



One Size Does Not Fit All—Addressing the Complexity of Food System Sustainability

Mary Ng'endo^{1*} and Melanie Connor^{2†}

¹ International Rice Research Institute (IRRI), Dar es Salaam, Tanzania, ² International Rice Research Institute (IRRI), Los Baños, Philippines

OPEN ACCESS

Edited by:

Donald C. Cole,
University of Toronto, Canada

Reviewed by:

Morufu Olalekan Raimi,
Niger Delta University, Nigeria
Isaac Luginaah,
Western University, Canada

*Correspondence:

Mary Ng'endo
mariangendo@gmail.com

[†]These authors have contributed
equally to this work and share first
authorship

Specialty section:

This article was submitted to
Land, Livelihoods and Food Security,
a section of the journal
Frontiers in Sustainable Food Systems

Received: 17 November 2021

Accepted: 04 February 2022

Published: 03 March 2022

Citation:

Ng'endo M and Connor M (2022) One
Size Does Not Fit All—Addressing the
Complexity of Food System
Sustainability.
Front. Sustain. Food Syst. 6:816936.
doi: 10.3389/fsufs.2022.816936

Food system sustainability has been highlighted as one of the major strategies to ensure healthy diets. A plethora of approaches to stabilize food systems have been suggested, including agroecology, climate-smart agriculture, and other forms of sustainable agriculture. However, a disconnect between sustainable production and consumption exists, which may hinder further progress toward achieving Sustainable Development Goal 2. This discourse was needed to connect these intersectional perspectives. To meet this need, we bring together the disconnected socio-environmental pillars and show how together they contribute to the food system sustainability agenda. We discuss the complexity of food system sustainability to cater to different geographies, building on evidence from development projects worldwide. We account for factors such as the need to incorporate intersectionality factors, food-system-related policy issues, food waste, food injustice, and undernutrition. While these intersectional inequalities can be solved through various human interventions, policy implementation, and dietary choices, we found that connecting the different policymakers remains a significant challenge for a sustainable food system. We propose implementing specific food system sustainability strategies that will be useful for policymakers and other stakeholders to enable the inclusion of a socio-environmental perspective for food systems that connect agricultural production with consumption.

Keywords: food security, nutrition security, food system, sustainability, missing middle

INTRODUCTION

Since the global COVID-19 pandemic, the urgent need for enhanced food system sustainability through a major shift in mindsets is irrefutable (Webb et al., 2020). The overriding message is that the trajectory of our global food systems is unsustainable and that multiple actions are needed urgently to amend this imbalance. Therefore, the need for transitioning food systems to ensure sustainable and healthy diets with minimal environmental impact has become one of the most prominent goals of several local and international organizations. The novelty in our work lies in our contribution to this agenda by discussing and linking hitherto disconnected socio-environmental pillars that pose barriers to change when considered in an isolated fashion and showing how together they contribute to the food system sustainability agenda.

The food system encompasses activities involved in producing, processing, packaging, distributing, retailing, and consuming food (Erickson et al., 2010) that form the basis of the four food security pillars of availability, accessibility, utilization, and stability

[GLOPAN (Global Panel on Agriculture Food Systems for Nutrition), 2020]. Undertaking these activities leads to several outcomes that contribute to food security and relate to environmental outcomes (Ingram, 2011). It is acknowledged that sufficient global food production is not synonymous with guaranteed food security for all (Bebbington, 1999). Food security, as commonly used in the development discourse, emphasizes food quantity over food quality. Hence the term “nutrition security” is now commonly used to capture the quality dimension (Smith et al., 2013). In addition to the aforementioned pillars of food security, Webb et al. (2020) present four priority policy actions to transition food systems toward healthy diets that are produced sustainably, that is availability, accessibility, affordability, and desirability. There is a need to link these policy actions, which can be done by explicitly showing the disconnect between food production and consumption, which has been referred to as the “missing middle” (Veldhuizen et al., 2020), and then making practical suggestions on how to close this gap. The missing middle refers to the paradox of persistent hunger despite growing global food availability. As more food is not synonymous with the right kind of food, there is a need for improvements in food access and changing consumer behavior.

Given the multifaceted nature of food security, especially in the context of global environmental change (Ingram, 2011), solving food insecurity needs to center on comprehension of complex interactions. Various stakeholders have utilized food system concepts to enhance interdisciplinary work on the two-way interactions between food and nutrition security efforts and global environmental change (Ericksen et al., 2010). However, there is a need to contextualize an integrated food system approach that accounts for interconnected inequalities to ensure food security.

INTERCONNECTED INEQUALITIES IN FOOD SYSTEM SUSTAINABILITY

While food systems are dynamic and complex, they also have national boundaries (Webb et al., 2020), with no single dietary pattern or food system that could be applicable globally. In line with Cadieux and Slocum (2015) and Paganini and Lemke (2020), we argue that to achieve food system sustainability, it is essential to address socio-environmental inequalities alongside agricultural transformation. Therefore, this perspective employs a descriptive methodology that interrogates a range of food system transformations measures that are needed and that collectively underpin socio-environmental local contexts, nutritional habits, livelihoods, and ecosystems.

Intersectionality factors determine how people adapt to various socio-ecological changes (Erwin et al., 2021), which in turn differentially shape their food and nutrition security experiences (Williams-Forsen and Wilkerson, 2011). Intersectionality is an approach to understanding the interconnectedness of multiple and overlapping identities (Lokot and Avakyan, 2020). These include socioeconomic status, age, race, nationality, language, religion, caste/class systems, disability, and place-based identities such as location and gender.

While gender is the most often used lens to assess inequalities, especially among women and girls, its sole use masks other equally pressing intersecting identity variables that could oppress certain groups of people (Lokot and Avakyan, 2020). There is a need to move beyond a focus on women and youth (Tavener and Crane, 2019) to examine intra-gender differences that shape people's realities (Ravera et al., 2016). Explicit recognition of the social and geopolitical forces shaping people's lives includes not only poverty, displacement, and conflict but also structural and systemic factors impacting people's capabilities, opportunities, and agency in political, social, and economic aspects (Lokot and Avakyan, 2020).

The imbalance and unsustainability in food systems are not only a consequence of over-reliance on nature or lack of access to nature by vulnerable groups. There are also broader policy issues, such as limited or lack of access to subsidized farm inputs and high dependence on manual labor, especially in developing countries. In Malawi, for example, a recently implemented subsidy program, the 2020 Affordable Inputs Program, has been heavily criticized for its poor implementation, transparency, and sustainability since it is unlikely to impact its target beneficiaries positively and has not served Malawi's most vulnerable and growing population (Phiri, 2021). Such short-term local solutions, which lack long term political support, risk plunging their target populations into disarray (Prosekov and Ivanova, 2018), and coupled with rapid population growth (Maja and Ayano, 2021), will exacerbate the inequalities in food and nutrition security, even if natural resources are available.

Furthermore, about a third of the food produced globally is either lost or wasted at different stages of the value chain (Corrado et al., 2019). In the developed world, this is predominantly at the consumption stage, while in the developing world, this mainly occurs at the immediate post-harvest stage (Parfitt et al., 2010). Most studies assessing post-harvest losses have been conducted in India and with cereal crops such as maize. Little is known, however, about other crops and especially Sub-Saharan Africa (Stathers et al., 2020). Food waste in the global north can be reduced through consumer behavior change measures to enhance the consumption of discarded edible food or more frugal food purchases (Visschers et al., 2016). Bolstering the financial, managerial, and technical aspects of post-harvest mechanisms can significantly reduce food losses in the global south (FAO, 2011). A reduction in food losses along the value chain also means that the sustainability of food production will be increased since food production is associated with greenhouse gas emissions, especially for staple crops such as rice (Socialist Republic of Vietnam M.o.N.R.a.E., 2017). Therefore, reducing post-harvest losses could be one of the main contributors to food system sustainability.

Lastly, food (in)justice is an often neglected but growing field in both the developed and developing world that aims to understand how inequalities of race, class, and gender are replicated and contested within food systems (Glennie and Alkon, 2017). Food justice and its underlying factors have been well-documented in developed countries, whereas socio-economically disadvantaged areas are linked to greater food injustice (Hallum et al., 2020). In the context of food system

sustainability, especially in the global south, we argue that food justice is an important concept not to be neglected. D'Odorico et al. (2019) discuss food injustice in the context of the human right to food. Inequalities in access to food are a result of the rural-urban distribution of populations, availability of natural resources, and the productivity of its use. Food injustice often results in multiple forms of malnutrition. Over-nutrition coexists with under-nutrition in both urban and rural areas, especially in the global south. This nutrition transition is leading to an increase in overweight and obese adults in many countries in rural Africa (Madise and Letamo, 2017) and Asia (Mishra and Khokhar, 2020), caused by the consumption of cheap energy-dense but nutrient-poor westernized foods (Keding et al., 2013). These inequalities can be targeted through human actions such as agricultural, rural, and urban development as well as policy implementation and dietary choices.

DISCUSSION

The recommendations on needing to change production and consumption patterns rely heavily on behavior change (Gwozdz et al., 2020), which, while necessary, needs to be expounded upon contextually—for example, how and which behavior change models can be used to facilitate food system sustainability (White et al., 2019)? Also, to what extent does behavior change work? The difficulties with behavior change have been well-documented, for example, in the case of scaling agrobiodiversity. It has been shown that agrobiodiversity is beneficial for smallholder farmers to attain all the pillars of food security and produce sustainably utilizing locally available resources. However, agrobiodiversity has been challenging to scale up, even with the support of multiple partners. One of the reasons for this is that behavior change is not easy for all stakeholders in the value chain thus resulting in isolated success stories, such as increasing agrobiodiversity of various cereals in rural Europe (CERERE, 2019), traditional rice varieties in India (Bisht et al., 2020) and agroforestry in Kenya (SNRD, 2018). Nevertheless, despite the existing challenges with scaling up agrobiodiversity, this agroecological practice that emphasizes diverse crop and animal husbandry is leading to food and nutrition security in countries such as Malawi (Kansanga et al., 2021) and Kenya (Ng'endo et al., 2018).

Similarly, many papers discuss the need to change food consumption patterns by growing seasonal and vegetarian foods locally with lower environmental costs (Vermeir et al., 2020). While growing and consuming locally produced seasonal foods is a valid suggestion, the recommendation to adopt a vegetarian diet needs to be evaluated considering geopolitical boundaries. In most developing countries, diets are primarily vegetarian or limited to certain food groups due to a lack of finances to purchase meat, milk, and fish. In general, animal-sourced foods, especially from large livestock such as cattle, are expensive and unaffordable, especially in rural areas. While consumption of animal-sourced foods may need to be reduced in the global north, we agree that this needs to be enhanced in the global south (Covic, 2019), primarily using small livestock such as chicken,

rabbits, and goats (Rota and Urbani, 2021). These are affordable, offer both macro- and micronutrient adequacy, and a possibility to enhance asset ownership, especially by women, who suffer from multiple forms of malnutrition (Adesogan et al., 2020). This, in turn, will benefit childhood nutrition and is also likely to improve the first critical 1,000 days 'window of opportunity' of a child's life (Global Alliance for Improved Nutrition (GAIN), 2015).

Smallholder farmers often face exclusion from global markets and commercial-oriented value chains, which leads to inequality but can also increase post-harvest losses significantly due to insufficient storage capabilities. While there is a lot of evidence on technology interventions that reduce post-harvest losses, there is a lack of interventions beyond technologies and handling practice changes. These include finance, infrastructure, policy and market interventions (Stathers et al., 2020). In addition, there are smallholder-driven solutions that could be presented to policymakers to pave alternative ways for co-creating positive change. This has been shown for the Githunguri dairy farmers' cooperative society in central Kenya that has grown into a significant market player outcompeting large-scale dairy systems through a local social finance model (Ojong, 2015). Similarly, the support of smallholder farmers by international organizations has facilitated changes in the dairy (Makoni et al., 2014) and root crops value chains in Tanzania (Lekule et al., 2014). Such local solutions could also benefit from the rigor that science provides to offer improved replicable innovative solutions. This approach aligns well with the need to build partnerships in the food systems agenda through emerging opportunities. One example is the G-soko ("soko" is Swahili for "market") online platform for regional trade that has gained popularity in the East African Community lately. The platform connects farmers and grain buyers and has gained popularity during COVID-19, facilitating regional and national grain trade. Furthermore, east and southern African governments have started to harmonize measures to ensure continued trade across borders. This needs to continue beyond COVID-19 by learning what is and is not working.

However, a significant challenge that remains for a sustainable food system is connecting the different policymakers. The problem is that policies relating to agricultural production are often at odds with policies for nutrition, and solving this disconnect would address the "missing middle" (Veldhuizen et al., 2020). Moreover, the different actors needed to transform the food system and nutrition patterns currently operate in silos, and many stakeholders speak different "disciplinary languages," making it difficult for policymakers to engage and negotiate with these multi-disciplinary complexities. We, therefore, argue that bringing existing scientific knowledge into practice is a far greater challenge than pursuing the acquisition of new scientific knowledge. There is value and need to remove barriers between knowledge generation and its use by addressing how different stakeholders interact with the knowledge, mainly traditional and indigenous knowledge. The nexus on how these changes are implemented is where knowledge generators can better interact with policymakers to effect much-needed change. Where policies are available, they must be backed by the political will to catalyze stronger linkages across science, policy, and practice to gain

increased momentum in addressing the complexities embedded in food system sustainability.

Specific Recommendations for Food System Sustainability:

- Shocks to food systems such as the COVID-19 pandemic should also be viewed as valuable opportunities to closely examine the local solutions that could change this unsustainability. This could be by increasing agrobiodiversity with locally available resources such as vegetables and grains that also include livestock production and consumption (including fish) that is culturally and environmentally applicable, so as to proliferate the success stories showing agroecology's contribution to food and nutrition security.
- As opposed to relying solely on top-down approaches, there is a need to incorporate bottom-up approaches from diverse geographies. This can be implemented by including emerging smallholder-driven solutions and integrating local and indigenous farmers, which could catalyze systemic thinking on similar or alternative ways to scale interventions. This can be done by showcasing alternative and emerging successful local smallholder farmer-led food security solutions that can be up-scaled and mainstreamed (for example, the aforementioned social finance models), especially in the regular high-level decision-making forums, such as the United Nations-led High-Level Political Forum (HLPF).
- Increase international organization-led multi-stakeholder interactions for professionals across science-policy-practice nexus to determine what can be done better or differently

REFERENCES

- Adesogan, A. T., Havelaar, A. H., McKune, S. L., Eilittä, M., and Dahl, G. E. (2020). Animal source foods: sustainability problem or malnutrition and sustainability solution? Perspective matters. *Glob. Food Security* 25, 100325. doi: 10.1016/j.gfs.2019.100325
- Bebbington, A. (1999). Capitals and capabilities: a framework for analyzing peasant viability, rural livelihoods and poverty. *World Dev.* 27, 2021–2044. doi: 10.1016/S0305-750X(99)00104-7
- Bisht, I. S., Rana, J. C., Yadav, R., and Ahlawat, S. P. (2020). Mainstreaming agricultural biodiversity in traditional production landscapes for sustainable development: the Indian scenario. *Sustainability* 12, 10690. doi: 10.3390/su122410690
- Cadieux, K., and Slocum, R. (2015). What does it mean to do food justice? *J. Polit. Ecol.* 22, 1–26. doi: 10.2458/v22i1.21076
- CERERE, C.R.I.R.E. (2019). *Cerere Book of Case Studies*. Available online at: http://cerere2020.eu/wp-content/uploads/2019/11/ENGLISH_finalBOOK_low.pdf
- Corrado, S., Caldeira, C., Eriksson, M., Hanssen, O. J., Hauser, H.-E., van Holsteijn, F., et al. (2019). Food waste accounting methodologies: challenges, opportunities, and further advancements. *Glob. Food Security* 20, 93–100. doi: 10.1016/j.gfs.2019.01.002
- Covic, N. (2019). *The Eat-Lancet Healthy Reference Diet: Perspectives From the Global South*. Washington, DC: CGIAR Research Program on Agriculture for Nutrition and Health (A4NH). Available online at: <https://a4nh.cgiar.org/2019/10/14/the-eat-lancet-healthy-reference-diet-perspectives-from-the-global-south/>
- D'Odorico, P., Carr, J. A., Davis, K. F., Dell'Angelo, J., and Seekell, D. A. (2019). Food inequality, injustice, and rights. *Bioscience* 69, 180–190. doi: 10.1093/biosci/biz002
- Ericksen, P., Stewart, B., Dixon, J., David, B., Loring, P., Anderson, M., et al. (2010). "The value of a food system approach," in *Food Security and Global Environmental Change*, eds J. Ingram, P. Ericksen, and D. Liverman (London: Earthscan), 25–45.
- Erwin, A., Ma, Z., Popovici, R., Salas O'Brien, E. P., Zanotti, L., Zeballos Zeballos, E., et al. (2021). Intersectionality shapes adaptation to social-ecological change. *World Dev.* 138, 105282. doi: 10.1016/j.worlddev.2020.10.5282
- FAO. (2011). *Global Food Losses and Food Waste-Extent, Causes and Prevention*. Rome: Food and Agriculture Organization of the United Nations.
- Glennie, C., and Alkon, A. H. (2017). Food justice: cultivating the field. *Environ. Res. Lett.* 13, 73003. doi: 10.1088/1748-9326/aac4b2
- Global Alliance for Improved Nutrition (GAIN). (2015). *Making a Difference in the First 1000 Days to Improve the Lives of Children and Women*. Available online at: <https://www.gainhealth.org/resources/reports-and-publications/making-difference-first-1000-days-improve-lives-children-and>
- GLOPAN (Global Panel on Agriculture and Food Systems for Nutrition). (2020). *Future Food Systems: For People, Our planet, and Prosperity*.
- Gwozdz, W., Reisch, L. A., and Thøgersen, J. (2020). Behaviour change for sustainable consumption. *J. Consumer Policy.* 43, 249–253. doi: 10.1007/s10603-020-09455-z
- Hallum, S. H., Hughey, S. M., Wende, M. E., Stowe, E. W., and Kaczynski, A. T. (2020). Healthy and unhealthy food environments are linked with neighbourhood socio-economic disadvantage: an innovative geospatial approach to understanding food access inequities. *Public Health Nutr.* 23, 3190–3196. doi: 10.1017/S1368980020002104
- Ingram, J. (2011). A food systems approach to researching food security and its interactions with global environmental change. *Food Security* 3, 417–431. doi: 10.1007/s12571-011-0149-9

to proliferate, evaluate and reflect upon ways of navigating through behavior change barriers. For example, the inaugural 2021 pre-HLPF seminar series led by the United Nations Research Institute for Social Development (UNRISD) promoted dialogue on navigating challenges in this interconnected space and catalyzed solving the 'missing middle' by linking production and consumption actors.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

AUTHOR CONTRIBUTIONS

MN and MC contributed equally to all aspects of this work, conceptual development, and the writing process. Both authors contributed to the article and approved the submitted version.

FUNDING

The authors disclosed receipt of the following financial support for the research, authorship, and publication of this article. Bill & Melinda Gates Foundation's Accelerating the Genetic Gains in Rice (AGGRi) Grant Number OPP1194925 and Swiss Agency for Development and Cooperation's Closing Rice Yield Gaps in Asia (Corigap) Grant Number 81016734, which are greatly acknowledged.

- Kansanga, M. M., Kangmenang, J., Kerr, R. B., Lupafya, E., Dakishoni, L., and Luginaah, I. (2021). Agroecology and household production diversity and dietary diversity: evidence from a five-year agroecological intervention in rural Malawi. *Soc. Sci. Med.* 288, 113550. doi: 10.1016/j.socscimed.2020.113550
- Keding, G. B., Msuya, J. M., Maass, B. L., and Krawinkel, M. B. (2013). Obesity as a public health problem among adult women in rural Tanzania. *Glob. Health Sci Pract.* 1, 359–371. doi: 10.9745/GHSP-D-13-00082
- Lekule, F. P., Lyimo-Macha, J., Moshia-Kilave, D., and Shayo, D. D. (2014). *Stories of Change: Bridging Gender Gaps With Dairy Goats and Root Crops*. Eye: WREN media.
- Lokot, M., and Avakyan, Y. (2020). Intersectionality as a lens to the COVID-19 pandemic: implications for sexual and reproductive health in development and humanitarian contexts. *Sexual Reprod Health Matters* 28, 1764748. doi: 10.1080/26410397.2020.1764748
- Madise, N. J., and Letamo, G. (2017). Complex association between rural/urban residence, household wealth and women's overweight: evidence from 30 cross-sectional national household surveys in Africa. *BMP Obes.* 4, 2052–9538. doi: 10.1186/s40608-016-0141-1
- Maja, M. M., and Ayano, S. F. (2021). The impact of population growth on natural resources and farmers' capacity to adapt to climate change in low-income countries. *Earth Syst Environ.* 5, 271–283. doi: 10.1007/s41748-021-00209-6
- Makoni, N., Mwai, R., Redda, T., Zijpp, A., and van der Lee, J. (2014). *White Gold - Opportunities for Dairy Sector Development Collaboration in East Africa*. Wageningen: Centre for Development Innovation.
- Mishra, S., and Khokhar, A. (2020). Obesity and associated risk factors: a cross-sectional study among rural women aged above 30 years using body fat analyzer. *Ann. Community Health* 8, 62–67. Available online at: <http://www.annalsofcommunityhealth.in/ojs/index.php/AoCH/article/view/236>
- Ng'endo, M., Bhagwat, S., and Keding, G. B. (2018). Contribution of nutrient diversity and food perceptions to food and nutrition security among smallholder farming households in Western Kenya: a case study. *Food Nutr. Bull.* 39, 86–106. doi: 10.1177/0379572117723135
- Ojong, N. (2015). *Innovative Finance for Social Justice*. International Labour Organization.
- Paganini, N., and Lemke, S. (2020). "There is food we deserve, and there is food we do not deserve" Food injustice, place and power in urban agriculture in Cape Town and Maputo. *Local Environ.* 25, 1000–1020. doi: 10.1080/13549839.2020.1853081
- Parfitt, J., Barthel, M., and Macnaughton, S. (2010). Food waste within food supply chains: quantification and potential for change to 2050. *Philos Trans R Soc B Biol Sci.* 365, 3065–3081. doi: 10.1098/rstb.2010.0126
- Phiri, G. (2021). Mlusu concedes subsidy pressure. *The Nation*
- Prosekov, A. Y., and Ivanova, S. A. (2018). Food security: the challenge of the present. *Geoforum* 91, 73–77. doi: 10.1016/j.geoforum.2018.02.030
- Ravera, F., Martín-López, B., Pascual, U., and Drucker, A. (2016). The diversity of gendered adaptation strategies to climate change of Indian farmers: a feminist intersectional approach. *Ambio* 45(Suppl. 3), 335–351. doi: 10.1007/s13280-016-0833-2
- Rota, A., and Urbani, I. (2021). "The small livestock advantage: a sustainable entry point for addressing SDGs in rural areas," in: *IFAD Advantage Series* (Rome: IFAD), p. 6–11. Available online at: https://www.ifad.org/documents/38714170/42264619/livestock_advantage.pdf/6e4114ab-5fb7-55c9-f79b-eb779c7214de?t=1619018180658
- Smith, J., Stones, K., Grace, D., MacMillan, S., Tarawali, S., and Herrero, M. (2013). *Beyond Milk, Meat, and Eggs: Role of Livestock in Food and Nutrition Security*. Nairobi, Kenya: International Livestock Research Institute. doi: 10.2527/af.0.2013-0002
- SNRD, S.N.R.D.A. (2018). *Agrobiodiversity Success Stories From Kenya*. Accra: SNRD Africa. Available online at: <https://www.snrd-africa.net/agrobiodiversity-success-stories-from-kenya/>
- Socialist Republic of Vietnam M.o.N.R.a.E. (2017). *The Second Biennial Updated Report of Vietnam to the United Nations Framework Convention*. Vietnam: Ministry of Natural Resources and Environment.
- Stathers, T., Holcroft, D., Kitinoja, L., Mvumi, B. M., English, A., Omotilewa, O., et al. (2020). A scoping review of interventions for crop postharvest loss reduction in sub-Saharan Africa and South Asia. *Nat. Sust.* 3, 821–835. doi: 10.1038/s41893-020-00622-1
- Tavener, K., and Crane, T. A. (2019). Beyond "women and youth": applying intersectionality in agricultural research for development. *Outlook Agric.* 48, 316–325. doi: 10.1177/0030727019884334
- Veldhuizen, L. J. L., Giller, K. E., Oosterveer, P., Brouwer, I. D., Janssen, S., van Zanten, H. H. E., et al. (2020). The missing middle: connected action on agriculture and nutrition across global, national and local levels to achieve sustainable development goal 2. *Glob. Food Security* 24, 100336. doi: 10.1016/j.gfs.2019.100336
- Vermeir, I., Weijters, B., De Houwer, J., Geuens, M., Slabbinck, H., Spruyt, A., et al. (2020). Environmentally sustainable food consumption: a review and research agenda from a goal-directed perspective. *Front. Psychol.* 11, 1603. doi: 10.3389/fpsyg.2020.01603
- Visschers, V. H. M., Wickli, N., and Siegrist, M. (2016). Sorting out food waste behaviour: a survey on the motivators and barriers of self-reported amounts of food waste in households. *J. Environ. Psychol.* 45, 66–78. doi: 10.1016/j.jenvp.2015.11.007
- Webb, P., Benton, T. G., Beddington, J., Flynn, D., Kelly, N. M., and Thomas, S. M. (2020). The urgency of food system transformation is now irrefutable. *Nat. Food* 1, 584–585. doi: 10.1038/s43016-020-00161-0
- White, K., Habib, R., and Hardisty, D. J. (2019). How to SHIFT consumer behaviors to be more sustainable: a literature review and guiding framework. *J. Marketing* 83, 22–49. doi: 10.1177/0022242919825649
- Williams-Forson, P., and Wilkerson, A. (2011). Intersectionality and food studies. *Food Cult. Soc.* 14, 7–28. doi: 10.2752/175174411X12810842291119

Author Disclaimer: The opinions expressed in this publication are those of the authors. They do not purport to reflect the opinions or views of the International Rice Research Institute or the CGIAR.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's Note: All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

Copyright © 2022 Ng'endo and Connor. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.