods

The aim of this paper is to gather lessons and develop recommendations for a fair, people-centred energy renovation process, in order to contribute to a more just transition towards a climate neutral social housing stock. Therefore, we studied the experiences with and views on the justice aspects of the energy renovation process in social housing by interviewing members of TAs and employees from SHAs in the Netherlands who have experiences with energy renovations in social housing. Theoretical sampling was applied for the identification of interviewees. Employees working in the social and technical-economic domain within the SHA were interviewed (see Fig. 4) because it was expected that they would have different perspectives on the topic. Furthermore, SHAs were selected from different regions in the Netherlands to take into account possible regional differences. The interviewed SHAs are located in the Provence of Limburg, of Noord Brabant, of Noord Holland, and of Groningen. In addition, different sizes of SHAs and SHAs with different energy ambitions were included, in order to have a diverse sample (see Table 2). The European umbrella organisation Housing Europe (Brussels) was also interviewed, and the researchers also tried to interview the Dutch umbrella organisation of SHAs (Aedes) but unfortunately, this was unsuccessful. Data collection was completed from July–November 2020 and stopped when no new

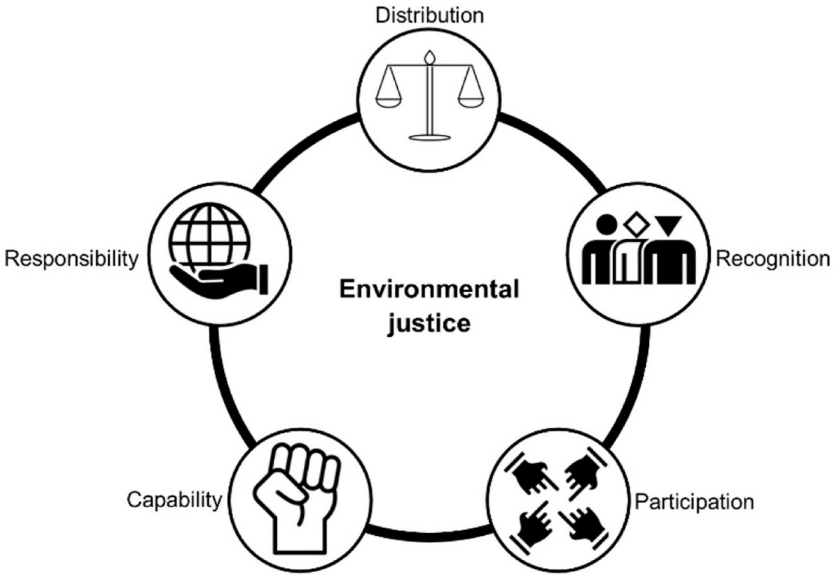

Fig. 3. The five interrelated dimensions of environmental justice [based on 15,20,22,54].

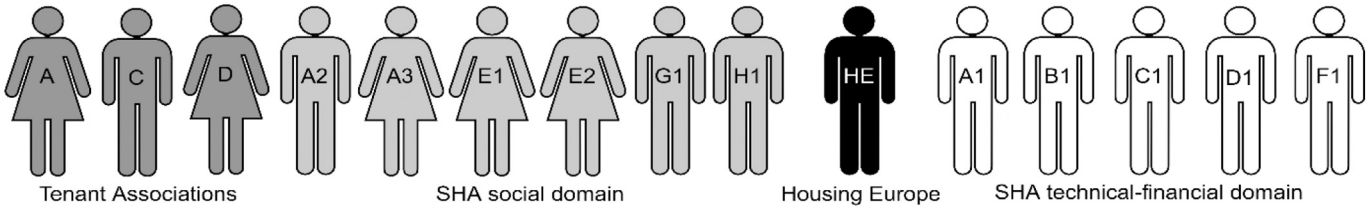

Fig. 4. Sample composition ($n = 15$) of interviewees (letters refer to the involved SHAs, see Table 2).

topics, relevant to the research questions, emerged from the interviews [67].

The multidimensional justice perspective was used to collect and analyse the data. A semi-structured interview guide was setup using the five justice dimensions (see Table A1 in the supplementary material) and was used for comparing and maintaining data quality, which also allowed the interviewer to ask additional questions if an interesting topic emerged [68]. The interview guide was piloted in two interviews and the questions were refined afterwards. The interviews were conducted face-to-face and in online interviews, by using Microsoft Teams. The latter was due to the COVID-19 restrictions in 2020. The researcher (first author) conducted the interviews. The interviews were audio recorded and digitally stored for transcription and analysis, with permission of the respondents. The interviews had an average duration of 50 min (30–90 min) and the names of the respondents and organisations are anonymized in the analysis to let them speak freely. The transcripts of the interviews were analysed by using qualitative software (Atlas.ti 8.1) and thematic coding was used to analyse the data. Analysis of the data was carried out within the research team of the five authors of this paper.

The interview technique was used to gain a better understanding of the involvement of tenants in the decision-making process about energy renovations in social housing in more depth and detail. This method allowed the interviewees to describe their experiences and their point of view on this topic satisfactorily. However, the interview technique also has disadvantages, such as a possible bias in sampling technique, interviewer bias, and subjectivity in the coding process [68]. Another limitation is that the tenants' views and needs were examined indirectly via the SHAs and TAs due to the restrictions of the COVID-19 pandemic. Consequently, the views of tenants on justice could vary from the ones offered by SHAs and TAs, which can have implications for the results and recommendations. These restrictions have to be taken into account when assessing this paper.

5. Experiences with and views on justice in the energy renovation process

5.1. Distribution

5.1.1. Financial distribution of costs and benefits

The analysis of the interview results demonstrated that the SHAs deal differently with the distribution of costs and benefits of energy renovations. Some SHAs implement a rent increase after the renovation (SHAs C, F, G, H), but others do not (SHAs A, B, D, E). However, as stated by TA_A, in most cases the costs are included in the general annual rent-increase for their complete housing stock. One way or another, the renovation has to be financially feasible, but respondent H1 questions whether it will be economical to continue to invest in the future because the rents have to stay affordable. Therefore, it was questioned by TA_A, if the SHA has to do everything the government wants regarding the climate goals, because it could make social housing unaffordable for low-incomes. External funding from national government could be a solution to overcome this barrier in reaching climate neutrality in future.

The interview results demonstrated another issue regarding the financial distribution, namely the uncertainty for the tenants if the energy savings will cover the rent increase after the renovation. It was pointed out by B1 and C1 that the calculated energy savings after renovation are based on average savings, which in practise can differ greatly per household. In addition, they both reported that there have been projects in the past in which the tenants used more energy than prior to the renovation:

Table 2
Characteristics of the interviewed SHAs (source: SHA's year plans of 2019 and data from the interviews).

Acronym	# rental dwellings	# employed fte's[a]	# rental units/ fte	Average rent	Energy ambition
SHA_A	14,500	129	112.4	Unknown	2022: average energy label B 2034: average energy label A
SHA_B	6064	34.6	175.3	€ 561	2030: average energy label A
SHA_C	9730	100	97.3	€ 544	2027: 90% of the houses have energy label A or B and 0% houses with energy label E, F or G
SHA_D	2844	32.9	86.4	€ 503	Not defined yet
SHA_E	26,062	217.2	120.0	€ 528	2020: average energy label B, 50% houses with energy label A or B 2025: 75% of the houses have energy label A or B
SHA_F	10,362	100	103.6	Unknown	2026: average energy label B
SHA_G	8354	80.5	103.8	€ 547	Average energy label B, renovate 300–500 dwellings every year until 2023
SHA_H	13,285	141.4	94.0	€ 512	2021: average energy label B

[a] fte: fulltime-equivalent.

'*In the past we experienced far less energy savings in some dwellings as could be expected from the calculated energy label. To avoid that kind of problems, we do not have a rent-increase anymore after renovation, except for solar panels*'.

(B1)

Partly due to this uncertainty about energy savings, some SHAs do not implement a rent increase anymore after an energy renovation. However, this can make deep energy renovations less financial feasible in future when deep renovations are needed to reach the climate goals. To ensure financial security for the tenants, a clear agreement on the transfer of risks about the actual energy performance and savings between the SHA and tenants can be made [15,17]. This agreement must be based on the individual energy profiles of the tenant, as they can differ greatly per household [12].

5.1.2. Non-financial distribution of costs and benefits

Respondents TA_C, B1, and D1 reported that the experienced inconvenience and the disruption of the domestic life during the renovation are important bottlenecks for the tenants. Consequently, this could mean that tenants will be reluctant to agree with the renovation plans, or that tenants will be less satisfied after the renovation. Table 3 presents an overview of the reported potential inconveniences for tenants in the interviews. In addition, TA_C revealed that it could differ per individual to what extent it is perceived as an inconvenience. Specifically people who are home during the day experience this inconvenience more, such as elderly, households with small children, and people who work in shifts and need a quiet place to sleep during the day. Moreover, D1 mentioned that the renovation is also a great challenge for tenants that are more vulnerable. Therefore, A3 advised to map the special needs of tenants regarding the renovation process, early in the process:

Table 3
Potential inconvenience issues for the tenants in the energy renovation process, derived from the interview results.

Potential inconvenience issues for tenants during the renovation process
Lack of communication of the SHA and builder
The mess builders make and leave behind
Nuisance from scaffolding – reduced accessibility dwelling
Too many house visits
Noise disturbance
Ongoing work in every living space (multiple measures)
Occupied parking places
Changing time-schedule
Excessive dust

"*Map the people with special needs during the renovation process, such as people working in shifts, and disabled people, or help 'hoarders' to clean up, so we take them into account*".

(A3)

In addition, TA_C indicated that it is needed to make clear arrangements about the inconvenience the tenant can expect during the renovation, and about what the builder will do to limit this inconvenience. In the Netherlands, these agreements can be drawn up in the legally obliged Social Plan.

In the interviews, respondents TA_A, TA_C, A1, A3, E1, E2, G1, and H1 revealed that tenants are often more interested in non-energy related benefits of a renovation to improve their overall living conditions. In contrast, B1 and C1 expressed that they do not combine energy renovations with bathroom and kitchen renovations, because, they said it causes too much inconvenience for the tenants to do everything at once. Table 4 presents the reported potential non-energy related benefits on a dwelling, and neighbourhood scale. As these non-energy related benefits could differ per individual household, it can be difficult to collect and implement this diversity in wishes and needs in the renovation plan.

5.2. Recognition

5.2.1. Reluctance to formal participation

The analysis of the interview results pointed out that it is increasingly difficult to attract a diverse group of people in their board. The interviewed TAs mentioned that this is because of the increasing legal requirements in terms of meetings, reporting, and administration, which

Table 4
Potential non-energy related benefits of energy renovations, derived from the experiences of the respondents.

Dwelling	Neighbourhood
• Improving thermal comfort	• Improving the liveability of the neighbourhood (e.g. creating more green areas for recreation, creating meeting places, setting up playgrounds for children)
• Improving indoor air quality	• Strengthening social cohesion
• Applying new bathrooms, kitchens, and toilets	• Solving climate issues (e.g. heat-stress, lack of biodiversity, drought)
• Making more living space (e.g. making the attic a living space)	• Improve traffic safety
• Implementing architectural upgrades (e.g. new front façades, painting)	• Improving safety (e.g. more outdoor lighting, safety measures for traffic)
• Improving gardens (e.g. new garden and –fences, paths to the front door)	• Improving the maintenance of public spaces
• Solving moist-issues	
• Addressing safety issues (e.g. burglar resistance, outdoor lighting)	
• Removing asbestos	

does not appeal to most tenants. Another reason is that the social housing matters have become too complex and members have to develop a very broad knowledge about several topics to be able to participate in the process. Overall, these barriers make it is challenging to involve a diverse group of tenants in formal TAs, and as a result, tenants often do not feel represented by a TA, something what is also reported in previous work [e.g. 15,16,55].

5.2.2. Representativeness in participation

Respondents A1, A3, B1, C1, E1, E2, and F1 revealed that is also challenging to include tenants in more informal participation methods, such as local resident groups. Respondent C1, F1 and A3 explained that in most cases, they are glad to find even a few tenants who are willing to participate:

> '*We always hope that there is a delegation of the tenants in a project, but if this delegation is representative that is often the question*'.
>
> (C1)

In addition, respondents A1, A2, C1, E2, and F1 stated that people who are willing to participate in the process, are often older people (55–75 years), mostly pensioners, people with a Dutch native background, and people with a strong connection to the neighbourhood. The latter are usually people who have lived in the neighbourhood for a long time. However, younger people, people with a different ethnic background, and vulnerable groups are much harder to involve in the participation process. This lack of diversity is also reported in other studies [16,52,55,56,69,70]. The under-representation is often caused by lack of time, because of a busy household and/or work [15,20], or a lack of connection to their neighbourhood [15]. As a result, the recognition of the diversity in needs and wishes of the tenants are not always met in the participation process at this time.

5.2.3. Vulnerable households

Respondents TA_A and TA_D mention that vulnerable households are even harder to involve because they have to deal with issues that are more urgent. Respondents A2 and E1 reported that not all vulnerable households are known by the SHA prior to the renovation, which can make it more difficult to recognise them. Consequently, the needs and interests of these vulnerable households could be less recognised in the renovation process and plans, which can lead to an increase of inequality. To encounter this, A3 suggested that an individual approach is needed to collect the wishes and needs of these vulnerable households.

5.3. Participation

5.3.1. Multiple participation methods

The analysis of the interviews revealed that there are multiple participation methods used in the current energy renovation process of social housing (see Table B1 in the Appendix for an overview). Respondent G1 discusses that it is important to offer different participation methods to address individual needs:

> '*Some tenants prefer to participate in a traditional resident committee, but younger people are more eager to participate in a thematic working group with concrete goals and actions*'.
>
> (G1)

These identified methods demonstrate different participation levels varying from informing, consulting to actually having decision power in the renovation process. In addition, also other studies recommend to implement a mix of participation methods, so that tenants can choose how they want to be involved: collective or individual, formal or informal, long-standing or short-standing [16,71,72]. In addition, different participation methods are also context specific and can be appropriate in different phases of the process [73], and no method is superior to others and that it is not always needed to reach the highest level of involvement [71]. However, the interview results reported that the participation methods are mostly determined by the SHAs at this time, and the tenants have little influence on this method. In addition, SHAs have still little experience with contemporary participation methods such as online platforms and videos. Nevertheless, respondents A3, B1, E2, F1, and H1, pointed out that the COVID-19 pandemic has forced them to implement and experiment with digital methods, and respondents F1 and H1 stated that these contemporary digital methods were especially appreciated by the younger tenants. This group was hard to involve in the past, and therefore they want to keep using these methods in the future.

5.3.2. Early involvement

The interview results demonstrated that it is best to involve tenants in an early stage of the project, to build up support for the renovation measures; to create a sense of ownership among the tenants; and to manage tenants' expectations early on. This is demonstrated in the following quote:

> '*By investing more time in the early stages of the renovation process, the renovation process runs more efficiently and faster and tenants experience less inconvenience*'.
>
> (H1)

In addition, respondent G1 suggested that the needs and wishes of the tenants, but also tenants' knowledge of the dwelling and possible issues, can be incorporated into the renovation plan. This information could help to make better renovation plans, which fit better to the needs and wishes of the tenants (see also Mundaca et al. [72]). Furthermore, respondents A1, G1, H1 and F1 reported that this would lead to more support among the tenants and a better renovation process with less complications and delays. However, respondents A2, B1, C1 reported that this was often not the situation, and involvement was often organised when most of the renovation plans were almost finished. Furthermore, respondents A3, C1, E2 revealed that tenants, in most cases, only have decision-power on peripheral phenomena, such as (the colour of) the front door, the tiles in the bathroom or the design of the outside area. Consequently, the tenants had little influence on the energy renovation plans, and as a result, the plans did not always meet their individual wishes and needs. Surprisingly, the interviewed TAs did report that they find it important that they as TA are involved in an early stage, but did not report the importance of an early involvement of (other) tenants. Thus, at this time, an early involvement of tenants is in most cases not embedded yet in the energy renovation process.

5.3.3. Multidisciplinary project team

Respondents A2, E2, and H1 identified that there is often a gap between the social department and the technical-economic department within a SHA. On the one hand, there are the project leaders of the renovation projects, which have to reach the energy, time and budget targets. On the other hand, there is the social department who represent the interests of the tenants. The results showed that this could sometimes cause a conflict in a renovation process:

> '*We prefer to work in a multidisciplinary team but this is often hard because the project leaders are used to develop a project within strict time and budget restrictions. Social aspects are often seen as a barrier*'.
>
> (E2)

Therefore, A2 suggested a more equal partnership between the social teams and the project leaders. However, there were no statements of TAs or SHAs' technical/economic employees on this matter. From this it can be concluded, that some SHAs experiment with multidisciplinary teams but that they are not mainstream yet.

To prevent this separation of interests of the social and technical-

economic departments in a SHA, respondent A3 explained that they have a new project organisation with a multidisciplinary project team for renovation projects. In this team, different disciplines are represented, such as someone from communication, social workers, the project supervisor, and the project leader participation. By working in this multidisciplinary way, project team members are more used to look at the process from different perspectives and learn to listen better to the needs of the tenant. As a result, the project members have declared, to interviewee A3, that they have received less negative feedback from the tenants and experienced that this way of working is more pleasant, because they can address tenants' needs prior the renovation, instead of dealing with it -ad hoc- when renovating. In addition, the renovation process is more efficient because the needs of the tenants during the process are met, and vulnerable households are helped with their problems prior to the renovation. Overall, the results demonstrate that a multidisciplinary team can contribute to a more just and people-centred energy renovation process.

5.4. Capability

5.4.1. Illiteracy

The results of the interviews reported that the growing problem of illiteracy among tenants can be a significant issue in the participation process. There is a growing problem of illiteracy in the Netherlands, where 14.7% of the adults have difficulties with reading and writing and 25% of the unemployed are illiterate [74]. However, SHAs still work quite a lot with written documentation. Nevertheless, respondent G1 mentions that many tenants solve this problem by asking a neighbour or relative for help. To address this growing illiteracy, it was proposed by E2 and A3 to find a way to communicate with the tenants, which is understandable for everyone to adapt to the tenants needs and capabilities, for instance with visual aids.

5.4.2. Capacity building

Respondent A1 identified that tenants are often reluctant to participate in the process because they think that they cannot contribute, and are often afraid they will not understand certain issues. However, A1 stated that the SHAs find the input of the tenants very valuable for the renovation process, and that tenants often underestimate what they can contribute in the process. In addition, A1 explained that they want to involve unemployed tenants in their renovation projects:

> '*In future, we would like to involve unemployed tenants in the renovation process, to allow them to gain experiences in renovation skills and enhance their possibilities in the labour market*'.
>
> (A1)

Furthermore, there were no other solutions for capacity building reported for individual tenants, but A2 suggested that the information has to be presented in such a way that all tenants can understand so that individual capacity building is not needed. Overall, capacity building for individual tenants is still an underexposed issue for SHAs.

Regarding the issue of capacity building in formal TAs, the interview results revealed that TAs have several possibilities for capacity building in the Netherlands. The TAs reported in the interviews, that they often make use of an advisor of the National tenants Union (Woonbond) when necessary. Woonbond is a National Association who stands up for the interests of tenants and TAs. They can advise tenants and TAs on several topics and assist in discussions with SHAs. This advisor from Woonbond can help the TAs to understand the technical and financial reports better. In addition, the advisor can also join the TAs in discussions with the SHA. Furthermore, the interview results reported that the formal TAs have the possibility to follow courses so that they can understand the documents of the SHA. They receive a yearly fee from the SHA for this. Overall, formal TAs have several possibilities for capacity building in the Netherlands.

5.4.3. Vulnerable households

The interview results expressed that especially the more vulnerable households are less willing or able to participate because they often have to deal with issues, which are more urgent, such as health or financial problems. As a result, they cannot afford to spent time on additional issues such as participating in an energy renovation process. Therefore, the interviewed SHAs try to help these households as much as possible before the renovation starts:

> '*Our social team tries to tackle social problems as much as possible before the renovation starts. In most cases we know the more vulnerable households*'.
>
> (D1)

When needed, they involve social authorities to help the tenants with their problems. However, respondents A2 and E1 reported that not all vulnerable households are known by the SHA on prior to the renovation, which can make it more difficult to help them in the participation process.

5.5. Responsibility

5.5.1. Responsibility for the participation process

All interviewed SHAs reported that in most cases the communication and participation process with the tenants is outsourced to the contractor, and the SHA stay more on the background. They only intervene when the contractor asks for help or when there are vulnerable households known prior to the renovation. Respondent B1 explains that SHAs often choose this working method because they have too little capacity in time and people themselves, and/or prefer not to take on this extra responsibility. However, the results demonstrated that this could cause problems with the tenants. Respondent H1 revealed that the SHAs have an important responsibility regarding the participation process, because they have a long-term commitment with the tenants:

> '*I think we outsource too much to the contractor; we have to depend on the contractor whether certain signals from the tenant are identified. However, their main focus is technology, and not on how we can let the resident live as pleasantly as possible after the renovation*'.
>
> (H1)

The outsourcing of the participation process forgoes an opportunity for SHAs to get to know their tenants better and to build up a good relationship. In addition, E2 explains that contractors do not always have the capabilities to recognise vulnerable households. Furthermore, also TA_C, A3, E2 and H1 reported the lack of social and communication skills of some builders, as they are more focused on the technical aspects of the renovation. As a result, the tenants felt dissatisfied, and especially vulnerable households did not get the help they needed. According to A3 and E2, the builders need to have empathy and social skills to address the tenants' needs in the renovation process. Thus, outsourcing the participation process to third parties can cause several difficulties in the energy renovation process if social issues are not dealt with properly. Overall, outsourcing the participation process to third parties will also require more multidisciplinary skills from this party to address the social issues in a renovation process.

5.5.2. Tenants' sense of ownership

Next to the responsibilities of the SHAs, the interview results reported that tenants also have a responsibility in the energy renovation process. The responsibilities tenants have are to participate in the process to express their wishes and needs for improving their living environment, to co-operate with the contractor in the execution of the energy renovation, and to take care of their newly renovated house and its surroundings after the renovation. However, respondents TA_A, TA_D, and A3, also revealed that it is often difficult for the more

vulnerable groups to take this responsibility, as they have to deal with issues that are more urgent. Therefore, E1 stated that these vulnerable households would often need help from the SHA and other social organisations to express their needs and wishes in the energy renovation process and beyond. Overall, tenants also have their responsibilities in the energy renovation process but especially the vulnerable households will need help to carry this responsibility.

Respondents A1 and A2 revealed that a sense of ownership of the tenants for their homes and neighbourhood is important, so that tenants feel responsible to take good care of their homes and surroundings:

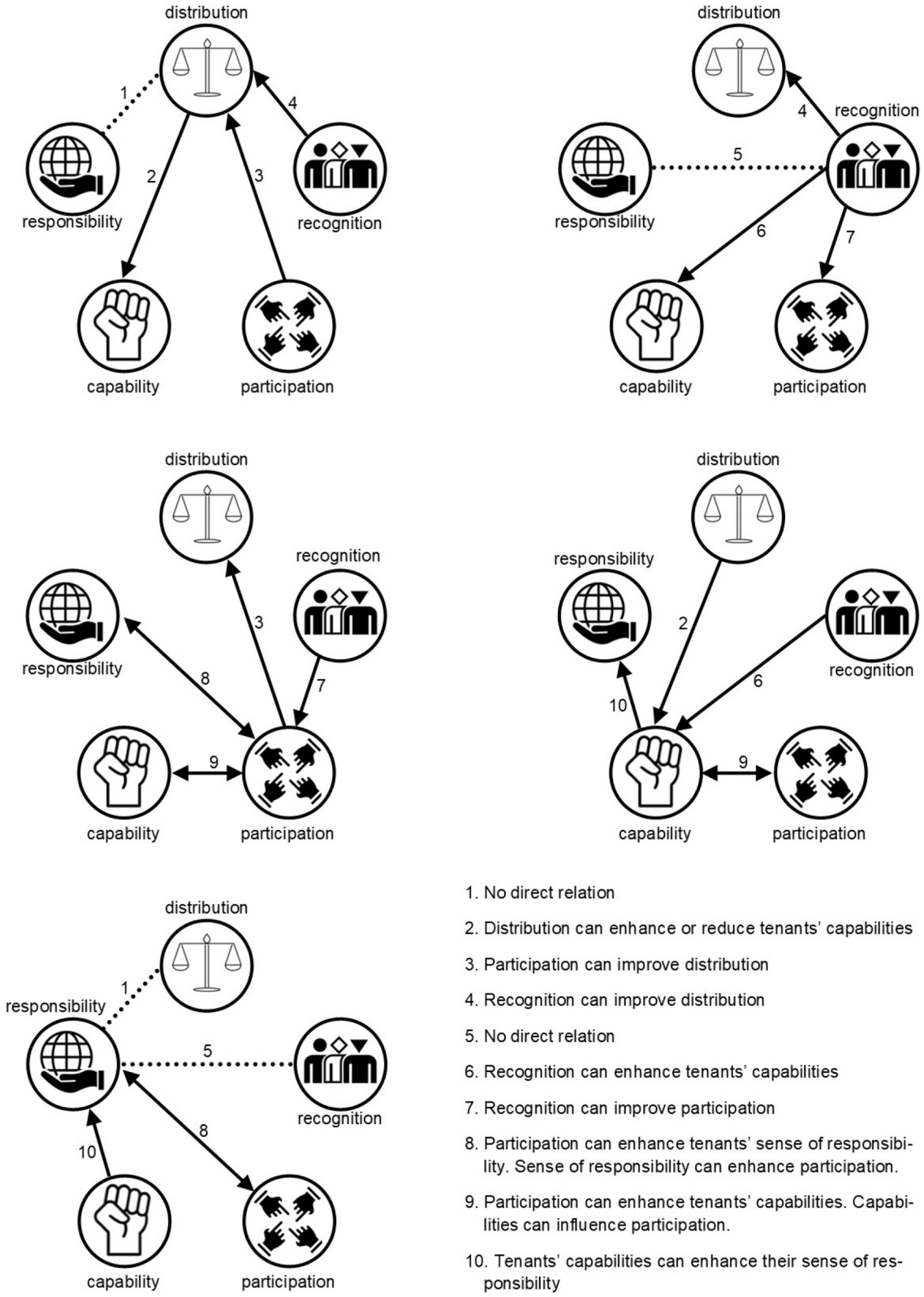

Fig. 5. The interrelations between the five justice dimensions distribution, recognition, participation, capability and responsibility, derived from our study results.

'*If you are not proud about your home, you will also not keep it tidy and neat, but if you are proud because you feel it's yours, you will also address other tenants who do not keep it tidy*'.

(A1)

To address this issue, respondents A1, A3, E1, and G1 explained that they often initiate neighbourhood projects, together with the municipality, to work on the social cohesion in the neighbourhood and tenants' sense of ownership. A strong social cohesion in the neighbourhood can contribute to a greater willingness to participate in the energy renovation process and it can increase the sense of responsibility tenants feel regarding taking care of their home and its surroundings [15]. This social cohesion can improve over time by working on strengthening the social ties within communities and encouraging interaction between different groups of tenants [16,17]. However, our study results reveal that projects, regarding strengthening social cohesion, are often project based, and within a limited time. As a result, the built up social ties often fall apart when the project finishes:

'*The long-term commitment of the SHA and municipality is often lacking, and as a result, the group of volunteers falls apart when the project is finished*'.

(TA_A)

Therefore, A1 explained that they want to invest in more long-term projects to maintain these social ties in the neighbourhood. Overall, the results revealed that a strong social cohesion and sense of ownership among the tenants could help improving their living environment. However, a long-term commitment from all stakeholders is needed to succeed.

5.6. Interrelations between justice dimensions

Next to bringing out the relevance of the five justice dimensions, our empirical findings show that the five dimensions of the multidimensional justice perspective are interrelated, and can reinforce each other. Fig. 5 demonstrates the interrelatedness of these dimensions. The relations are numbered 1–10 and are referred to in the following text. We found direct interrelations between most of the justice dimensions, except between the dimension distribution and responsibility (1) and the dimension recognition and responsibility (5), which influence each other only indirectly through the other dimensions.

Our analysis of the interview results identified that the dimension distribution can affect the capabilities of tenants (2) positively when the energy renovation improves their financial situation and negatively if it worsens it. In addition, the inconvenience during the renovation could worsen the situation for especially vulnerable households if they are not able to cope with the disruption of the renovation. Next, our findings revealed that the dimension distribution could be influenced by the dimension participation (3) when tenants' needs and wishes are incorporated in the renovation plan and process, thanks to a fair participation process early in the process. However, when there is no rent increase after the renovation, the housing association is not legally obliged to have a participation process:

'*For years the project developers have tried to do everything without a rent increase, because with a rent increase you have to talk with the tenants and get their agreement. They have to carry out the renovation in a certain time to reach the energy targets, and consultation with tenant's makes this more complicated and time consuming. Therefore, the rent increase is avoided at this time. This is something that is still very traditional in our organization*'.

(A2)

In that case, not having a rent increase appears a good distributional result but the absence of a participation process means opportunities for catering to specific needs and wishes are missed. Another finding was that the dimension distribution directly interrelates with the dimension recognition (4). When tenants are recognised in the process, their distributional needs and wishes can be better addressed in the renovation plan and process.

Next to the connection between recognition and distribution, the dimension recognition can also influence the dimension capability (6). This is because when tenants, especially vulnerable households, are recognised, they can receive the help they need, which can enhance their capabilities and the possibility to live the life they want. Furthermore, the dimension recognition influences the dimension participation (7) because when tenants are recognised, they are better able to participate in the energy renovation process. When especially vulnerable households are identified in an early stage, more can be done to help them to participate, and as a result, their individual needs can be represented better. However, vulnerable people are not always recognised as such in the process, especially not in case of non-participation. This is illustrated by the following quote:

'*Vulnerable households will not attend plenary meetings. As a result, only the issues of the people, who are present, are addressed*'

(TA_D)

This quote demonstrates that vulnerable households often do not participate in the energy renovation process, and as a result, their needs for improving their living conditions are often not met in the renovation plans.

Another finding of this study was that the dimensions participation and responsibility mutually influence each other (8). First, when tenants participate from the start, they can develop a sense of ownership, which can lead to a sense of responsibility for their home and its surroundings. In the words of one respondent:

'*You can create a sense of ownership by investing in a good participation process*'.

(A2)

Moreover, in most cases tenants with a sense of responsibility will be more willing to participate. Tenants have the responsibility to participate in the renovation process, but this is often difficult for the more vulnerable groups. Furthermore, the SHA is responsible for facilitating the participation process, but in practise, this is often outsourced to the contractor, which can hamper a fair process. The results also demonstrate that the dimension participation and the dimension capability influence each other (9). This is illustrated by respondent TA_A who questions if vulnerable households must be 'bothered' with renovation plans because they have issues that are more pressing:

'*Social housing is increasingly rented out to vulnerable households, who are concerned with their own health or financial problems. Should you bother these people with renovation plans?*'

(TA_A)

However, this can lead to renovation plans in which their needs to improve their living conditions are not met. In addition, through participation tenants can acquire certain capabilities, which can also be used in other aspects of their lives. Lastly, this study demonstrated an interrelation between the dimensions capability and responsibility (10). When tenants have more capabilities, they are more competent and capable to take responsibility for their home and its environment. This also means that vulnerable households, which often have fewer capabilities, can have problems to take that responsibility, and will need help to do so. Of course, capabilities cannot be enhanced so easily. Overall, our study revealed that it is important to also take the interrelations between the justice dimensions into account as they influence each other.

6. Lessons and recommendations

One of the goals of this study was to gather lessons and develop recommendations for a just and people-centred energy renovation process in social housing. Data was collected by interviewing members of TAs and employees of SHAs in the Netherlands on their experiences with, and views on, a fair energy renovation process. Based on the analysis of our interview results, we developed recommendations for a people-centred and just energy renovation process in social housing. Table 5 reveals the main lessons of this study and presents the main barriers and recommendations per justice dimension for a fair and people-centred energy renovation process of social housing. In addition, Table B1 in the supplementary material reports the participation methods reported in this study, including the benefits and barriers for each method. These identified methods demonstrate different participation levels varying from informing, consulting, to actually deciding. Based on our results, we recommend an implementation of a mix of participation methods adapted to the needs, preferences and capabilities of the tenants, the context of the neighbourhood, and the different phases of the energy renovation process. As discussed in Section 5, no participation method is superior to others and it is not always needed to reach the highest level of participation [71]. This overview can be used by SHAs and TAs to determine which methods are most useful depending on their specific situation.

A practical contribution of this study is presented in Table C1 in the supplementary material, which reveals recommendations for a more people-centred energy renovation process per renovation phase and per justice dimension. These findings demonstrate that awareness is needed for the five justice dimensions in all the renovation phases. From this it can be concluded that more attention must be given for justice aspects throughout the whole energy renovation process, and not only focus on energy renovations as a whole. These outcomes contribute to the literature by giving more insight into the five justice dimensions and their interrelations in the context of the energy renovation process of social housing. The recommendations can be used by policymakers, SHAs and TAs to implement a more just energy renovation process in social housing in the transition to climate neutrality.

7. Towards a people-centred energy renovation process

Prior work has documented that implementing energy renovations in social housing could worsen vulnerability to energy poverty and inequality [11–14]. Moreover, energy renovations are often technology-driven and often do not fit the wishes and needs of the tenants [15–18]. This is reinforced by the large share of vulnerable households living in social housing [7]. Hence, the transition to climate neutral social housing touches upon important issues of justice, but so far little attention has been devoted to justice aspects in the energy renovation process of social housing. First, we argue that a broader pluralistic justice approach is needed to address the needs of vulnerable households in particular. Therefore, we applied the multidimensional justice perspective of Davoudi and Brooks [22] through an investigation of the five interrelated justice dimensions of distribution, recognition, participation, capability and responsibility.

The five justice dimensions are found to be highly relevant in the context of the energy renovation process of social housing. This is because of the presence of vulnerable households, which makes a more pluralistic view on justice more relevant, considering that the dimensions recognition, capability and responsibility are specifically important for this group, next to the more common justice dimensions of distribution and participation. Second, we argue that it is also important to study also the interrelations between these justice dimensions, something what has not been done in depth in the past. Our study demonstrates that these dimensions are strongly interlinked and should not be addressed separately. Third, we argue that more awareness is needed for the five justice dimensions in the different phases of the

Table 5

People-centred energy renovation process

Dimensions	Main barriers	Main recommendations
Distribution	• The transition to a climate neutral social housing stock can worsen energy poverty when the energy savings are not realised. • The investments needed for a climate neutral social housing stock often cannot be covered by the rental revenues, and subsidies are often insufficient. • Many tenants experience major inconvenience during the renovation, especially vulnerable households. • Energy saving is not considered that important by most tenants, and if energy measures are the only ingredients of the renovation, the plan will fail to connect to most of the tenants.	• Make a clear agreement about the transfer of financial and non-financial risks and benefits between the SHA and the tenant, based on tenants' individual characteristics. • Additional funding is needed to realise the energy transition and keep rents affordable in social housing. • Limit the inconvenience of the renovation for the tenants as much as possible. • Solve problems quickly and efficient and make someone responsible for this. • Include also non-energy related benefits of the renovation in order to meet the tenants' needs.
Recognition	• Tenants often do not feel represented by a formal tenant representation. • It is difficult to recognise and involve vulnerable households. • There is often no complete overview of the social profiles of the tenants early in the process, which can hinder the renovation process. • It is difficult to take diversity into account when there are many relocations of tenants.	• Acknowledge and recognise the diversity of tenants and neighbourhoods. • Adapt to the norms, values, and attitudes of the tenants and the neighbourhood and use their way of communication. • Map the social profiles of the tenants and neighbourhoods on forehand. • Take the special needs of (vulnerable) households into account during the renovation process.
Participation	• Tenants are often not involved until late in the process, leaving little room to take their needs into account. • The different departments within a SHA often do not cooperate enough to tackle the renovation-process in a multidisciplinary way. • It is difficult to involve a representative group of tenants who are willing to participate.	• Involve tenants early in the process, to better address their needs and use their knowledge about and experiences with the dwellings. • Implement an individual participation approach in order to collect the individual needs and wishes of the tenants for improving their living conditions, and to detect vulnerable households early in the process and assist them to get the help they need. • Implement a mix of participation methods to adapt to the different preferences of tenants to participate, and involve a more diverse group of tenants. • Communicate clearly the level of control tenants have in every renovation phase. • Implement a multidisciplinary team with equal partnerships between the technical and social departments within the SHA, to create joint responsibility for the participation process.

(*continued on next page*)

Table 5 (*continued*)

People-centred energy renovation process		
Dimensions	Main barriers	Main recommendations
Capability	• Vulnerable households often do not have the capabilities to participate in the energy renovation process because they have to deal with more urgent issues. • Information from the SHA is often not read or not properly understood by the tenants due to illiteracy. • Tenants often feel not capable to participate in the participation process.	• Invest in capacity enhancement of (vulnerable) tenants on individual and neighbourhood level. • Make information about the renovation plans understandable for everyone. • Use visual and spoken communication as much as possible to address illiteracy. • Use informal and individual low-profile participation methods to involve (especially vulnerable) households.
Responsibility	• Vulnerable tenants often do not have the capacity to take responsibilities. • Tenants often feel less responsible for their homes when there is less social cohesion in their neighbourhood. • SHAs often do not have the capacity themselves to carry out the participation themselves. • In the event that participation is left to third parties, often less attention is paid to the social issues of the tenants, and vulnerable households are often not recognised.	• Help vulnerable households to be capable to participate, and to communicate their needs. • Make sure that the SHA is primarily responsible for the renovation process, as opposed to a third party. • Be visible and easily accessible as an SHA for tenants during the whole renovation process. • Work on building up social cohesion in the neighbourhood on the short and long-term, to increase a sense of joint responsibility among the tenants for their living environment.

energy renovation process, as they can differ per phase. Overall, the results demonstrate that all five justice dimensions and their interrelations are important to address in the different phases of the energy renovation process of social housing.

From our results, we conclude that a clear agreement should be made between the SHA and the tenants on how to deal with the financial and non-financial *distributional issues* in the energy renovation process. An interesting finding in this study is the trade-off between distributional and procedural justice in the event that no rent-increase takes place after the renovation, and therefore a participation process is not mandatory. Consequently, also other distributional issues are not discussed an agreed upon with the tenants. Not having a rent-increase seems as a kind distributional offer from SHAs but also leaves the opportunity to engage with their tenants about their needs and wishes concerning their living conditions.

In order to have a fair participation process, it is important to recognise the diversity of tenants with their various needs, rights, and experiences in the energy renovation process. However, our results demonstrate that it is often difficult to *recognise* the diversity of tenants with their various needs, rights, and experiences in the energy renovation process. It is often a challenge for SHAs to involve a representative group of tenants in the participation process, and specifically to involve vulnerable households. First, it is difficult to involve vulnerable households because they have other more urgent problems to deal with, and are therefore less capable of participating. Second, it is not always easy to identify or recognise vulnerable households, and consequently they do not receive the help they need to improve their living conditions and capabilities. These barriers can hinder the recognition of the diversity of needs of vulnerable households in the energy renovation plan and process, which can have a negative effect on distribution issues. To recognise the diversity of tenants in the energy renovation process, a more individual participation approach is needed to recognise and map the different needs of the tenants prior to making the renovation plans.

Our results point out that a more multidisciplinary way of working is needed to implement a more people-centred energy renovation process in social housing. Social aspects should be put on a par with technical and financial aspects. However, this way of working is not mainstream yet within the SHAs, as the different departments within an SHA often work separately. Nevertheless, some SHAs have started working with multidisciplinary teams in which there is a more equal partnership between the project leader (technical/financial department) and the social department. The results demonstrate that this has several advantages: vulnerable households are recognised and helped before the renovation starts; tenants are better informed, due to openness in communication and better accessibility of the project members; and justice-related problems can be recognised prior to the renovation, and do not need to be solved ad-hoc during the renovation process. This results in fewer complaints from the tenants.

The dimension recognition is an essential precondition to develop a fair and inclusive *participation* process. In this participation process, it should be possible for tenants to make their needs and wishes known about how to improve their living environment and how to limit their inconvenience during the renovation process. An important issue is that this participation starts prior to the development of the renovation plans. This is seldom done. A mix of participation methods can be used to acquire this diversity in needs, and to address the different preferences in how tenants want to participate. Individual methods can be used especially for vulnerable households, as they are harder to involve in participation processes. In the participation process, the financial and non-financial *distribution* issues should be discussed and agreed fairly between the SHA and the tenants.

The dimension *capability* is a justice dimension, which is understudied in previous research on energy renovations, principally because it is not part of the framework. However, it is an important dimension because of the large number of vulnerable households in social housing. Our study argues that vulnerable households often do not have the capabilities to participate in the energy renovation process. Also, a recent study by Stapper [75], about participatory processes in urban developments, reports that participatory processes are likely to increase social inequality caused by differences in capabilities. This is because in many cases, high-educated people express themselves, better, and are therefore better understood by civil servants and advisors. Whereas less privileged residents, often do not have these capabilities and as a result, often see that their needs are not met in the new development [75]. Consequently, the participation process will be less inclusive and social inequality can increase because of this.

Capacity enhancement can help tenants to build up capacities and skills to participate in the energy renovation process but also to take on *responsibilities*. These capabilities can also be useful in other aspects of their lives. Accordingly, Kimhur [36] stresses that more focus is needed on expanding capabilities in the participation process of housing policies, to also empower people in other aspects of their lives. A study by Preece [55] demonstrates that when participating tenants can acquire certain capabilities, which also can be used in other aspects of their lives, such as gaining skills and knowledge, building confidence, and developing a sense of pride in their achievements [55,76]. In line with this, Breukers et al. [15] in their study recommend that time and effort should be given to build up local capacities, so tenants have the capabilities and feel empowered to participate in the energy renovation process. Working on capacity building in the participation process can bring benefits to the energy renovation process and plan, but also to other aspects of tenants' lives. However, our study showed that this is not really a focus area at this time for SHAs. Capacity enhancement is a difficult and complex task because there are more structural problems at the root, which are not easy to solve and need long-term commitment from several stakeholders. Participating in the energy renovation process can

act to create or enhance *responsibility* among the tenants for their home and its surroundings. However, tenants need to have certain capabilities to take this responsibility and specially targeted action may be required (which makes use of existing assets). Overall, this study demonstrates that dealing with justice is not a simple managerial issue because of the contested nature of what is just and differences in values and interests.

In conclusion, our study reveals that the multidimensional justice perspective, and the five interrelated justice dimensions, can be a starting point for achieving a more just energy renovation process in social housing. The perspective can be used to implement a broader and more pluralistic perspective on justice principles. This study contributes to existing literature by providing more insight into the five justice dimensions and their interrelations in the context of energy renovations of social housing. The multidimensional perspective is found useful for addressing different justice aspects, and especially when dealing with the needs of vulnerable households. A particular novel contribution is the identification of interaction effects, which demonstrate that the five justice dimensions are strongly interlinked and should not be addressed separately.

8. Limitations and further research

Since the recommendations were developed from empirical evidence in the Netherlands and a limited sample size was used, we do not suggest that these are comprehensive and hold true for all contexts. Nevertheless, municipalities, SHAs and TAs in countries with similar social housing structures can use the findings to make their renovation process more just and people-centred. In addition, the findings can be used in broader discussions regarding justice in housing but also in other related topics, such as to compare the findings with co-ownership forms of housing (e.g. condominiums). Regarding the testing of the multidimensional framework, the scope of data collection could be extended to other cases, larger sample sizes, and other regions, to generate further elaboration. Validation of the lessons and recommendations in expert and tenant groups could also be a valuable addition for further development of the people-centred energy renovation process. In particular, the views of tenants on justice could vary from the ones offered by SHAs and TAs in this study, and it could therefore be a valuable follow-up to inquire into this. The tensions and trade-offs between the different dimensions are a topic for further research because our study was not designed to study those in great detail, for instance in an in-depth case-study. How SHAs can help to enhance tenants' capabilities in the energy renovation process is an important issue that also warrants more research.

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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.

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