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From Climate Injustice to Resilience: What Is the Role of Social and Technological Innovation?

Farzaneh Khayat

ABSTRACT

For too long climate change addressed as an environmental issue without truly articulating that this is first and foremost a social/environmental justice issue. Using a justice framework that includes the principles of distribution, recognition, and procedural, this article explores how innovation can address causes of climate injustice. The article highlights opportunities for introducing social and technological innovation in two areas: communities and institutions. The discussion of these two areas underscores the many potential roles of social and technological innovation: (1) to handle the impacts of extreme weather in communities; and (2) to create climate and energy resilient institutions. Furthermore, the article shows that this (in)justice framework is useful to better capture the role of innovations in the reduction of existing inequalities. This study calls attention to the pivotal role that innovative social and technological approaches play in finding solutions for climate injustice.

Keywords: climate (in)justice, social innovation, technological innovation, resilience

INTRODUCTION

CLIMATE CHANGE UNEQUALLY affects¹ the poor, people of color, and indigenous communities, who are less responsible for global emissions, yet it bears the most. Climate-related hazards can drive a “vicious cycle” of increasing vulnerability and exacerbating inequality with more frequent and more intense weather events such as floods, droughts, storms, rising sea levels, and insufficient precipitation.^{2,3} In other words, the world’s most vulnerable people suffering

early and from the harshest consequences of climate change disruption have experienced increased challenges that threaten their wellbeing.⁴

Furthermore, climate change is a matter of ethical concerns because its consequences are likely to be devastating for human and nonhuman life for now and in the future. Ethics, dealing with *human goods* that can be harmed by climate change, raised the questions of who has what responsibilities, who has to suffer the burdens, and how these link to the rights of others.⁵ To answer these questions, academics engage in ethical inquiries to clarify the construct of moral considerations to ascertain what should be done.⁶ Indeed, substantial debates demonstrate the inevitable need to put the concept of justice at the center of climate change to address unequal climate-

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¹Linda Shi, Eric Chu, Isabelle Anguelovski, Alexander Aylett, Jessica Debats, Kian Goh, Todd Schenk, *et al.* “Roadmap Towards Justice in Urban Climate Adaptation Research,” *Nature Climate Change* 6 (2016): 131–137.

²United Nations. *Inequality in a Rapidly Changing World, World Social Report 2020*. (United Nations, 2020).

³April Karen Baptiste and Kevon Rhiney. “Climate Justice and the Caribbean: An Introduction,” *Geoforum* 73 (2016): 17–21.

⁴World Health Organization. “Climate Change and Health,” October 30, 2021. <<https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health>>. (Last accessed on July 16, 2022).

⁵Tim Hayward. “Climate Change and Ethics,” *Nature Climate Change* 2 (2012): 843–48.

⁶*Ibid.*

related hazards linked to sociopolitical and economic inequalities that marginalized communities confront.⁷

A climate justice—rooted in social and environmental justice—has been proposed to understand the unequal consequences of climate change. In this framework, the focus is on how individuals have experienced the unequal and adverse effects of climate change, and to address who is the most responsible for the human-induced climate change and who is the most negatively affected.⁸ Climate justice links human rights and development by protecting the rights of the most vulnerable and conceding the need for fair stewardship of the global resources.⁹ Climate justice highlights anthropogenic climate change impacts that are intergenerational and persist on the earth for centuries. Each generation inherits a legacy of environmental conditions and natural resources from its predecessors that should be held in trust for future generations. Climate change has repercussions for future generations and results in intergenerational equity concerns.

Like it or not, we all are affected by climate change and need an adaptive response to live in a changing climate. In view of adapting to changes, humans have found ways for survival purposes throughout history with innovative thinking, which allows them to imagine possible solutions to help them adjust to new environments. This ability possibly makes humans the most adaptive species.¹⁰ In fact, innovations have been part of this adaptive response to changing needs, demands, and socioeconomic instabilities.¹¹ The future will come with changes and innovations are “designed to initiate and establish future developments concerning technology [...], and social practices.”¹²

Furthermore, the depth of change experienced in modern society demands greater attention to innovations as innovations are not only essential in responding to uncertainties but can contribute proactively to the expected changes in communities, such as responding to the effects of climate change,¹³ and addressing the inequalities caused or exacerbated by climate change. In 2018, the Intergovernmental Panel on Climate Change announced with “high confidence” that “innovations can

contribute to limiting warming to 1.5°C.”¹⁴ The difference of half a degree of reduction of global warming “has strong benefits for terrestrial and wetland ecosystems,” including prevention of desertification, flood control, water and air purification, sources of food, and recreation.”¹⁵ The significant role of innovations in response to climate change can support solutions that reflect injustices in the burden imposed by the climate crisis among communities. Using a polycentric model, this article explores social and technological innovations, occurring in communities, institutions to address the causes of climate injustice and to enable community resilience.

The rest of this article is organized as follows: First, a summary of discourse about climate (in)justice is outlined and a framework to illustrate causes of climate injustice, drawing from literature on justice philosophy and principles is presented. Next, social and technological innovations in practice is explored upon a range of diverse scholarship with the aim of addressing the causes of climate injustice, in two areas of communities and institutions. Finally, the necessity for exploring innovations leading to fortifying resilience is reflected.

JUSTICE FRAMEWORK IN CLIMATE CHANGE

Although past research studied dimensions of climate justice^{16–20} a comprehensive frameworks is still needed to recognize and integrate diverse dimensions of climate (in)justice in a systematic way.²¹ To be more precise, climate justice, unlike environmental justice, often lacks clarity on analytical focus and spatial deconstruction.²² Justice framework most often recognizes principles of distribution, procedural, and recognition. These principles illustrate why climate change is an issue of injustice

⁷Adrian Martin. “Global Environmental in/Justice, in Practice: Introduction,” *Geographical Journal* 179 (2013): 98–104.

⁸Baptiste and Rhiney. “Climate Justice and the Caribbean: An Introduction.” 2016.

⁹Mary Robinson Foundation. “Principles of Climate Justice,” *Mary Robinson Foundation—Climate Justice*, 2015, 3. <www.mrfcj.org/pdf/Principles-of-Climate-Justice.pdf>. (Last accessed on March 2020).

¹⁰Nathanael Massey. “Humans May Be the Most Adaptive Species - Scientific American,” September 25, 2013. <<https://www.scientificamerican.com/article/humans-may-be-most-adaptive-species/>>. (Last accessed on July 16, 2022).

¹¹Daivi Rodima-Taylor, Mette F. Olwig, and Netra Chhetri. “Adaptation as Innovation, Innovation as Adaptation: An Institutional Approach to Climate Change,” *Applied Geography* 33 (2012): 107–111.

¹²Carrie Bauer and Vanna Gonzales. “Social Innovation,” *Encyclopedia of Quality of Life and Well-Being Research* 5 (2014): 6098–6101.

¹³Ibid.

¹⁴IPCC. “Proposed Outline of the Special Report in 2018 on the Impacts of Global Warming of 1.5°C above Pre-Industrial Levels and Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change,” *Ipcc-Sr15 2* (Oct 2018): 17–20.

¹⁵Ibid.

¹⁶David Schlosberg. “Reconceiving Environmental Justice: Global Movements and Political Theories,” *Environmental Politics* 13 (2004): 517–540.

¹⁷Baptiste and Rhiney. “Climate Justice and the Caribbean: An Introduction.” 2016.

¹⁸Jeff Popke, Scott Curtis, and Douglas W. Gamble. “A Social Justice Framing of Climate Change Discourse and Policy: Adaptation, Resilience and Vulnerability in a Jamaican Agricultural Landscape,” *Geoforum* 73 (2016): 70–80.

¹⁹Mary Robinson and Tara Shine, “Achieving a Climate Justice Pathway to 1.5°C,” *Nature Climate Change* 8 (2018): 546–569.

²⁰Zoha Shawoo and C.L. McDermott. “Justice through Polycentricity? A Critical Examination of Climate Justice Framings in Pakistani Climate Policymaking,” *Climate Policy* 20 (2020): 199–216.

²¹Melanie McDermott, Sango Mahanty, and Kate Schreckenber. “Examining Equity: A Multidimensional Framework for Assessing Equity in Payments for Ecosystem Services,” *Environmental Science and Policy* 33 (2013): 416–427.

²²Susannah Fisher. “The Emerging Geographies of Climate Justice,” *Geographical Journal* 181 (2015): 73–82.

by evaluating individuals' access to social goods, decision making, inclusivity, and value.^{23,24}

To indicate, distributive justice assesses where unequal allocation of benefits and burdens associated with climate actions exists and how inequalities characterized by actors with different thoughts about what is a *just* result, and how these inequalities might be addressed. Juul defined Recognition justice "as the general prerequisite for the development of a socially well-functioning identity and hence for people's possibilities for self-realization, participation and social integration."^{25,26} Recognition justice help to identify whose voices may be ignored and whose development matters.²⁷ This dimension of justice recognizes power, and the process that results in status differences including, income, gender, race, nationality, and so on—in the hopes that community input will be fair.²⁸ Procedural justice is about who makes decisions and how, although definition varies with regard to whose opinion is being asked and in what context.²⁹ Procedural justice necessitates equity in political processes and encourages open and inclusive participation of decision making.³⁰ The participatory approach to planning and decision making has never been easy; any decision-making process might be considered *just* by some and *unjust* by others³¹ owing to different prioritization practices for the justice principles.

Equally important with respect to justice, Sen³² introduced the capability approach. He argues that this approach to wellbeing assessment includes evaluation of efficiency and inequality, and defines efficiency as the overall improvements, checking if someone's situation has been enhanced without anyone else's situation having become worse. He perceives human life as a set of "doings and beings"—called "functionings," and it links the evaluation of life quality to the assessment of the capability to function. Meaning that the valuation of human life quality cannot be done by concentrating only on commodities or incomes but must also give attention to capabilities.³³ In the context of climate change³⁴

Schlosberg argues that capabilities approach helps us to understand what the adaptation to climate change would consist of and what the issues of vulnerability would be, and to provide principles for climate policies.

Additionally, the inequitable structures in which marginalized communities exist are not the result of singular decision and are representative of various forms of discriminations that have negative consequences associated with different forms of injustices.³⁵ Accordingly, justice is plural, and does not have a single notion of principles, but expresses multiple ones.³⁶ For instance, indigenous groups require a "collective right of self-determination" not only an individual's human right.³⁷ Plurality acknowledges nonhuman species as subjects of justice equal to humans³⁸ because climate change leads to massive extinction of nonhuman nature. In addition, justice as a balance of these three dimensions—distributive, recognition, and procedural—are overlapped and linked together. When community members are not recognized, consequently they are unable to participate in decisions about benefits and losses of resources allocation and disputations resolvers, all of which exacerbate inequality rather than decrease it.³⁹

To address causes of climate injustices (drawing on the summary of justice reviewed previously), Table 1 outlines a conceptual framework, based on the mentioned principles. This framework provides a mechanism that helps reveal main notions of injustices that are associated with climate change. Note that this framework outlines criteria to assist addressing causes of climate injustice rather than generalizing applicable guidelines.

Applying this framework, this article uses the polycentric model (adapted from Elinor Ostrom, the late Nobel Laureate) to indicate the role of social and technological innovations and (in)justice principles in two areas of: communities and institutions (Fig. 1). In fact, this figure conceptually illustrates the relations of three (in)justice principles with social and technological innovations among communities and institutions. The concept of polycentricity has recently been at the center of environmental governance discussions recently owing to lack of progress in global climate negotiations.⁴⁰ Elinor Ostrom argues the advantages of polycentric

²³Ibid. Martin (2013).

²⁴Ibid. McDermott *et al.* (2013).

²⁵Søren Juul. "Solidarity and Social Cohesion in Late Modernity: A Question of Recognition, Justice and Judgement in Situation," *European Journal of Social Theory* 13 (2010): 253–269.

²⁶Axel Honneth. "The Struggle for Recognition: On the Social Theory in Hegel's Jena Realphilosophie," ed. Translated by Joel Anderson (1995). *The Struggle for Recognition: The Moral Grammar of Social Conflicts*. (The MIT Press, 1996), 31–63.

²⁷Shanil Samarakoon. "A Justice and Wellbeing Centered Framework for Analysing Energy Poverty in the Global South," *Ecological Economics* 165 (2019): 106385.

²⁸Ibid. Martin (2013).

²⁹Ibid.

³⁰Ibid. McDermott *et al.* (2013).

³¹Ibid. Martin (2013).

³²Amartya Sen. "Development as Capability Expansion," in *Human Development and the International Development Strategy for the 1990s* (1990).

³³Ibid.

³⁴David Schlosberg. "Climate Justice and Capabilities: A Framework for Adaptation Policy," *Ethics & International Affairs* 26 (2012): 445–461.

³⁵Lemir Teron, "Deconstructing Inequality: Cumulative Impacts, Environmental Justice, and Interstate Redevelopment," *Richmond Public Interest Law Review* 25 (2022).

³⁶K. Morrow. "The Justices and Injustices of Ecosystem Services," *Journal of Environmental Law* 26 (2014): equ010.

³⁷Morrow, 2014, p. 9.

³⁸Ibid.

³⁹Jouni Paavola and W. Neil Adger. "Fair Adaptation to Climate Change," *Ecological Economics* 56 (2006): 594–609.

⁴⁰Tiffany H. Morrison, W. Neil Adger, Katrina Brown, Maria Carmen Lemos, Dave Huitema, and Terry P. Hughes. "Mitigation and Adaptation in Polycentric Systems: Sources of Power in the Pursuit of Collective Goals," *Wiley Interdisciplinary Reviews: Climate Change* 8 (2017): 1–16.

TABLE 1. PROPOSED CONCEPTUAL (IN)JUSTICE FRAMEWORK

<i>Causes of climate injustice</i>	
(Mal)distribution	Unfair distribution of individual rights and power Disproportionate distribution of burdens and benefits ¹⁴² Undetermined distribution of responsibility for inter/intragenerational climate change impacts ^{18,20}
(Mis)recognition	Lack of the realization of rights and equity ^{142,143} Failure in vulnerability recognition ^{16,39,144} Broken social networks and nonrecognition of political voice ¹⁴³ Unrecognition of nonhuman rights
(Non)procedural	Unequal access/participation in decision making ³⁹
(In)capabilities	Lack of human ultimate wellbeing and flourish the functioning of his life ³²

approaches over monocentric ones, describing climate change as a global collective action problem could be lowered if many participants take remarkable actions.⁴¹ Ostrom further states polycentric approach promotes experimentation by multiple actors and learning from diverse groups at multiple scales.⁴²

This article proposes a polycentric model, specifically indicating how social and technologically innovative actions can be taken at multiple scales ranging from communities and institutions to generate equity and benefit the marginalized.

SOCIAL AND TECHNOLOGICAL INNOVATION IN PRACTICE: TWO AREAS OF COMMUNITY AND INSTITUTION

Social innovation

Social innovations are known as novel solutions that meet social needs more efficiently than present solutions, leading to new or enhanced capabilities and relationships and better use of resources. From the early days in practice, social innovations came to be known to drive cultural change and challenge the traditional values. Social innovation has been used in numerous contexts for centuries; for instance, in the nineteenth century, the U.S. Supreme Court provided a system to adapt the American Constitution to new situations and requirements, whereas earlier constitutions had been accepted as “eternal verity” and were believed to be unchangeable. One century later, social innovation, without any precedent, created health insurance, retirement pensions, and insurance against industrial accidents followed by unemployment compensation to “defuse a class war” in Germany. In 1992, social innovation was discussed at the United Nations Conference on Science and Technology, by focusing on finding solutions for the basic issues of poverty, hunger, and extreme social injustices.

When it comes to the topic of climate change and injustices, scholars readily agree to interdisciplinary in-

tegration of social and physical science and establish research centers and journals to engage with social innovations to shed light on climate change.⁴³ In 2010, special issues of *Annals of the Association of American Geographers* and the *Journal of Applied Geography* highlight how important this interdisciplinarity is to understand socioecological systems and emphasize a need for a place-based approach on vulnerability to climate change and an expansion of social science perspective of climate actions.⁴⁴ These scholars believe effective solutions to climate change demand innovation because innovation is humans’ adaptive response to altering needs and conditions.⁴⁵

These two special issues emphasize a need for “practice-relevant” and “locally based” research and creative solutions, necessitate the significance of collective and cooperative aspects of innovation to analyze multidimensional nature of climate change, and concentrate on local institutions and their multiscale character.⁴⁶ Moreover, these issues consider social innovations to concentrate on the social good and reinforce civil society while maintaining the interests of the vulnerable within a capitalist economy.⁴⁷

According to Phills *et al.* an innovation is truly social only if it benefits the society as a whole rather than benefit entrepreneurs, financiers, and ordinary (not deprived) consumers.⁴⁸ They define social innovation as “a novel solution to a social problem that is more effective, efficient, sustainable, or just than existing solutions and for which the value created accrues primarily to society as a whole rather than private individuals.”⁴⁹ Phills *et al.* further explain a social innovation can be “a product,

⁴³Ibid. Rodima-Taylor *et al.* (2012).

⁴⁴Ibid.

⁴⁵Ibid.

⁴⁶Ibid.

⁴⁷Molly Scott-Cato and Jean Hillier. “How Could We Study Climate-Related Social Innovation? Applying Deleuzian Philosophy to Transition Towns.” 4016 (2010), <https://doi.org/10.1080/09644016.2010.518677>.

⁴⁸Dale T. Miller, James A. Phills, and Kriss Deiglmeier. “Rediscovering Social Innovation,” *Stanford Social Innovation Review* 6 (2008).

⁴⁹Ibid.

⁴¹Elinor Ostrom. “Polycentric Systems for Coping with Collective Action and Global Environmental Change,” *Global Environmental Change* 20 (2010): 550–557.

⁴²Ibid. Ostrom (2010).

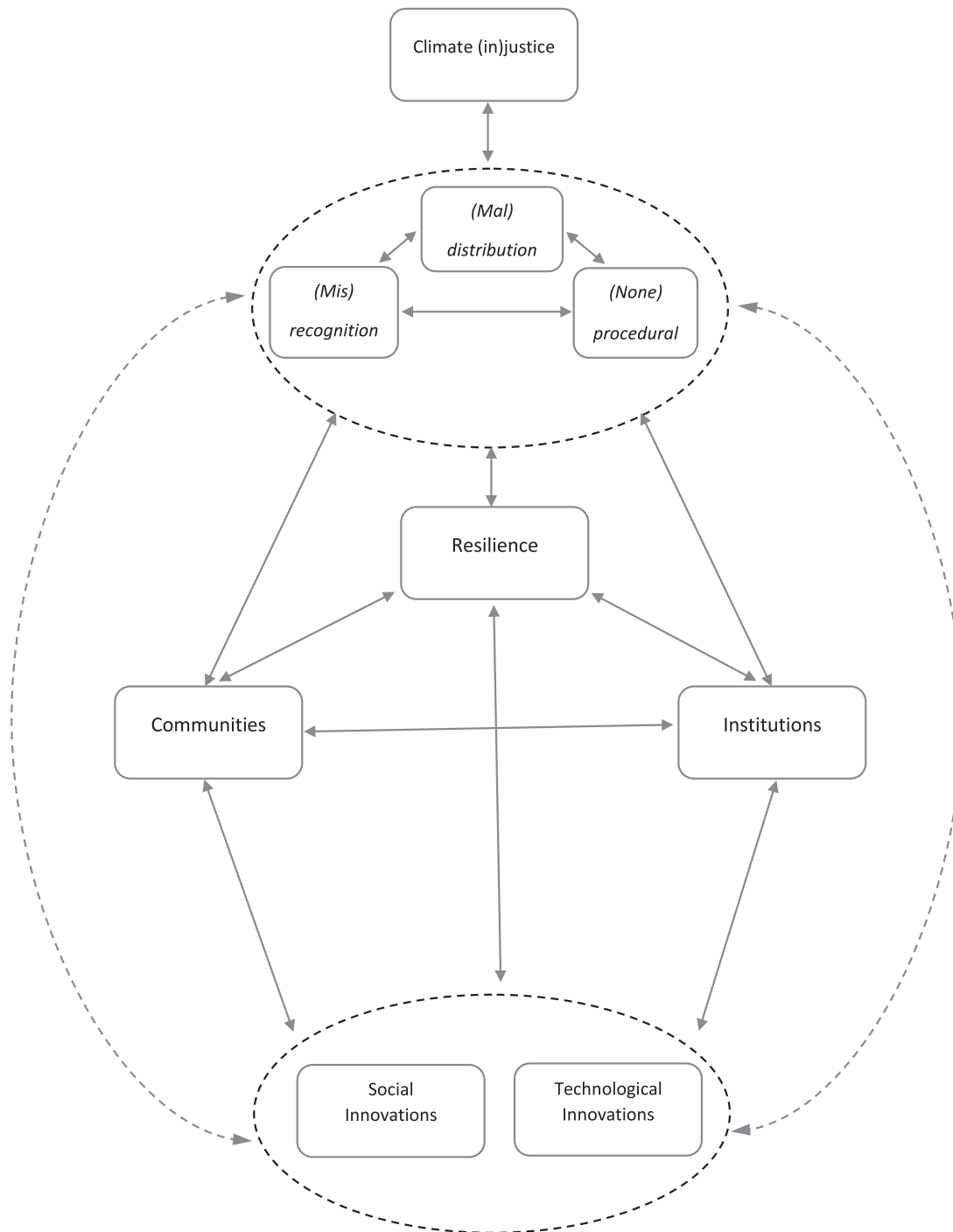


FIG. 1. The relations between three (in)justice principles with social and technological innovations among communities and institutions.

production process, [...], but it can also be a principle, an idea, a piece of legislation, a social movement, an intervention, or some combination of them.”⁵⁰ In 2014, the European Commission’s Directorate-General Environment, which provides the latest environmental policy-relevant findings, acknowledges social innovation is a valuable tool to analyze multidimensional challenges of climate-related

risks that often require behavioral shifts in communities and (climate) actions on the multiscale local institutions.⁵¹

Consider a study of assessing 202 cases of (sustainable) innovations, deriving from a European database (titled Casipedia), concerning climate action, resource

⁵⁰Ibid.

⁵¹European Commission. “Social Innovation and the Environment,” *European Commission DG Environment* 10 (2014): 41.

efficiency, and the environment, exploring how social innovations differ from other types of innovations.⁵² This dataset contains seven types of innovations: social, service, product, governance, organizational, systemic, and marketing, and applies five success factors: economic, environmental, social, political, or technological. By looking at success factors and the vital issues initiating these innovative cases, Repo and Matschoss found social innovation targets social issues directly and relates economic progress to eradicate poverty more precisely compared with other innovations.⁵³ With regard to climate change, this research shows social innovations direct climate action more than other innovations through sustainable lifestyle but less by direct climate change mitigation innovations. Repo and Matschoss report social inclusion and the empowerment of residents (such as employment of and/or housing for disadvantaged people) is much more prevalent in social innovation than in other types of innovations and mainly associated with social interaction and community involvement (such as cooperation with schools) and social acceptance. How social innovation can support climate justice in community and institution is given in more detail hereunder.

Social innovation in community

Distributional justice. Climate change integrates three patterns of distribution: (1) harm and the vulnerability to harm (or disbenefit), (2) responsibility for that harm,⁵⁴ and (3) resources to assist with effective post-disaster recovery. These patterns of distribution interconnect to create multiple forms of injustices. This “triple injustice” provides the foundation on the concept of “who gets what and who suffer the most,” which is always crucial to justice claims on climate policy documents. To illustrate how this distribution of inequities plays a role before and after a disaster, hurricane Katrina that hit Gulf Coast of the United States, caused >1800 deaths and \$1 billion damage in the city of New Orleans⁵⁵ in 2005 explains here. Then two examples of social innovation at the local level that make the New Orleans more resilient have been explained.

Campanella⁵⁶ discusses the history of distributional injustices throughout the New Orleans 300-year history, beginning in colonial times. He discusses how predominantly lower income and African American neighbor-

hoods developed in areas with higher environmental risks and in twentieth century these communities face greater flood risks. This city relied on engineered infrastructure to reduce exposure to flooding. Although land use and development patterns play a central role in defining how harm and vulnerability are distributed during floods, within days of the city’s flood walls and the levees collapsing, it was revealed flooded areas comprised mostly poor and black.⁵⁷ Lower income and African American neighborhoods developed in areas with greater flood risks where 75% of African American lived in damaged areas and only 46.2 in undamaged areas.⁵⁸ In addition, Campanella explained the ethnic geography of New Orleans in face of Katrina as the population of African Americans was 67% of pre-Katrina and 76% of flood victims; Whites had 28% and 20%; Hispanics had 3% and 3%; and Asians had 2% and 3%.⁵⁹ Disproportionate flood impacts in line with wealth inequality shows that damaged areas had 30% of households under the federal poverty line versus undamaged areas with 25%.⁶⁰

Relative to unequal harm distribution after the storm, those who were unable to evacuate were disproportionately poor, black, the and elderly population.⁶¹ Although a mandatory evacuation order was announced the day before the hurricane (leads to a mass evacuation), many were left behind because most of the evacuation took place by private car, and evacuation by bus was insufficient and poorly organized.⁶² Furthermore, access of poor African Americans to cars compared with poor Whites was 17% versus 53% by the time of disaster.⁶³ Elliott and Pais’s analysis of collected survey data from >1200 survivors claims higher income groups were about twice as likely to have evacuated before the storm, and low-income blacks were most likely to have remained.⁶⁴ And the total fatality statistic shows the Katrina’s victims were disproportionately elderly and black people.⁶⁵

Concerning the unfair distribution of benefits and resources to assist with post-Katrina recovery, one controversial issue is planning processes. New Orleans experienced a number of planning processes. The first plan that sought to reduce the city’s footprint proposed replacement of largely African American residential neighborhoods (such as Gentilly) with parks while saving similarly severely damaged areas with predominantly white resident (such as Lakeview); this plan was

⁵²Petteri Repo. “Social Innovation for Sustainability Challenges.” 2020.

⁵³Ibid. Repo (2020).

⁵⁴Lucrecia Wagner. “Environmental Justice,” in *The Routledge Handbook to the Political Economy and Governance of the Americas*. (Routledge: London, 2020), 1–14.

⁵⁵Kevin Ambrose. “Sixteen Years after Katrina, New Orleans Has Strengthened Its Flood Barriers - *The Washington Post*,” August 28, 2021. <<https://www.washingtonpost.com/weather/2021/08/28/hurricane-katrina-orleans-rebuilt-photos/>>. (Last accessed on July 16, 2022).

⁵⁶Richard Campanella. “An Ethnic Geography of New Orleans,” *Journal of American History* 94 (2007): 704–715.

⁵⁷Ibid. Wagner (2020).

⁵⁸Manuel Pastor, Robert Bullard, James K Boyce, Alice Fothergill, Rachel Morel Lo-Frosch, and Beverly Wright. “Environment, Disaster, and Race After Katrina,” *Race, Poverty & the Environment* 13 (2006): 21–26.

⁵⁹Ibid. Campanella (2007).

⁶⁰Ibid. Pastor *et al.* (2006).

⁶¹Ibid. Wagner (2020).

⁶²Ibid. Pastor *et al.* (2006).

⁶³Michael Eric Dyson. *Come Hell or High Water: Hurricane Katrina and the Color of Disaster* (Basic Civitas Books, 2006).

⁶⁴James R. Elliott and Jeremy Pais. “Race, Class, and Hurricane Katrina: Social Differences in Human Responses to Disaster,” *Social Science Research* 35 (2006): 295–321.

⁶⁵Ibid. Wagner (2020).

abandoned shortly after.⁶⁶ In discussion of post-Katrina's planning development, Anguelovski *et al.*⁶⁷ argues continuing disproportionate distribution of high flood risks to the poor and African American—despite the construction of new flood infrastructure—owing to: inattention to the issues of equity and inclusion, gentrification of fairly flood-safe neighborhoods, failure of recovery and address the unequal flood vulnerability with land-use reform.⁶⁸ Although these illustrations state the increase of vulnerability among communities, social innovations emerge to increase this city's resiliency after Katrina. Murray *et al.* argued (in global study on methods to create and develop social innovation) learning through crisis such as Katrina is a trigger to develop and design social innovation.⁶⁹

Two examples of social innovation and self-organization that helps to build resilience at the local level are explained here. One activity was taking thousands of photographs by an artist Karen Gadbois to track demolished or threatened (historic) houses and made the website titled, "Squandered Heritage." She later created the New Orleans first nonprofit newsroom, now of the pioneers of investigative and explanatory journalism in the country. Another example is The Neighborhoods Partnership Network, a nonprofit to facilitate community collaboration, increase their access to government and information, and strengthen their voices. This organization realized that "a need existed for a citywide framework to assist communities in maximizing the use of limited resources and information while providing connections to other communities that have similar obstacles so that communities can avoid duplicating efforts and work toward shared goals." This organization responds to the desires of residents to be engaged in the city's decision-making processes that impact their wellbeing.⁷⁰ The discourse of distributional justice has been articulated in various social innovations. One case study that explores the emergence of social innovation by forced-evicted communities in Jakarta is explained here. In Jakarta, forced eviction for public improvement/commercial purposes has become a long-standing and recurring problem, happens without any consultation or compensation, particularly during the authoritarian New Order era in the late twentieth century.⁷¹ From 2015 to 2017 development-induced displacement continues dis-

placing 15,042 households and 13,394 small business in this city.⁷² In kampung neighborhoods in Jakarta, engineering heavy flood mitigation imposes eviction of the most vulnerable who live along the Ciliwung river. Marginalization occurs in these neighborhoods as many underprivileged communities end up living in irregular kampung along the river owing to access to basic sanitation, transportation, and livelihoods needs, although during the rapid transformation of the city, the government widely combines them with squatters.⁷³ As a consequence of forced evictions, a large number of people became homeless, women and migrants faced a huge difficulty to earn a livelihood for themselves, and parents and children challenged access to schooling.⁷⁴ Widyarningsih and Broeck bring the discourse of social innovation into this debate to understand the dynamics of displacement, the nature and symbolic meaning of flood mitigation development, and argue that social innovation contributes to fairer relocation planning.

For this research, they conducted 16 semi-structured interviews with relocated communities, local nonprofit organizations (NGOs) such as Urban Poor Consortium, and representatives from government agencies such as the Deputy Governor for Spatial Planning and Environment of Jakarta and members of the Housing and Administrative Buildings Agency. These primary data were included site observation and official document analysis and complemented with secondary data from newspaper articles. This research acknowledges that "contestation from the grassroots was apparent from the fact that local communities were able to influence some eviction policies—indicating how social resistance can lead to social innovation."⁷⁵ They argue eviction can be opposed, challenged, formed, and transformed when local groups succeed in empowering themselves and finding alternate answers and believe "such empowerment was demonstrated in the way residents managed to negotiate with politicians and other powerful actors, build support from NGOs and other social networks, whilst simultaneously developing leadership capacities amongst themselves."⁷⁶ To go further, climate change and consequent sea level rise increase the likelihoods of flooding along the rivers, demand more attention to social innovation to respond to large number of displacements in vulnerable areas.

Recognition justice. According to recognition justice, "individuals must be fairly represented...free from

⁶⁶Isabelle Anguelovski, *et al.* "Equity Impacts of Urban Land Use Planning for Climate Adaptation: Critical Perspectives from the Global North and South," *Journal of Planning Education and Research* 36 (2016): 333–348.

⁶⁷Ibid.

⁶⁸Ibid. Anguelovski, *et al.* (2016).

⁶⁹Robin Murray, Geoff Mulgan, and Julie Caulier-Grice. "How to Innovate: The Tools for Social Innovation," The Young Foundation. <<https://www.youngfoundation.org/our-work/publications/how-to-innovate-the-tools-for-social-innovation-2/>>. (Last accessed on June 17, 2022).

⁷⁰Transmission Project | Amplifying the Power of Public Media and Technology. <<http://transmissionproject.org/resources.html>>. (Last accessed on June 17, 2022).

⁷¹L.H. Sheppard and B. Sandler. "Condemned Communities: Forced Eviction in Jakarta," *Human Rights Watch*, 2006, 18.

⁷²Anastasia Widyarningsih and Pieter Van den Broeck. "Social Innovation in Times of Flood and Eviction Crisis: The Making and Unmaking of Homes in the Ciliwung Riverbank, Jakarta," *Singapore Journal of Tropical Geography* 42 (2021): 325–45.

⁷³Tobias Gebetsberger. "Living on the Water," *Scientific American* 2 (1847): 208–208.

⁷⁴Ibid. Sheppard and Sandler (2006).

⁷⁵Ibid. Widyarningsih and Van den Broeck (2021).

⁷⁶Ibid.

physical threats and offers complete and equal political rights.”⁷⁷ In fact, lack of recognition can happen as different types of cultural, political domination, degradation, and devaluation, lead to communities (and individuals) to be overlooked or stigmatized.⁷⁸ Unjust recognition of the marginalized intensifies underlying discriminations and existing inequalities while recognizing the vulnerability of those underrepresented and/or misrepresented will lead to a more equitable community. Recognition justice is about misrecognition of vulnerable population. Recognition justice needs to be addressed to advance individuals wellbeing through fuel and energy services. How social innovation can respond to fuel poverty is given hereunder.

Social innovation includes individuals and communities that most often face multiple deprivations and challenges simultaneously and are systematically excluded from more opportunities that others have access to. This is because they are discriminated against based on their race, gender, disability, income, religion, and so on, or in other words, those are not “just like the rest of the poor” but poorer.⁷⁹ The marginalized are excluded from mainstream sociopolitical, economic, and educational life, and this exclusion deprives them from realization of opportunities and participation in the life of their communities, to have a voice and claim their rights.⁸⁰

One area that social innovation can support communities is tackling with fuel shortage because as climate change worsens fuel shortage, and the incidence of health issues related to it become worse. Fuel shortage and energy insecurity are complex and multifaceted issues; long-term unaffordable and inaccessible to energy that threaten wellbeing of household often associated with a number of socioeconomic indicators including age, gender, education, income, race, and employment status.⁸¹ Low-income, older, and minorities often live in older and less efficient housing contributing to energy insecurity. Energy insecurity on housing has been studied particularly in northern Europe and New Zealand, where the consistency of long and cold winter increases the need for reliable indoor heating. A large body of existing research demonstrates the association of inadequately heated homes with poor health outcomes that leads to: excess deaths,⁸² medical issues such as cardiovascular symptoms,⁸³ arthritis symptoms, and higher rates of hy-

pertension that can lead to strokes and heart attacks,⁸⁴ higher rates of poor well-being, and more frequent hospital visits among asthmatic children.⁸⁵

To demonstrate how social innovation can face fuel poverty findings from Real Pearl Foundation⁸⁶ in Told village, Hungary—a very disadvantaged village with high rate of unemployment and poverty—is explained hereunder. An industrial ecologist introduced the topic of producing the communities heating fuel from locally sourced waste materials to the Real Pearl Foundation. This project enables the production of biomass briquettes (mostly from agricultural by-products and paper waste), creates jobs, and employs local workers to achieve socioeconomic benefits for the marginalized, reduces heating costs, saves forests, and avoids illegal exploitation, and builds the sense of community. The openness of the municipality and the local community and the financial support of local governments were about critical to implement this project.

Procedural justice. Social innovation moves society toward “open governance” systems and helps with the policy purpose and sensitivity. Policy should be designed to ensure that individuals have a voice in decision making and are empowered,⁸⁷ support human dignity, articulate their needs and issues, and social innovations reflect those. What is more, the vulnerable are often considered as objects to be helped in ways policymaker determines, rather in ways they identify their needs and have at least some control over.⁸⁸ Unquestionably the marginalized should be treated with dignity and their full value as a human should be recognized, something that many are not used to; the policy makers can only do this in collaboration with both the social innovator and individuals in communities.

One example of implementing social innovation in communities to advocate climate action is a project platform titled Transition Now⁸⁹ in Denmark. This project provides a platform for dialogue between residents,

⁷⁷Raphael J. Heffron, Darren McCauley, and Benjamin K. Sovacool. “Resolving Society’s Energy Trilemma through the Energy Justice Metric,” *Energy Policy* 87 (2015): 168–176.

⁷⁸Ibid. Heffron *et al.* (2015).

⁷⁹DFID. “Reducing Poverty by Tackling Social Exclusion,” *Reducing Poverty by Tackling Social Exclusion*, 2005.

⁸⁰Ibid.

⁸¹Sonal Jessel, Samantha Sawyer, and Diana Hernández. “Energy, Poverty, and Health in Climate Change: A Comprehensive Review of an Emerging Literature,” *Frontiers in Public Health* 7 (2019): 00357.

⁸²J. D. Healy. “Excess Winter Mortality in Europe: A Cross Country Analysis Identifying Key Risk Factors,” *Journal of Epidemiology and Community Health* 57 (2003): 784–789.

⁸³Ibid. Jessel *et al.* (2019).

⁸⁴Jan Gilbertson, Maryjane Stevens, Bernadette Stiell, and Nicki Thorogood. “Home Is Where the Hearth Is: Grant Recipients’ Views of England’s Home Energy Efficiency Scheme.” 2006.

⁸⁵Julie Evans, Sophie Hyndman, Sarah Stewart-Brown, David Smith, Sophie Petersen, Health Services, J Evans, S Hyndman, S Stewart-Brown, and S Petersen. “An Epidemiological Study of the Relative Importance of Damp Housing in Relation to Adult Health,” *Journal of Epidemiology and Community Health* 54 (2000): 677–686.

⁸⁶“Against Fuel Poverty with Biomass Briquettes | CASI Project.” <<http://www.futuresdiamond.com/casi2020/casipedia/cases/real-pearl-foundation-against-fuel-poverty-with-biomass-briquettes>>. (Last accessed on July 16, 2022).

⁸⁷Lemir Teron and Susan S. Ekoh. “Energy Democracy and the City: Evaluating the Practice and Potential of Municipal Sustainability Planning,” *Frontiers in Communication* 3, (2018): 1–5.

⁸⁸Popke, Curtis, and Gamble. “A Social Justice Framing of Climate Change Discourse and Policy: Adaptation, Resilience and Vulnerability in a Jamaican Agricultural Landscape,” 2016.

⁸⁹“Transition Now | CASI Project.” <<http://www.futuresdiamond.com/casi2020/casipedia/cases/transition-now>>. (Last accessed on July 16, 2022).

professionals, and politicians to moves toward a “green mindset.” The way this project shaped was through a seminar that brought together 50 youth to talk about sustainable transition, created Transition Now in 2013.⁹⁰ This platform covers a wide range of topics toward a sustainable society and opens interdisciplinary dialogue between citizens, professionals, politicians. This includes a variety of activities such as seminars and monthly debate cafes where participants come up with innovative, pragmatic, and radical ideas, and create an open-source network with a communication structure such as webpage and e-mail newsletters. Members doubled after a few years; this platform provides the opportunity for open interdisciplinary dialogue related to new sustainable solutions, zero-emission transportation, and justice for under-invested communities.

Another example that indicates how social innovation is well-positioned to address the impacts of extreme weather and support procedural justice is citizen observatories. Citizen observatories (titled e-Participation) in local flood risk management processes highlights the divergent responsibilities that authorities consider for citizens and the responsibilities that citizens designate to themselves to support a mutual communication between citizens and decision makers, leads to deep changes of local environmental management practices. In fact, social innovation directs communities to create, improve, and distribute ideas and solutions to address important social needs owing to its participatory, place-based, and creative nature, where authorities do not have exclusive control of power to represent communities’ challenges and benefits.

Social innovation in institution

In discussion on climate change, social innovations highlight the social dimension of climate change and shift discourses on solutions to collective attitudes and community-based approaches.⁹¹ This shift highlights the central role of institutions as facilitating and structuring local actions to strengthen resiliency among communities.⁹² O’Riordan and Jordan defined institutions as “the multitude of means for holding society together for giving it a sense of purpose, and for enabling it to adapt.”⁹³ Institutions use structures of power and relationships in organizations with leaders, participation, resources, and knowledge, to socialize approaches of looking at the world that is shaped by communication, communities’ cultural values, and forms of active collaboration.⁹⁴ Social innovation creates a transformative force through the (inter)relationship between institutions, and social systems to promote power-sharing

between historically excluded social groups and decision makers, and to encourage community-led outcomes and decisions.⁹⁵ Moreover, institutions describe climate change both as an issue and a context. Through these relationships, institutions construct scientific knowledge and decide on more politically acceptable adaptation strategies.⁹⁶

Social innovation theory has three main dimensions of (1) creating new combinations or hybrids of active elements rather than being completely new in themselves; (2) cutting through borders of different disciplines, organizations, and sectors; and (3) supporting innovation’s distribution among all individuals, whereby each innovation reveals more (possible) innovations.⁹⁷ These key dimensions underline the vital role that “connectors” play in all innovation structures and define *institutions* as one of the main connectors in societies, link communities, concepts, and ideals, capital, and power.⁹⁸ Social innovation necessitates decision makers to work in partnership with all other legitimate actors, and as a result, policy works better for the vulnerable because they will be able to deliver their own difficulties through their own agency.⁹⁹ In fact, social innovation plays a part in providing opportunities to shift power relations toward marginalized groups and balance power disparities.

Institutional support is an influential factor to develop social innovations and to inform policy on ecosystem management.¹⁰⁰ Overlooking six case studies on how social innovations has taken place in real-world settings with consideration for the environmental implications in Europe and reveals the importance of institutional support in all cases most specifically at the start of the innovative process.¹⁰¹ This support can be in different forms such as providing places, educational resources, or access to potential stakeholders.

One of the main issues with climate change is food security; and global farmer community is threatened by climate change. Lacking precipitation, shifting precipitation patterns, increasing frequent and severe weather events, and rising sea level and average temperature make it more difficult to grow food. Although the importance of agriculture is not only for food security, it is

⁹⁵Giovany Cajaiba Santana. “Social Innovation: Moving the Field Forward. A Conceptual Framework,” *Technological Forecasting and Social Change* 82 (2014): 42–51.

⁹⁶Ibid. O’Riordan and Jordan (1999).

⁹⁷Geoff Mulgan, Simon Tucker, Rushanara Ali, and Ben Sanders. “Social Innovation: What It Is, Why It Matters, How It Can Be Accelerated,” The Young Foundation. <<https://www.youngfoundation.org/our-work/publications/social-innovation-what-it-is-why-it-matters-how-it-can-be-accelerated/>>. (Last accessed on June 21, 2022).

⁹⁸Ibid.

⁹⁹Edoardo Mollona, Eirini Aivazidou, Vitaliano Barberio, Giovanni Cunico, Luca Pareschi. PERCEIVE Project - Deliverable D7.6 “Guidelines on Cohesion Policy Communication” (2019): 14.

¹⁰⁰Reinette Biggs, Frances R. Westley, and Stephen R. Carpenter. “Navigating the Back Loop: Fostering Social Innovation and Transformation in Ecosystem Management,” *Ecology and Society* 15 (2010): 28.

¹⁰¹Ibid. European Commission (2014).

⁹⁰Ibid. Repo (2020).

⁹¹Jessica Ayers and Tim Forsyth. “Community-Based Adaptation to Climate Change-Strengthening Resilience through Development,” *Environment: Science and Policy for Sustainable Development* 51 (2009): 22–31.

⁹²Daivi Rodima-Taylor. “Social Innovation and Climate Adaptation: Local Collective Action in Diversifying Tanzania,” *Applied Geography* 33 (2012): 128–134.

⁹³Ibid. O’Riordan and Jordan (1999).

⁹⁴Ibid.

for economic development specially in underdeveloped and developing countries.¹⁰² Farming is the mainstay of the rural economy, particularly in countries such as India, Thailand, Vietnam, and Malaysia, because of limited availability of nonfarm activities in the rural regions.¹⁰³ In Malaysia, rice farmers are financially vulnerable and highly depending on the government support such as subsidies on fertilizer and pesticide.¹⁰⁴ In addition, inefficiency in rice production, dependency on imported rice caused billions of dollars to be invested in rice production to secure the nation's demand as rice is the most important food in Malaysia.¹⁰⁵

To illustrate how social innovation can address food security and tackle climate injustice, a case study of applying social innovation in agriculture sector is explained hereunder. In Malaysia rice farming has been increasingly threatened by the effects of climate change.¹⁰⁶ To confront this issue and to support farmers to improve their productivity and income—300,000 farmers rely on rice farming for their survival—and to develop governments' rural policies, agro-based public research institutes (called agro-institutions in this article) are created.¹⁰⁷

Agro-institutions create partnership between farmers and scientist and provide more efficient rice farming by applying social innovation. The partnership of researchers and farmers, improves farmers' knowledge and skills, and enhances community support in publicizing the outcomes of the project. This participatory approach does not essentially have to generate new ideas, it could be a better management of existing local knowledge with the assistance of scientist. Researchers in agro-institutions test novel rice varieties on research station or on-farm and experiment a range of research with the close monitoring, and farmers duplicate and manage the experiment on farm. Noor *et al.* acknowledge agro-institutions play two vital roles to support community through social innovation: (1) knowledge creation as a "source of future sustained growth that is non-excludable and non-rivalrous," make agro-institutions as a critical actor to rise the nation's rice productivity, economic development, and employment and (2) agriculture extension service to farmers to make them capable of improving their income.¹⁰⁸

I argue that applying social innovation in agro-institutions assists rice farmers to move toward a more equitable life and food security particularly in the era of climate change by applying three justice principles. We can clearly see *distributive justice* being approached by improving Malaysian rice farmers' income/production, providing more agriculture service to farmers, and transferring science and technology to them. Their project has had some success and the fact that this participatory approach ensures to include as many farmers as possible (both the advanced large-scale and small-scale farmers) and to realize the restrictions experienced by the farmers on the ground gives status to justice as recognition. Equally important, procedural justice can be seen as having policy interventions targeted at rural development because agro-institutions are key players to implement policy and regulation.¹⁰⁹ This researcher-farmer collaboration transforms farmers into more active actors,¹¹⁰ whose voice and concerns can be heard by local governments and decision makers in the agricultural system, leading to more opportunity for this vulnerable population. In this context, social innovation meets the needs of farmer community and requires transformation of social relations including governance system and institutions.

Technological innovation

Technological innovation in community

Every day, the significance of climate change issue rises and becomes bolder in the world. Humans have been constantly craving for new methods and technologies to tackle the unforeseeable barriers. In fact, conceiving systematic innovations to cope with the unavoidable threats posed by climate change in the contemporary history would be the norm. Creation of different types of technological innovations is one of the means to assist humans not only in addressing climate change impacts, but also concerns that have been struggled over by humans for eons. These technological innovations have been utilized to benefit our well-being in any possible way, and communities and individuals take advantage of technological innovations to implement this significance. Innovation in renewable energy technologies such as solar and wind impact enhance low-carbon development of production and living,¹¹¹ result in unlocking massive decarbonization.

Despite the apparent benefits it is unclear to what extent these innovative practices are in favor of presenting solutions against existing inequalities around the world

¹⁰²Rulia Akhtar, Muhammad Mehedi Masud, and Rafia Afroz. "Perception of Climate Change and the Adaptation Strategies and Capacities of the Rice Farmers in Kedah, Malaysia," *Environment and Urbanization ASIA* 10 (2019): 99–115.

¹⁰³Ibid.

¹⁰⁴Nur Hanis Mohamad Noor, Boon Kwee Ng, and Mohd Johaary Abdul Hamid, "Forging Researchers-Farmers Partnership in Public Social Innovation: A Case Study of Malaysia's Agro-Based Public Research Institution," *International Food and Agribusiness Management Review* 23 (2020): 579–597.

¹⁰⁵Norsida Man and Sami Ismaila Sadiya. "Off-Farm Employment Participation among Paddy Farmers in the Muda Agricultural Development Authority and Kemasin Semerak Granary Areas of Malaysia," *Asia-Pacific Development Journal* 16 (2012): 141–153.

¹⁰⁶Ibid. Akhtar *et al.* (2019).

¹⁰⁷Ibid.

¹⁰⁸Ibid. Noor, *et al.* (2020).

¹⁰⁹Victor Bekkers, Jurian Edelenbos, and Bram Steijn. "Innovation in the Public Sector Linking Capacity and Leadership," 2011.

¹¹⁰Ibid. Noor *et al.* (2020).

¹¹¹Wen Liu, Henrik Lund, Brian Vad Mathiesen, and Xiliang Zhang. "Potential of Renewable Energy Systems in China," *Applied Energy* 88 (2011): 518–525.

and endeavoring to enhance justice in the future. Governments do not succeed in distributing these advantages equally among all and justice concerns associated with moving toward low-carbon societies and shifting to renewable energy poses a serious socioeconomic threat for communities especially among the most vulnerable. To demonstrate, this section clarifies how innovative renewable energy sources, especially solar and wind energy—as an effective means of climate change mitigation—can address justice concerns to not perpetuate the discriminations created by the traditional energy system and advance climate (in)justice among communities. Many factors can drive this deficiency that highlight socioeconomic injustice. These parameters make equal accessibility to energy technology innovations and/or their benefits difficult or even impossible. This unfair access and distribution of energy technological innovations not only excludes many of local communities from the benefits of innovative practices, but also impose various burdens to the local communities.

Distributive justice. One example is developing on-shore wind energy in Oaxaca, Mexico, having more than a quarter of the country's overall wind power capacity installed and under construction.¹¹² Oaxaca is one of the Mexico's poorest states, with large portion of residents in poverty, without access to basic services, relying largely on wood biomass for their energy needs.¹¹³ The Isthmus of Tehuantepec (mainly situated in Oaxaca) is also inhabited by one of the most considerable indigenous people in Mexico.¹¹⁴ Remarkable wind potential and easily reachable land made this area by far the best place to develop wind power in Mexico, and yet this development unfairly distributes benefits and burdens on local communities. Wind power development in this area does not provide better access to energy for local people that already are marginalized because this project was designed to export electricity to large industrial consumers elsewhere.¹¹⁵ Furthermore, the developers gave significantly low fees to landowners, provided limited and low-quality employment for the locals, and impacted local farming negatively.¹¹⁶ In addition to these disadvantages for the Indigenous, developers enjoyed financial facilities and carbon credits whose benefits have not been shared with local community.¹¹⁷

Another case study under operation is *Lake Turkana Wind Project* in Kenya (the biggest private investment in the country's history with 365 wind turbines). When constructed, it will be the largest wind farm in Africa.¹¹⁸ This project not only benefited better-off urban residents with the produced electricity and left the rural communities behind but doubled the rate of violence and prostitution in the resettled camp because of huge influx of job seekers from around the county and increased the concerns about potential land grabs without compensation to landowners.¹¹⁹

These examples reveal the unfair distribution of benefits and burdens of innovative renewable energy (both at the national and local scale) and underscore the fact that the achievement of technological innovations is not an end to build a resilient community but a beginning. Although renewable energy plays a huge role to face climate change, we cannot deny the accountability of the unequal distribution of benefits and ills where local communities lose access to their land and/or deal with forced additional issues, while do not benefit from the project, for example.

Recognition justices. The challenge of technological innovation and recognition of justice are two sides of the same coin. On the one hand, technological innovations can identify who the most vulnerable are and where they live in case of climate hazards like flooding, storm, and so on. For example, satellite remote sensing provides valuable data for analysis of the different scenarios; GIS analyze and predict (potential) hazard exposures and help to better emergency management in times of extreme weather. On the other hand, it is unclear to what extent the most vulnerable benefit from the results of using these innovative tools in the real world. To demonstrate this Woodruff and Stults assessed 44 local adaptation plans in the United States, discussed how plan quality varies across communities, and through adaptation planning.¹²⁰ They argued adaptation planning fails to prioritize impacts or provide detailed procedures, raised concerns if these adaptation plans will translate into on-the-ground increase of communities' vulnerability.¹²¹

In discussion of technological innovation and recognition justice, one controversial issue is development of renewable energy technology in the land of Indigenous people without recognizing their rights. When it comes to the topic of the Indigenous rights most scholars agree the Indigenous are marginalized, their rights to self-determination are unrecognized and/or misrecognized, their culture is considered backward by officials concerned with giving attention to the Indigenous rights would slow down the development of the nation

¹¹²María Elena Huesca-Pérez, Claudia Sheinbaum-Pardo, and Johann Köppel. "Social Implications of Siting Wind Energy in a Disadvantaged Region—The Case of the Isthmus of Tehuantepec, Mexico," *Renewable and Sustainable Energy Reviews* 58 (2016): 952–965.

¹¹³Ibid.

¹¹⁴Paola Villavicencio Calzadilla and Romain Mauger. "The UN's New Sustainable Development Agenda and Renewable Energy: The Challenge to Reach SDG7 While Achieving Energy Justice," *Journal of Energy and Natural Resources Law* 36 (2018): 233–254.

¹¹⁵Ibid.

¹¹⁶Ibid.

¹¹⁷Ibid.

¹¹⁸Ibid.

¹¹⁹Ibid.

¹²⁰Sierra C. Woodruff and Missy Stults. "Numerous Strategies but Limited Implementation Guidance in US Local Adaptation Plans," *Nature Climate Change* 6 (2016): 796–802.

¹²¹Ibid.

(particularly in the case of projects with national interest).¹²² These misrecognitions lead to a wide range of injustices and negative effects such as loss of livelihood, ecosystem losses, food insecurity, displacement of people, and social conflicts among the Indigenous communities.¹²³ To demonstrate, violations of recognizing Indigenous rights in development of wind power projects that was explained earlier is discussed hereunder.

In Mexico, the land and culture of Indigenous is disrespected by businesses and government who deconsecrate their territory. Unrecognizing the Indigenous rights results in agriculture and livestock issues because of the building of roads and platforms, which represents loss of their economic activities in the lands like seasonal harvesting.¹²⁴ Howe and Boyer quote important central members of the country's wind energy lobby stating outrageous, blunt, even racist statements opposed to the Indigenous, considering them obstructing project development.¹²⁵ Besides, when the Indigenous people presented a community-owned wind farm to contribute to a bid, the Federal Electricity Commission excluded them "from even competing for access to the substation on their own land" declaring they would not be able to fund this project.

Procedural justice. In addition to distributive and recognition injustices mentioned previously, the (un)fairness process of decision making in the above-mentioned Mexican and Kenyan wind projects leads these national projects to put pressure on the Indigenous people, bias decision making, and lead to procedural injustice. To go a bit further, in Mexico, treatment of Indigenous communities was unjust because of nonexistent and inaccurate information given, lack of clarity on meetings regarding the land's rental fees and the impacts of wind farm, failure to provide translation services for non-Spanish individuals in the meetings and lease agreements, and false assemblies to sign the contracts without the involvement of all affected individuals.¹²⁶ In the Kenyan wind development project, the procedural injustice issue relates to the lack of information and inefficient planning for the locals to participate in decision making. The land lease and the approval by the authorities happened at least a year before the first official documents became available.

Technological innovation in institutions

Technological innovations hold the potential to face climate-related challenges in institutions. Indeed, technological innovations built resilient institutions through

significant contribution to Greenhouse gases (GHGs) emission reduction, improve food and energy security—including agricultural supply chains and energy production—and access to digital technology and the Internet. But there is a wide gap in the ability to use technology. Lack of access to basic infrastructure, affordability, illiteracy, and insufficient digital skills are among the reasons that marginalize the poor and prevent the benefits from innovative technology.¹²⁷

There are numerous examples of technological innovations that make institutions more climate resilient. Two institutions that could be more resilient are the Food and Agriculture Organization (FAO), an international institution that leads global effort to defeat hunger, and "Global Action Plan," a U.K.-based institution that works for a green planet. Discussed in this section are a few examples of how technological innovations, that involve institutions, can create climate resilience environment.

FAO is one of the most important, if not the most important institutions to improve food nutrition and food security working in over 130 countries worldwide. Beginning in the 1960s, the industrial model of agricultural production marginalized many of the millions of smallholders' farms and forced them out of farming by larger capitalized farmers.¹²⁸ This structure of the corporate food regime called the Green Revolution significantly weakens global agroecosystem resilience and intensified climate change. Over the past 30 years, New Green Revolution illustrated FAOs political will to reform food systems in combination with social and technologically innovative approaches. FAO uses innovative technology, traditional skills, and information, as well as social and agroecological systems, to enhance the livelihoods of smallholders, feed the hungry, and restore the agroecosystem resilience. An example on how FAO applied this strategy in Afghanistan is given hereunder.

Afghanistan has suffered immensely from the impacts from negative impacts of climate change, recognized as one of the most vulnerable countries in the world by the Global Adaptation Index.¹²⁹ According to *The Guardian*, ~80% of conflicts in Afghanistan are associated with land, water, and food insecurity, emanating from climate change.¹³⁰ To make Afghanistan more climate

¹²⁷Nikola M Trendov, Samuel Varas, and Meng Zeng. "Digital Technologies in Agriculture and Rural Areas - Status Report." <<http://www.wipo.int/amc/en/mediation/rules>>. (Last accessed on June 19, 2022).

¹²⁸Eric Holt-Giménez and Miguel A. Altieri. "Agroecology, Food Sovereignty, and the New Green Revolution," *Agroecology and Sustainable Food Systems* 37 (2013): 90–102.

¹²⁹"Afghanistan | ND-GAIN Index." *The ND-GAIN Matrix*, 2019. <<https://gain-new.crc.nd.edu/country/afghanistan>>. (Last accessed on July 16, 2022).

¹³⁰How Climate Change Is a 'death Sentence' in Afghanistan's Highlands | Afghanistan | "The Guardian," August 30, 2017. <<https://www.theguardian.com/world/2017/aug/28/how-climate-change-is-death-sentence-afghanistan-highlands-global-warming>>. (Last accessed on July 16, 2022).

¹²²Ibid. Villavicencio Calzadilla and Mauger (2018).

¹²³Ibid.

¹²⁴Ibid. Huesca-Pérez *et al.* (2016).

¹²⁵Cymene Howe and Dominic Boyer, "Aeolian Extractivism and Community Wind in Southern Mexico," *Public Culture* 28 (2016): 215–235.

¹²⁶Ibid. Villavicencio Calzadilla and Mauger (2018).

and energy resilient, a 10-year Renewable Energy Strategy that is recognized as the most important national economic policy, determined by the Ministry of Rehabilitation and Development of Rural Areas, executes plans in cooperation with the Ministry of Energy and Water, and prioritizes energy provision for small and medium-scale corporations. This policy aims to provide access to innovative green energies to develop rural areas. The implementation of renewable energies' technologies help Afghanistan move toward a low-carbon economy, develop the country's economy and wellbeing, concentrate on the efficiency of renewable energy, and reduce electricity and fossil fuel importation. This includes all renewable energy technologies including solar (photovoltaic and thermal), wind, biomass, small hydro, biogas, municipal waste, geothermal, fuel cells, clean storage, and hybrids of the two or more of the above.¹³¹

Distributive justice. Development of renewable energy technology improves the marginalized groups' access to energy from 28% to 65% in villages. This development harmonizes with projects on the irrigation, farming, manufacturing, educational, and health care programs. To go further, the implementation of innovative green energy decreases the use of solid fuels for cooking and heating, provides efficient and effective heating and cooking facilities in households that leads to public health more specially among women and children in Afghanistan's rural areas. Indoor exposure to solid fuels associated with health issues such as respiratory infections in children, and chronic pulmonary illness and lung cancer in women due to the World Health Organization report (worldwide 2.6% of all ill-health is associated with smoke from solid fuels, whereas 90% of rural families, most of whom live in developing countries, use solid fuels for cooking or heating).¹³²

Recognition justice. The implementation of the above-mentioned energy innovations empowers Afghan women and promotes gender equity. This implementation requires enhancing role of rural women in the use of renewables—needed at least 30% women's employment in all renewable energy activities—and other socioeconomic activities through education, health plans, and cooperation in agriculture. Women in Afghanistan suffer disproportionately from multiple issues including lack of economic and social independence. Recognizing women as a vulnerable part of society and increasing their access to development of renewable technology and as a result to financial resources support women representation in

economy and promote recognition, justice, and development in Afghanistan.

Procedural justice. Another institution that applies technological innovation to combat climate change is Global Action Plan, a U.K.-based institution founded in 1993. This institution partners with several government departments and agencies, local authorities, and philanthropic organizations. This institution defines itself as a charity working with communities on bringing "compassion not consumerism" and increasing wellbeing. Global Action Plan consists of volunteers who work together and organize groups to explore innovative actions to improve communities' resilience. This institution is behind the United Kingdom's largest air pollution campaign that created the first online carbon calculator. Global Action Plan adopts resources and tools for social change and attempts to reduce GHG emissions by leading different activities among communities.

One of their recent activities is to support the youth to confront overconsumption and encourage buying less to reduce families' carbon footprints. To do so, this institution developed two programs for youth and parents with the collaboration of the Department for Digital, Media, and Sport. One of these programs provides free resources such as ad-block plugins and digital privacy tools for youth to disable cookies in browsers (cookies collect and sell data to big companies and target people's interest becomes a new way of shopping). These plugins allow users to prevent advertisements from being showed. Another program offers an educational platform to parents to help the youth of their family to be more resilient to advertising, for example, by editing advertising settings and social media platforms. In addition, they ask parents to write letters to their child's school and question local councilors to evaluate how online marketing and advertisements are regulated. The institution activities give citizens voice and truthful motives contribute to a positive relationship between local governments and citizens and drive procedural justice.

In addition to using the above-mentioned innovative digital practices, this institution provides the following: a public source web platform on air pollution to calculate individuals' produced air pollution, a program to teach students on how to decrease waste at schools by 42% and cut energy use by 11% and a trend on Twitter (titled #noidling) on the Clean Air Action Days, encourages individuals to switch their engines off. Furthermore, these ongoing programs promote environmental justice, which lead to a significant reduction of patient exposure to air pollution in 2016.¹³³ These activities infrequently mention innovation, but their bottom-up approaches—with the integrated partnership of institutions, a wide variety of social groups ranging from teenagers, work organizations, political and administration groups in

¹³¹Ministry of Energy and Water. "Islamic Republic of Afghanistan, Renewable Energy Policy," 2015. <<https://www.fao.org/faolex/results/details/en/c/LEX-FAOC184369>>. (Last accessed on July 16, 2022).

¹³²Manish A Desai, Sumi Mehta, and Kirk R Smith. "Indoor Smoke from Solid Fuels: Assessing the Environmental Burden of Disease at National and Local Levels," *Environmental Burden of Disease Series* 4 (2004): 82.

¹³³"Achievements |Sustainability| Global Action Plan." <<https://www.globalactionplan.org.uk/our-work/our-track-record>>. (Last accessed on July 16, 2022).

collaboration with multiscalar and multidimensional governmental sectors—are clearly applications of social and technological innovations in institutions.¹³⁴

DISCUSSION AND CONCLUSION

Human-induced climate change, the defining issue of our time, causes double inequality “through the inverse distribution of risk and responsibility,”¹³⁵ meaning not only the most marginalized are the least responsible to climate change, but also are exposed to the highest extreme weather risks. The most socially and economically marginalized communities use far less fossil energy sources and carry less responsibility for environmental degradation than the wealthier communities that overconsume beyond ecological sustainability for the sake of social status and life quality.¹³⁶ Between 1990 and 2015, the wealthiest 1% of the world’s population emitted more than twice as much carbon dioxide as the poorest half.¹³⁷ Injustices are manifested in the roots of climate change and we cannot hope to build resilient and equitable community without clearly addressing the root causes of climate injustices.

As noted, existing inequalities and the complexity of human–ecological interactions raise difficulties in addressing who is vulnerable and where is it at risk. Human vulnerability to natural hazards including climate change varies over time, place, and among social groups, and concept of resilience develops based on the vulnerability.¹³⁸ In short, understanding the origins of vulnerability and inequality are complex while necessary in developing resilience.

Innovative practices may help to provide the opportunities to focus more on the bottom-up processes, knowledge co-production, and better incorporate with the poor and marginalized groups. These practices are applied to explore how and, in whose needs and interests, resources and power are mobilized to address inequalities and enhance resilience. Below I summarize how social and technological innovations might be applied to serve mitigation and adaptation goals, and help people and marginalized communities more resilient in the face of climate change.

Addressing maldistribution

Innovative approaches can address uneven allocation of benefits and burdens. In addition, innovations can be used to find solutions to distribute less burden on future generations.

Addressing lack of recognition

Social exclusion is often a cause of poverty, vulnerability, and insecurity.¹³⁹ If we are to confront it effectively, we need to recognize where the problem is. Innovations might help us to realize who are the vulnerable or where they live as well as the reasons for exclusion. Social and technological innovations facilitate avenues to work with communities, institutions, and government actors to overcome the obstacles.

Putting procedures in place

The marginalized are (mostly) deprived of choices and do not have fair access to opportunities, and a voice to claim their rights and demands. Social and technological innovations provide opportunities for participatory approaches and inclusion of the marginalized. This engagement and communication enable involvement of communities at every decision-making level¹⁴⁰ to decentralize power, and shape climate change policy and action at local and scales.

Enhancing capabilities

Some individuals lack the opportunity to acquire the capabilities required for functioning in communities and to flourish and realize their potentials. They are discriminated based on their race, gender, disability, or other social identities. The inefficiency of the marginalized wellbeing can be recognized by social and technological innovations when decisions consider criteria associated with equity.

Finally, as noted, the innovative approaches are place based, and it is much more challenging to practice social innovation in countries with authoritarian governments and a wide power gap between state, actors, and citizens as well as in underdeveloped countries. It remains to be seen whether and how less hierarchical relationships among communities and decision makers can be built. On the contrary, fair planning for climate change does not treat all individuals in the same way. In many regions, democratic decision making may lead to exacerbating inequality. Preferences should consider criteria related to ethics and justice principles to make sure results eradicate vulnerability.¹⁴¹ This article

¹³⁴Noam Bergman, Nills Markusson, Peter Connor, Lucie Middlemiss, and Miriam Ricci. “Bottom-up, Social Innovation for Addressing Climate Change,” *Conference on Energy Transitions in an Interdependent World: What and Where Are the Future Social Science Research Agendas* 2015 (2010): 1–27.

¹³⁵Sam Barrett. “Local Level Climate Justice? Adaptation Finance and Vulnerability Reduction,” *Global Environmental Change* 23 (2013): 1819–1829.

¹³⁶Pierpaolo Marrone, *Chambers, RT, Etica e Politica*, vol. 15, 2013.

¹³⁷“Carbon Emissions of Richest 1 Percent More than Double the Emissions of the Poorest Half of Humanity | Oxfam International,” September 21, 2020. <<https://www.oxfam.org/en/press-releases/carbon-emissions-richest-1-percent-more-double-emissions-poorest-half-humanity>>. (Last accessed on July 16, 2022).

¹³⁸Susan L. Cutter. “The Vulnerability of Science and the Science of Vulnerability,” *Annals of the Association of American Geographers* 93 (2003): 1–12.

¹³⁹Ibid. DFID (2005).

¹⁴⁰Harald Klinsky and Sonja Winkler. “Equity, Sustainable Development and Climate Policy,” *Climate Policy* 14 (2014): 122–147.

¹⁴¹Jingzheng Ren, Michael Evan Goodsite, and Benjamin K. Sovacool. “Climate Change: Climate Justice More Vital than Democracy,” *Nature* 526, 7573 (2015): 323.

¹⁴²E. Cameron, T. Shine, and W. Bevins. “Climate Justice: Equity and Justice Informing a New Climate Agreement,” (Sep 2013).

indicates that innovations can assist in addressing inequalities in power and social arrangements with consideration of justice principles in the center of their approaches and practices.

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¹⁴³E. Chu K. and Michael “Recognition in Urban Climate Justice: Marginality and Exclusion of Migrants in Indian cities,” *Environment and Urbanization* 31 (2019): 139–156.

¹⁴⁴D. Schlosberg and L.B. Collins. “From Environmental to Climate Justice: Climate Change and the Discourse of Environmental Justice,” *Wiley Interdisciplinary Reviews: Climate Change* 5 (2014): 359–374.