

Searching for the essential: Exploring practitioners' views on actions for re-orienting food systems towards healthy diets

Stephanie Walton^{a,*}, Corinna Hawkes^{a,b}, Jessica Fanzo^c

^a Centre for Food Policy, City, University of London, Northampton Square, EC1V 0HB, London, United Kingdom

^b Food and Agriculture Organization of the United Nations (Current), Viale delle Terme di Caracalla, Rome, Italy

^c Berman Institute of Bioethics, Nitze School of Advanced International Studies (SAIS) and Bloomberg School of Public Health, Johns Hopkins University, 1717 Massachusetts Ave NW, Washington DC, 20036, United States

ARTICLE INFO

Keywords:

Food policy
Nutrition policy
Global nutrition
Food systems
Multicriteria mapping

ABSTRACT

To effectively accelerate action from policymakers on re-orienting food systems towards healthy diets, global stakeholders need to first determine which of the many actions under discussion are essential to delivering healthy diets. In this exploratory study, we sought to identify if there are any actions that are considered essential for re-orienting food systems towards healthy diets across a diverse range of stakeholders and sectoral and country contexts. Through engaging practitioners in scoring and ranking actions, we found a wide diversity of views across many of the proposed actions. However, a handful of actions emerged as more essential, particularly school food programmes.

1. Introduction

Despite important gains made in food security and undernutrition over the past half-century, a high prevalence of different forms of malnutrition persists (Global Nutrition Report, 2022). Food systems in their current form sustain a stubbornly high prevalence of wasting, underweight, stunting, micronutrient deficiencies, obesity, and/or diet-related non communicable diseases (Herforth and Ahmed, 2015; Haddad et al., 2016; HLPE, 2017). As the failure of food systems to play their role in delivering healthy diets becomes increasingly clear, there is a growing interest in generating decisive political action from policymakers across food systems to improve diets.

There is a growing body of empirical research into what drives political action towards reducing malnutrition (Pelletier et al., 2011, 2012; Gillespie et al., 2013). In a synthesis of this literature, Baker et al. (2018) identified that political commitments from policymakers are the result of deliberate action taken by *nutrition actor networks* (NANs). These are “the individuals and organisations operating within a jurisdiction with a shared interest in attenuating malnutrition and who act collectively to do so” (Baker et al., 2018). The global nutrition community is one such NAN (hereon referred to as the global NAN) comprised of UN agencies and programmes, development banks, national and regional governments, aid agencies, charitable foundations, NGOs, academic and

research institutions and the private sector (Morris et al., 2008). The global NAN has been tremendously successful over the past two decades in raising nutrition up the global policy agenda (Harris, 2019; Leach et al., 2020) and coordinating efforts across organisations and countries (Bezanson and Isenman, 2010; Gillespie et al., 2013).

Now this momentum needs to be leveraged to drive accelerated action from policymakers on the policies, programmes and interventions that will re-orient food systems towards healthy diets (Global Nutrition Report, 2022). But to do so effectively will first require the global NAN to determine *which* actions need to be prioritised (Morris et al., 2008). As the Voluntary Guidelines on Food Systems and Nutrition published by the Committee on World Food Security (2021) shows, there are scores of possible actions that could be taken across food systems with the potential to impact diets. While every action may be beneficial, it is not feasible for policymakers to pursue all of them given the reality of limited financial and human resources. It is therefore necessary to determine which actions are *essential* to re-orienting food systems to healthy diets. Essential actions are those that are foundational, necessary or a prerequisite to making nutritious food available, accessible, affordable and/or appealing. They are those actions without which it would be impossible to have food systems oriented towards healthy diets. While the relevance of many actions will depend on country and local contexts (Pelletier et al., 2011; Baker et al., 2018), essential actions

* Corresponding author.

E-mail addresses: stephanie.walton@city.ac.uk (S. Walton), corinna.hawkes@city.ac.uk (C. Hawkes), jfanzo1@jhu.edu (J. Fanzo).

<https://doi.org/10.1016/j.gfs.2023.100687>

Received 28 February 2022; Received in revised form 23 March 2023; Accepted 28 March 2023

2211-9124/© 2023 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

are those that are necessary everywhere – some countries may already have them in place and others may have yet to implement them, but every country needs them in order to deliver healthy diets, albeit the specific design of these actions would need to be adapted to local context.

Precedents have been set for developing a prioritised list of actions that are universally important, such as the INFORMAS framework (Swinburn et al., 2013), the NOURISHING framework (Hawkes et al., 2013) and the nutrition-specific and nutrition-sensitive actions from *The Lancet* series on nutrition (Bhutta et al., 2008; Ruel and Alderman, 2013). These frameworks focused primarily on actions targeted at changing food environments to address one form of malnutrition. Since their development, discussions have advanced substantially on actions that cover the breadth of entire food systems with the aim of supporting healthy diets more broadly, particularly in agriculture for nutrition and along supply chains. These types of actions have not been incorporated into existing frameworks in substantial depth. Given the important role of the global NAN in informing country best-practice, directing international investments, funding specific research agendas and monitoring policy progress (Shiffman and Smith, 2007; Morris et al., 2008; Hill et al., 2011; Hoey and Pelletier, 2011; WHO, 2018), as well as how active the demand is to understand precisely what to do in food systems to support healthy diets, determining a prioritised list of essential actions is an important first step in driving accelerated action towards healthier diets.

Developing such a list will undoubtedly be a difficult process. Concrete evidence of impact for different actions is patchy and relying on this criterion would preclude consideration of many actions, limiting the range of possibility only to those that have been widely implemented and/or are easily measurable. Compounding this difficulty are the different conceptualisations of food systems (Béné et al., 2019; Brouwer et al., 2020) and conflicting objectives, agendas and values among food systems stakeholders that lead to wide-ranging views on what actions are needed and what will work (Morris et al., 2008; Lang and Heasman, 2015; OECD, 2021). For the global NAN to be effective at driving action, it will need to identify if there are any actions that are considered essential for re-orienting food systems towards healthy diets across a diverse range of stakeholders and sectoral and country contexts.

Therefore, the first step in developing a list of essential actions around which the diversity of actors in the NAN can coalesce is to take stock of the current state of consensus and dissensus among these actors on a broad range of actions. Among such a diverse group, are there certain actions on which a consensus exists that they are essential? Or is each action highly contested? Answers to these questions should inform a strategic approach to the development of a core set of essential actions amongst actors in the global NAN.

To answer these questions, we engaged a panel of participants from the global NAN in scoring and ranking a set of actions to reveal where there is currently consensus or dissensus. We used the method of Multicriteria Mapping (MCM) (described in Section 2) which provides a means of comparing, analysing and visualising stakeholder perspectives on various actions and collecting their rationale behind these perspectives. This paper presents the results from the quantitative data on the scoring and ranking of each action to understand the degree of consensus/dissensus for each action. The underlying rationale behind the rankings will be explored in forthcoming publications.

2. Methods

MCM is a well-established deliberative method for developing a detailed and coherent understanding of participants' views on different options (Ross and Stirling, 2004). It has been used extensively in policy appraisals on issues including agriculture and sustainable farming (Brooks et al., 2009; White and Stirling, 2013; Harriss-White et al., 2019), obesity (Lobstein et al., 2006), nutrition (Holdsworth et al., 2015; Lubogo and Orach, 2016) and anti-microbial resistance (Coburn et al.,

2021).

MCM was selected because of its emphasis on incorporating and equally weighting a diversity of perspectives and opinions. Strongly rooted in principles of participatory policy analysis (Stirling, 2006), it is designed to 'open up' policy appraisals to different forms and sources of knowledge rather than 'close down' or limit appraisals according to pre-selected conditions (Stirling, 2008; Bellamy et al., 2013). As opposed to other methods like the Delphi process, the goal of MCM is not to arrive at a consensus view, but to measure existing views and allow for a detailed understanding of the distribution of those views. Structured interviews and the collection of both qualitative and quantitative data ensures the systematic appraisal of each action based on a stakeholders' perspective and rationale and reveals a more precise picture of if, where and to what extent perspectives vary.

MCM follows a well-defined process of (1) identifying the options for appraisal (2) gathering perspectives on these options through interviews then (3) analysing and visualising the data, described below.

2.1. Identifying the actions for appraisal

Our starting point was the 42 food systems actions identified from international reports (Hawkes et al., 2020). Actions were identified from a review of major international evidence-based reports on food systems which include detailed recommendations on how to orient food systems towards healthier diets. A list of all the recommended actions from the reports was recorded in detail then filtered and consolidated based on mapping the pathway-to-impact by which each action could plausibly shift the availability, affordability, appeal/acceptability of certain foods. Each action is listed in Table 1 along with the abbreviations to which they are referred throughout this paper.

Prior to the interviews, it was necessary to bring this long list of actions from the reports down to a number that could reasonably be individually appraised in an hour-long interview. To identify actions that should move forward into the interviews, a survey was distributed to 190 people who work within the global NAN at advocacy NGOs, government, academia, humanitarian aid agencies and development NGOs with direct experience in the development and implementation of nutrition and food systems policies and programmes. An initial list of leading practitioners in the field was compiled based on the knowledge and experience of the authors from the world's major international agencies, research institutions, funding bodies and government agencies. An analysis of the sector, food system type they work in (Fanzone et al., 2020; Marshall et al., 2021) and country of potential respondents was conducted and the list expanded by identifying practitioners from relevant written materials and sector events to ensure adequate geographic coverage and a diversity of professional backgrounds. The survey completion rate was 51% (98 people). The sector, geography, food systems context and specialism for each participant who completed the survey can be seen in Table 2 as reported by participants. Participants were able to select multiple options for each question.

Respondents were first asked, "Which actions, based on your professional experience, are more or less likely than other actions to successfully lead to populations eating more nutritious foods and/or less foods that are high in fat, sugar and salt (HFSS)?" Then they were shown the actions they voted as 'more likely' and asked to select up to ten they considered 'most likely' to successfully lead to populations eating more nutritious foods and/or less HFSS food. The survey findings were analysed by identifying the number of times an action was voted as 'more likely' to have an impact and the number of times it was voted 'most likely' to have an impact. 'More likely' was considered a proxy for the *potential* of an action to have an impact while 'most likely' was considered a proxy for the *confidence* that an action would have an impact. Any actions that received an above-average number of votes for *either* 'more likely' or 'most likely' were moved forward to the interviews. Using both measures ensured that the options taken forward were not biased only towards 'safe' choices (i.e., most likely) but would incorporate actions

Table 1

The 42 actions along with the abbreviation by which they are referred to in the remainder of this paper.

Action	Abbreviation
Agricultural actions	
1 Deliver agricultural extension programmes, infrastructure and education to support farmers to grow and market nutritious foods	Ag extension programmes
2 (Re)design agricultural development programmes intended to increase food producers' income to also focus on producing, and accessing markets for, nutritious crops and providing nutrition education	Agricultural development
3 Provide women with agricultural assets, training and support to increase agriculture productivity and output, and access to markets to sell nutritious foods	Women in agriculture
4 Provide low-income households, including women, with support for animal-husbandry and training for animal rearing, safety management and processing along with nutrition education	ASF for low-income homes
5 Support the production and consumption of nutritious indigenous crops through agrobiodiverse cropping systems, agricultural extension, breeding programmes, subsidies, land tenure rights, regulatory protection, market development and public awareness	Indigenous crops
6 Deliver (peri-)urban agriculture programmes which provide land and other inputs, support local market development and deliver training and nutrition education	Urban agriculture
7 Provide inputs and training to develop and maintain home gardens along with nutrition education	Home gardens
International trade actions	
8 Design trade policies to prioritise the supply of nutritious foods over foods manufactured high in fats, sugars and salt and their ingredient, taking account of the benefits of local and international supply chains in different contexts, the protection smallholder farmers, and the availability of complementary policies	Trade for nutrition
Research, processing and technology actions	
9 Prioritise high-nutrient density when breeding crops in conventional crop breeding programmes and when selecting crops to grow	Breeding for nutrition
10 Implement biofortification programmes including breeding, support for adoption and market development and public awareness campaigns	Biofortification
11 Develop innovative postharvest storage technologies, packaging and processing techniques for nutritious foods to reduce nutrient losses, remove anti-nutrients, prevent contamination and reduce food losses	Post-harvest losses
12 Develop new processed products that extend the shelf life of nutritious foods, make them more convenient for consumers to prepare, and reduce food and nutrient losses	New processed products
13 Implement mandatory large-scale food fortification programmes	Fortification
14 Reformulate processed food to reduce fats, sugars and salt	Reformulation
15 Research and develop alternative proteins sources and share the research in the public domain	Alternative proteins
Supply chain infrastructure actions	
16 Build and improve roads, transportation, storage, cold chain and logistical distribution infrastructure to enable the delivery of safe, perishable nutritious foods to urban and rural markets	Transport infrastructure
17 Support the development of e-commerce platforms to help producers create markets for nutritious foods and improve access for populations with limited mobility or in underserved areas	E-commerce
18 Maintain and upgrade markets selling nutritious foods to low-income communities and ensure they have access to infrastructure to enhance food safety and reduce foods losses	Retail infrastructure
19 Empower smallholder farmers and small farm businesses to access markets for nutritious foods by establishing farm associations, cooperatives and	Smallholder market access

Table 1 (continued)

Action	Abbreviation
food hubs, developing mechanisms for collective bargaining and increasing access to price information	
20 Develop infrastructure to reduce loss and waste of nutritious foods and increase its redistribution	Food loss and waste
21 Mandate training programmes for food producers and retailers on storage, processing and packaging to reduce spoilage and contamination of nutritious foods	Food safety training
Financial actions	
22 Redirect agriculture subsidies from staple crops to increasing production of nutritious foods	Ag subsidies
23 Provide nutritious foods and meals at lower prices at point-of-purchase by subsidising public distribution programmes, state-managed stores, public restaurants, and other forms of subsidy programmes	POP subsidies
24 Focus cash transfer, voucher and food delivery programmes on increasing the availability, affordability and appeal of nutritious foods and limiting the appeal of foods high in fats, sugars and salt	Social safety nets
25 Implement taxes to decrease affordability and incentivise reformulation of sugary drinks and foods high in fats, sugars and salt food	Retail taxes
Public institution actions	
26 Implement comprehensive school food programmes, incorporating food and meals, nutrition standards, nutrition education, school gardens, food personnel training, food skills and literacy.	School food programmes
27 Adopt a public food procurement policy that applies nutritional guidelines to food procured for public institutions and prioritises purchasing from smallholders, local, family and/or sustainable food producers	Public procurement
Business incentives	
28 Provide investment funds and technical support for start-ups and small- and medium-sized food processing business to produce, market and promote nutritious foods targeted at low-income consumers	SME investments
29 Use financial incentives and planning regulations to drive the establishment of new supermarkets, fresh food markets, shops and street vendors in underserved communities	Food deserts
30 Provide incentives to fast food outlets, street food vendors and food service trucks to place nutritious options more prominently or in place of foods high in fats, sugar, salt, reformulate their recipes and promote only nutritious foods	Placement and menu change
31 Provide technical assistance, equipment, cost-sharing etc. to businesses to provide nutritious foods to their employees at lower prices	Employee food programmes
32 Develop independent accountability mechanisms to monitor and publicly report on business progress towards increasing the availability, access, affordability and appeal of nutritious foods and decreasing it for foods high in fats, sugars and salt	Accountability mechanisms
Regulations and laws	
33 Set mandatory limits on trans fats, sugar, salt/sodium and/or saturated fat in packaged foods	Mandatory limits
34 Require nutrition labelling on packages/menus to indicate if foods are high in calories, fats, sugars and/or salt and/or in positive nutrients	Nutrition labelling
35 Restrict all forms of marketing, advertising and in-store promotions of HFSS foods, particularly to children	Marketing restrictions
36 Use zoning laws to restrict numbers of "fast food" outlets and vendors in select geographic areas	Zoning laws
37 Establish and enforce safety regulations, surveillance mechanisms and protocols throughout the supply chain for nutritious foods, taking into consideration the importance of access to affordable nutritious foods among low-income populations through the informal sector	Food safety

(continued on next page)

Table 1 (continued)

Action	Abbreviation
Education and public awareness actions	
38 Deliver culturally-appropriate nutrition education, food literacy and skills training to children and adults through schools, health services, agricultural extension, social protection schemes and community settings	Public education
39 Provide dietary counselling to women during antenatal care and pregnancy, including awareness of benefits of nutritious food and risks of foods high in fats, sugars and salt	Antenatal counselling
40 Launch engaging and compelling mass media and behaviour change communication campaigns about foods and diets	Communications campaigns
41 Promote traditional food cultures associated with good nutrition by supporting and protecting traditional foods, providing information about traditional dishes and public awareness campaigns	Traditional foods
National guidelines	
42 Align all food systems policies and programmes with food-based dietary guidelines and widely communicate the guidelines to the general public	FBDG

Table 2

The number of survey respondents and interview participants according to their sector, geography and food system context.

	Survey Respondents		Interview Participants	
	n	Percentage	n	Percentage
Sector				
Academia/Research	33	34%	12	43%
Government	18	18%	3	11%
NGO	22	22%	5	18%
Private sector	8	8%	1	4%
UN agency/International body	25	26%	10	36%
Geography				
Africa	37	38%	10	36%
Asia	33	34%	9	32%
Central/South America	20	20%	5	18%
Europe	7	7%	3	11%
Global	14	14%	6	21%
North America	4	4%	0	0%
Food System Type				
Rural and Traditional	57	58%	17	61%
Informal and Expanding	42	43%	15	54%
Emerging and Diversifying	39	40%	13	46%
Modernizing and Formalizing	22	22%	9	32%
Industrialised and Consolidated	18	18%	5	18%

on which people felt there was strong potential but are perhaps not yet widely implemented or supported by evidence (i.e., more likely).

2.2. Gathering perspectives on actions through interviews

Since the objective in MCM is to elicit a diversity of nuanced perspectives among a group, Coburn et al. (2021) note that attempting to achieve ‘statistical representativeness’ with the participant mix would rely on the assumption that these perspectives can (1) be neatly categorised and (2) be determined prior to the interviews and used to guide recruitment. Rather, the selection process and interviews are specifically designed to avoid requiring participants to fit into pre-determined groups and to allow these perspectives to naturally emerge. Therefore, while achieving a healthy demographic mix is helpful for capturing a diversity of perspectives, ‘statistical representativeness’ is not the goal.

For this reason, interview participants were recruited by asking survey respondents if they would be willing to be interviewed to discuss the actions further. 42 people responded that they would be willing. These respondents were invited to schedule interviews. 31 proceeded to schedule interviews and 27 were completed to a sufficiently high standard to be used in the analysis. This sample size was considered

sufficient as similar studies on global policy prioritisation were referenced and the sample size comparable. The sector, geography and food system type of the interview participants can be seen in Table 2.

MCM uses custom-designed proprietary software created by the developers of the method to guide participants through the discussion. At the start of the interview, participants were first asked to exclude any actions they did not consider essential to re-orienting food systems towards healthy diets. Participants then chose the evaluative criteria against which they wanted to appraise the remaining actions. An evaluative criterion is the measure against which participants chose to appraise actions. Allowing participants to select their own criteria is a key component of MCM so that the results represent what the participants consider to be important in appraising an action rather than what the research team might select. For example, some participants might consider the scale of impact to be most important when comparing actions while others might consider the availability of evidence of impact to be most important. The only parameter set for participants was to not consider feasibility in their appraisals as the intention was to identify what they think is essential, regardless of whether it is feasible in any specific context. If participants selected multiple evaluative criteria, they were asked to assign each criterion a weight to signify differences in their relative importance.

After the evaluative criteria was selected, participants were asked to provide two numerical scores for each action against their criteria – an optimistic and a pessimistic score. An optimistic score is how the participant expects an action to perform against their criteria in the best-case scenario and the pessimistic is how it would be expected to perform in the worst-case scenario. It was left open to participants to determine what they consider a best- and worst-case scenario based on their professional experience, but if they asked for examples, they were told that a best-case scenario could be if action is fully implemented, effectively funded, politically supported, etc. whereas a worst-case scenario could be if the action is underfunded, only partially implemented, etc. The range of optimistic/pessimistic scores is intended to document degrees of uncertainty or variance in the strength of an action. Participants could score on whatever scale they chose - 1–5, 1–10, 1–100, etc. – and scores were subsequently normalised to a 1–100 scale in the analysis.

In some cases, participants chose to abstain from scoring an action because they felt they did not have enough knowledge to confidently score it. At the end, participants are shown their final scores and the ranking of each action. The interview ended when the participant was pleased with their ranking. Throughout the interview, participants are asked to provide their rationale for their exclusions and for each score they give, resulting in substantial qualitative as well as quantitative data. The results from the quantitative data are analysed here and the qualitative data will be presented in forthcoming research.

2.3. Analysing the data

As discussed above, whilst the goal of MCM is not to collect a statistically representative sample, the risk of such an approach is a potential tendency towards selection bias. Whilst a balanced sample by sector was sought for the survey, the risk of selection bias was not controlled for in the recruitment of interview participants since participants were self-selected. However, within the sectors in Table 2, there exists a wide range of varying areas of expertise which may have important bearing on how individuals appraise different policy options. Thus, it is important to determine how area of expertise shape the findings. To achieve this, interview participants were categorised into one of six areas of expertise (Table 3).

- **Agricultural research:** Participants who focus primarily on research in agricultural development or plant breeding (e.g. development and diffusion of bio-fortified crops)
- **Food policy and systems research:** Participants who do not focus on one particular part of the food value chain but who take a systems’ based

Table 3

The number of interview participants by expertise (this data was not collected for all survey respondents so differs from Table 2).

Expertise	n
Food policy and systems research	8
Humanitarian aid	3
Advocacy NGOs	5
Agricultural research	3
Development NGOs	4
Government policy and programmes	4

approach to research on how policy can achieve a specific outcome (e.g. improved diets)

- **Humanitarian aid:** Participants who focus primarily on ensuring food security in times of crises (e.g. delivery of food aid)
- **Advocacy NGOs:** Participants who focus on communicating with policymakers and civil society on issues related to dietary outcomes for specific populations (e.g. farmers organisations, consumer rights groups)
- **Development NGOs:** Participants who focus on agricultural and economic development for LMIC populations
- **Government policy and programmes:** Participants who work either within government or consult government on the adoption and implementation of policies for achieving nutrition outcomes

To measure the degree of consensus and dissensus, a pairwise ranking method was used, building on the work established by Coburn et al. (2021). This analysis calculates a metric called the *merit score* which is a measure of if an action was ranked higher or lower than another action and by how much it was ranked higher or lower. The *merit score* is calculated at two levels:

- (1) **Aggregate Merit Score:** The average merit score calculated across all participants by their organisational type, eg. the ‘average’ view of that action compared to other actions by all participants grouped by expertise (Table 3)
- (2) **Participant Merit Score:** The average merit score calculated by participant, eg. the view of that action compared to other actions for a single participant

Merit scores can range from -1 to 1 . Actions can then be ranked in order from the highest to the lowest merit score. A merit score >0 indicates the action is considered more essential than other actions. A merit score <0 indicates it was considered less essential. Actions that were excluded by a participant were assigned a *merit score* of -1 . (For a detailed review of how these metrics are calculated, see the supplementary material.) The results of the merit scores were then analysed to determine the extent of consensus or dissensus that exists for each action.

3. Results

3.1. Survey to identify the actions for appraisal

The results from the survey are shown in Table 4. In the survey, the average number of ‘more likely’ votes was 63.8 and the average number of ‘most likely’ votes was 22.4. Thus, all actions which received above 63.8 were selected from the ‘more likely’ list ($n=25$) and above 22.4 for the ‘most likely’ ($n=20$). 19 actions received above-average votes for both potential and confidence. Six actions received above-average votes for potential but below-average marks for confidence. For example, *Traditional food cultures* received 71 votes for ‘more likely’ but only 15 votes for ‘most likely’, indicating a strong belief in its potential, but accompanied by less confidence. One action – *Fortification* – received 59 votes for ‘more likely’ but 28 votes for ‘most likely’, indicating that while the action was not widely popular, those who did consider it to

Table 4

Number of votes received by each action for ‘more likely’ and ‘most likely’ to have an impact on diets ($n = 98$). Bold and italicised actions are those that received above-average votes for both potential and confidence (19). Bold actions are those that received above-average votes in either potential or confidence (7).

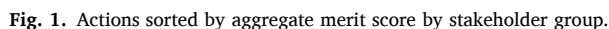
Action	‘More likely’ votes	‘Most likely’ votes
<i>School food programmes</i>	88	45
<i>Smallholder market access</i>	84	40
<i>Retail infrastructure</i>	84	29
<i>Public education</i>	81	31
<i>Public procurement</i>	78	34
<i>Social safety nets</i>	76	41
<i>Agricultural development</i>	76	30
<i>Women in agriculture</i>	76	22
<i>Mandatory limits</i>	74	35
<i>Ag extension programmes</i>	74	25
<i>Transport infrastructure</i>	72	34
<i>SME investments</i>	72	19
<i>Traditional foods</i>	71	15
<i>Retail taxes</i>	70	37
<i>Agriculture subsidies</i>	70	33
<i>Marketing restrictions</i>	70	30
<i>FBDG</i>	70	27
<i>Communication campaigns</i>	69	35
<i>POP subsidies</i>	69	25
<i>Post-harvest losses</i>	69	24
<i>Reformulation</i>	67	22
<i>Nutrition labelling</i>	65	35
<i>Trade for nutrition</i>	65	26
<i>Indigenous crops</i>	65	21
<i>Antenatal counselling</i>	65	14
<i>Urban agriculture</i>	61	11
<i>Home gardens</i>	60	18
<i>Food loss and waste</i>	60	10
Fortification	59	28
<i>ASFs for low-income homes</i>	59	18
<i>Zoning laws</i>	59	17
<i>Breeding for nutrients</i>	55	12
<i>Food safety</i>	54	17
<i>New processed products</i>	50	11
<i>Biofortification</i>	50	8
<i>Food safety training</i>	49	8
<i>Accountability mechanisms</i>	48	14
<i>E-commerce</i>	48	10
<i>Placement and menu change</i>	47	15
<i>Employee food programmes</i>	41	4
<i>Food deserts</i>	35	10
<i>Alternative proteins</i>	25	2

have high potential also believed strongly in its likely impact. Because actions only had to reach the cut-off for *either* potential or confidence, all moved forward into the final round, bringing the total number of actions to 26.

3.2. Pairwise analysis and merit scores

3.2.1. Ranked actions by stakeholder group

Fig. 1 shows the aggregate ranking of each action by organisational group from Table 3. Each list shows which actions the participants in each organisational group, on average, considered to be more essential or less essential (the order of actions from top to bottom) and how much more or less essential the actions were considered to be (the distance between actions). This provides an indication of how the various groups appraised the actions. First, the range between the highest and lowest ranked actions vary substantially between stakeholder groups, indicating differences in how strongly different groups felt about the relative rankings. Researchers have the narrowest range between what they considered to be the most essential (*Social safety nets*) and least essential (*Reformulation*) actions while the distance is much greater between what Advocacy NGOs considered the most essential (*Marketing restrictions*) and least essential (*Fortification*) actions.



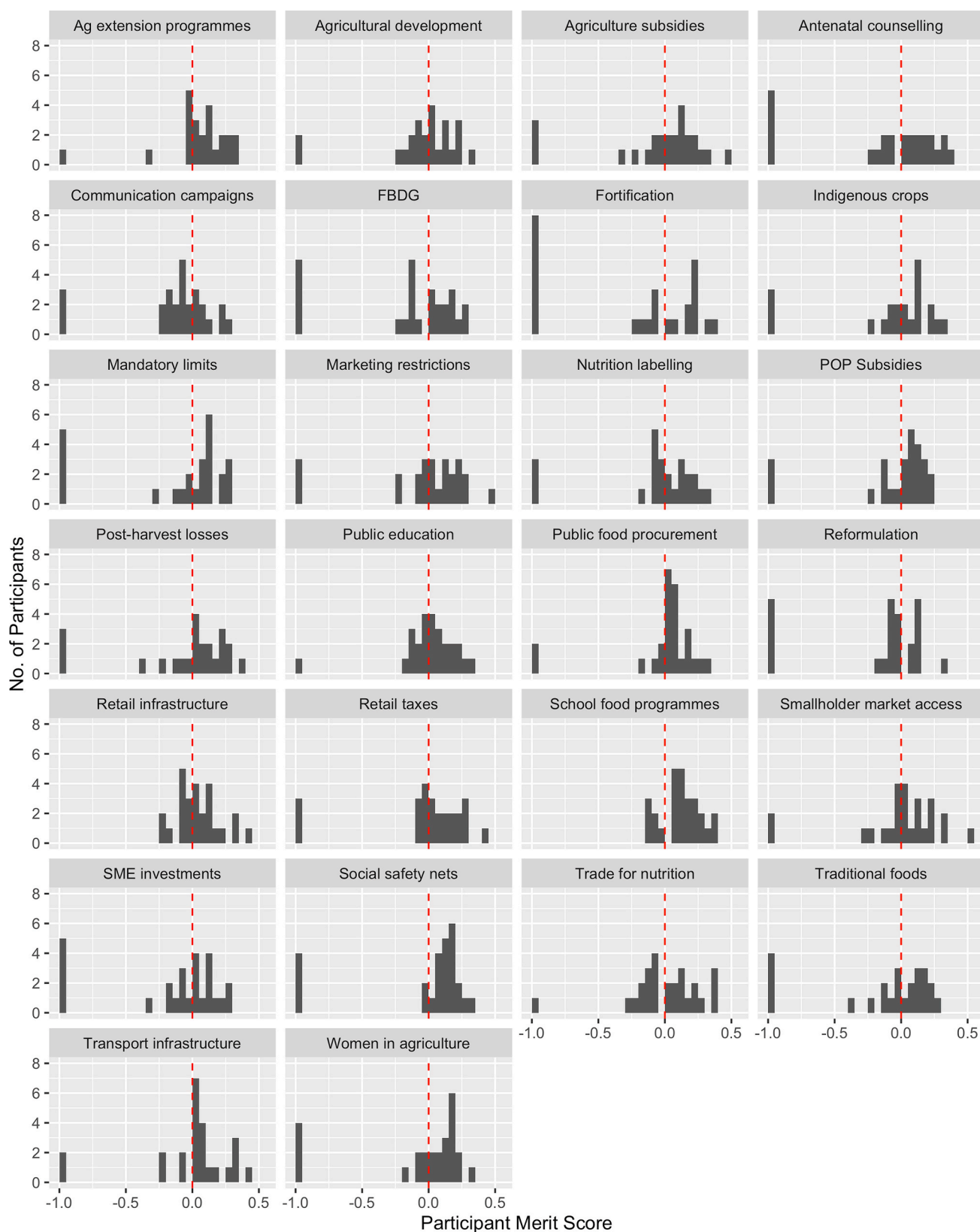


Fig. 2. The distribution of participants' merit scores for individual actions, ranging from -1 (exclusions) to 0.5 (the highest merit score received by an action.).

Second, Fig. 1 also shows how actions were viewed by different groups. *School food programmes* was the only action that was considered 'more essential' (aggregate merit score >0) by all organisational groups. *Ag extension programmes* were considered more essential by all groups

except for humanitarian aid agencies who strongly preferred *Agricultural subsidies*. Conversely, all groups agreed that *Fortification* was less essential except for participants from humanitarian aid agencies. *Reformulation* was also considered less essential by all groups except for

agricultural researchers while *Retail infrastructure* was considered more essential across all groups except agricultural researchers. *FBDG* were considered less essential by all groups except participants from government while *Public procurement* was considered more essential by all groups except from government. The remainder of the actions varied with different mixes of different groups considering them either more or less essential.

3.2.2. Distribution of participant merit score

Fig. 2 shows the distribution of perspectives of individual participants, grouped by who gave similar merit scores for each action (bin-width = 0.05). For example, 8 participants excluded *Fortification* (merit score = -1) while 11 participants gave it a merit score >0, indicating they consider it 'more essential.'

No action received a consensus. However, some actions did attract 'clusters' of agreement around a certain range of scores. *School food programmes* and *Retail infrastructure* attracted the most consensus that they are essential as no one excluded them.

While they all had their detractors, there were also tendencies towards considering several agricultural and upstream policies as essential - *Ag extension programmes*, *Post-harvest losses*, *Indigenous crops*, *Small-holder market access*, *Transport infrastructure* and *Women in agriculture*. However, opinions were mixed on *Agricultural development* and *Ag subsidies*. There were also tendencies to considering several food provision and affordability actions as essential - *POP subsidies*, *Public food procurement* and *Social safety nets* along with *School food programmes*.

Conversely, opinions on actions focused on consumers tended towards more ambivalence, with several detractors for *Antenatal counselling*, *Communications campaigns*, *FBDGs* and *Nutrition labelling* – although *Public education* and *Retail taxes* received more support. Opinions were mixed on *Mandatory limits* and *Reformulation*. *Fortification* had the greatest number of detractors.

4. Discussion

This study has shown that there is a diverse range of opinions across the majority of actions that might re-orient food systems towards nutrition. Such a diversity of opinion is to be expected considering that different conceptualisations of a problem and the pathway to impact of a policy, combined with how varying interpretations of facts and differences in values and interests shape how people perceive and therefore rank different options (Banwell et al., 2005; Raven et al., 2017; OECD, 2021). The divergence in views that this study reveals, even amongst people in similar organisational groups, suggests that many different factors are shaping individuals' appraisals that beg greater attention. Forthcoming research on the comments and rationale provided by participants will offer insight into why views varied as much as they did.

The action that garnered the most disagreement and polarisation was *Fortification*, with many considering it to be absolutely non-essential while another contingent considered it to be quite important. A similar degree of disagreement was seen for *Mandatory limits* and *Reformulation*. This outcome is surprising considering the attention that has been paid to these actions over many years. However, it might be indicative of the formation of two opposing camps – those who think industry-led technical fixes still offer an important route for improving nutrition versus those who consider attempts up to this point to have failed and who prioritise food-based approaches (Tontisirin et al., 2002; Lawrence, 2013; Thompson and Amoroso, 2014).

Nevertheless, participants showed some tendency towards agreement on some actions. *School food programmes* and *Retail infrastructure* were considered the most essential across all participants. Indeed, the evidence on *School food programmes* is well established and point to the importance of such social support programmes for nutrition (WHO, 2021; Bedasso et al., 2022; Medeiros et al., 2022). The importance of social support may indeed be echoed by the tendency towards agreement that actions such as *Social safety nets*, *Public procurement* and *POP*

subsidies received strong support. However, it is interesting to consider that participants who worked in government ranked these actions rather low, perhaps indicating scepticism on their feasibility.

There also was a tendency towards agreement on a collection of agriculture and upstream actions. This may be reflective of the growth in discussions on agriculture for nutrition (Ruel et al., 2018). It is notable that *Ag extension programmes* received strong support compared to *Ag development programmes*, perhaps pointing to an important distinction between the need for farmer support and education versus the need for sector growth more broadly. This mix of opinions on *Ag subsidies* considered in light of the low ranking by participants from government may also point to difficulties around feasibility.

These findings suggest two important takeaways that leaders in the global NAN need to consider. First, a wide diversity of views is present on these actions which may indicate a difficult road ahead in determining which actions to prioritise. However, rather than avoid addressing and engaging with the dissensus indicated here, actors within the network should take advantage of the diversity of views present to step back and fully consider the strengths and weaknesses of each action and to avoid the inevitable blind spots, pitfalls or conditionalities that result from their own positionality within the network (Stirling, 2008, 2010; Sol et al., 2018). Indeed, such a diversity of views is essential to taking the multi-pronged approach that will be necessary for improving nutrition in different contexts around the world.

The second important takeaway is that, while a diversity of views and approaches is important, a handful of actions and approaches - *School food programmes* and agriculture-targeted actions more generally – are increasingly recognised as essential to re-orienting food systems towards nutrition.

To put these findings into practice within the global NAN, an evaluation of the current suite of policies and programmes that are commonly advocated for and implemented should be conducted, led by a diverse group of actors from across the network. Several of these policies and programmes overlap with the 42 used in this research – *FBDGs*, *Fortification*, *Reformulation*, *Marketing restrictions*, etc. This research indicates that there are quite mixed, even polarised, opinions on whether oft-advocated policies are actually essential to improving diets. While this data should not be taken as definitive on this point, it does signal that there is a plurality of views on the prevailing global nutrition agenda - particularly as the importance of upstream actions like *Ag extension programmes* are increasingly recognised. These findings also indicate that the availability of evidence in support of the effectiveness of a certain actions on diets does not necessarily have a bearing on if it attracted a consensus. For example, the benefits of fortification on nutrition have been extensively researched, yet this was one of the actions that attracted the most dissensus. This implies that actors take many different factors into consideration when appraising an action, not only evidence of its impact on nutrition outcomes (this will be explored further in forthcoming publications). Evaluations should therefore build upon but not rely solely on formal evidence of an action's impact on diets. Other factors need to be incorporated into an evaluative framework, building a multi-stakeholder model of evaluation (Kugelberg et al., 2021).

4.1. Limitations of the study

Because the goal of this study was to assess pre-existing consensus rather than generate consensus, it is likely that if we had followed a traditional Delphi-like approach where participants could read other participants' rationale, the outcomes might have been different. However, methods like Delphi rely on the aggregation of views to present a loosely-defined 'consensus' view. There is still dissensus within their panel even after multiple rounds of communication. A back-and-forth between participants might have led to some movement on views towards more consensus, but it also might not given the 'distance' between views on some actions indicated in Fig. 2. Either way, the results of this

research should be considered as a “temperature check” on the baseline state of consensus/dissensus among actors within the NAN rather than a predictor of what results could potentially be achieved through community deliberation.

As discussed in Section 2, the goal of recruitment for an MCM study is not to get a statistically representative sample nor to be able to predict from the data what people within each sector or geography thinks about each action. However, these results are heavily dependent on the individual participants and their views will be rooted in their different backgrounds and areas of expertise. Fig. 1 in particular must be considered in light of the exploratory nature of this study. Analysing the drivers behind these views was beyond the scope of this paper so it is not possible to say the extent to which participants' sectors and areas of expertise informed their perspectives. However, this study provides a starting point for understanding what those perspectives are.

It is also important to note that participants could be categorised differently than the groupings in Table 3 and Fig. 1. We did not draw on any pre-existing ‘categories of expertise’ and so these groupings could certainly be debated. Here, the aim was to strike a balance between granularity and data interpretability. Disaggregating groups further – for example, to distinguish farmer advocacy groups from consumer advocacy groups or policymakers from policy consultants – would make findings more difficult to interpret. Furthermore, while some lines between areas of expertise are clear (e.g. the distinction between a plant breeder and a health policymaker), they quickly become blurred when, for example, the plant breeder works in agricultural development with policymakers focused on agriculture-for-nutrition. Thus, the interpretation of Fig. 1 needs to be considered in light of the ‘fuzziness’ of boundaries between expertise within food systems.

These results may also be impacted by different interpretations of the interview question, of what makes an action ‘essential’ and different priorities in assessing this. Whilst the qualitative data will be analysed in forthcoming research, it was notable that some participants struggled to appraise actions in a global context rather than in the context in which they work. Some also had a hard time not considering feasibility in their appraisals. However, as the purpose of this study was to capture the ‘state of opinion’ across a diverse range of participants, these differences in interpretation and approach are not considered a negative. Rather, the data is indicative of not only the plurality of views on the merits of an action, but the plurality of frames and values that are brought to the appraisal of an action which must be considered in real-world agenda-setting discussions.

5. Conclusion

This study sought to identify if there is any agreement on actions that are considered essential for re-orienting food systems towards healthy diets across a diverse range of stakeholders and sectoral and country contexts within the global NAN. The diversity of views identified among this panel indicates that leaders in the global NAN will need to put substantial effort towards facilitating effective and constructive discussions amongst the various actors to arrive at a list around which the community can coalesce. A substantial amount of discussion has been taking place around broader food systems issues, particularly leading up to the UN Food Systems Summit. This model could serve as a starting point. However, these findings also show that there is common ground is beginning to emerge on some important starting points for improving nutrition, with social provision and agriculture at the centre.

Funding

Funding for this research was provided by the Children's Investment Fund Foundation.

Declaration of competing interest

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

Data availability

The data that has been used is confidential.

Acknowledgements

The authors would like to thank Lawrence Haddad for his contributions to the inception of this research and his feedback and comments throughout. They would also like to thank all of the survey and interview participants who contributed their time and expertise to this study.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.gfs.2023.100687>.

References

- Baker, P., Hawkes, C., Wingrove, K., Demaio, A.R., Parkhurst, J., Thow, A.M., Walls, H., 2018. What drives political commitment for nutrition? A review and framework synthesis to inform the United Nations Decade of Action on Nutrition. *BMJ Glob. Health* 3, e000485. <https://doi.org/10.1136/bmjgh-2017-000485>.
- Banwell, C., Hinde, S., Dixon, J., Sibthorpe, B., 2005. Reflections on expert consensus: a case study of the social trends contributing to obesity. *Eur. J. Publ. Health* 15, 564–568. <https://doi.org/10.1093/eurpub/cki034>.
- Bedasso, B., Afridi, F., Gentilini, U., Sabarwal, S., 2022. Are school meals worth the cost? [WWW Document]. Center for Global Development. URL: <https://www.cgdev.org/blog/are-school-meals-worth-cost-contributions-biniam-bedasso-farzana-afridi-ugo-gentilini-and>. (Accessed 24 February 2023).
- Bellamy, R., Chilvers, J., Vaughan, N.E., Lenton, T.M., 2013. ‘Opening up’ geoenvironment appraisal: multi-Criteria Mapping of options for tackling climate change. *Global Environ. Change* 23, 926–937. <https://doi.org/10.1016/j.gloenvcha.2013.07.011>.
- Béné, C., Oosterveer, P., Lamotte, L., Brouwer, I.D., de Haan, S., Prager, S.D., Talsma, E. F., Khoury, C.K., 2019. When food systems meet sustainability – current narratives and implications for actions. *World Dev.* 113, 116–130. <https://doi.org/10.1016/j.worlddev.2018.08.011>.
- Bezanson, K., Isenman, P., 2010. Scaling up nutrition: a framework for action. *Food Nutr. Bull.* 31, 178–186. <https://doi.org/10.1177/156482651003100118>.
- Bhutta, Z.A., Ahmed, T., Black, R.E., Cousens, S., Dewey, K., Giugliani, E., Haider, B.A., Kirkwood, B., Morris, S.S., Sachdev, H.P.S., Shekar, M., 2008. What works? Interventions for maternal and child undernutrition and survival. *Lancet* 371, 417–440. [https://doi.org/10.1016/S0140-6736\(07\)61693-6](https://doi.org/10.1016/S0140-6736(07)61693-6).
- Brooks, S., Thompson, J., Millstone, E., Odame, H., Kibaara, B., Nderitu, S., Karin, F., 2009. Environmental Change and Maize Innovation in Kenya: Exploring Pathways in and Out of Maize. STEPS Centre. <https://opendocs.ids.ac.uk/opendocs/handle/20.500.12413/2455>.
- Brouwer, I.D., McDermott, J., Ruben, R., 2020. Food systems everywhere: improving relevance in practice. *Global Food Secur.* 26, 100398 <https://doi.org/10.1016/j.gfs.2020.100398>.
- Coburn, J., Bone, F., Hopkins, M.M., Stirling, A., Mestre-Ferrandiz, J., Arapostathis, S., Llewellyn, M.J., 2021. Appraising research policy instrument mixes: a multicriteria mapping study in six European countries of diagnostic innovation to manage antimicrobial resistance. *Res. Pol.* 50, 104140 <https://doi.org/10.1016/j.respol.2020.104140>.
- Committee on World Food Security, 2021. CFS Voluntary Guidelines on Food Systems and Nutrition. FAO, Rome. <https://www.who.int/teams/nutrition-and-food-safety/cfs-voluntary-guidelines-on-food-systems-and-nutrition#:~:text=The%20Voluntary%20Guidelines%20present%20a,are%20impacted%20by%20food%20systems>.
- Fanzo, J., Haddad, L., McLaren, R., Marshall, Q., Davis, C., Herforth, A., Jones, A., Beal, T., Tschirley, D., Bellows, A., Miachon, L., Gu, Y., Bloem, M., Kapuria, A., 2020. The Food Systems Dashboard is a new tool to inform better food policy. *Nat Food* 1, 243–246. <https://doi.org/10.1038/s43016-020-0077-y>.
- Gillespie, S., Haddad, L., Mannar, V., Menon, P., Nisbett, N., 2013. The politics of reducing malnutrition: building commitment and accelerating progress. *Lancet* 382, 552–569. [https://doi.org/10.1016/S0140-6736\(13\)60842-9](https://doi.org/10.1016/S0140-6736(13)60842-9).
- Global Nutrition Report, 2022. 2022 Global Nutrition Report. <https://globalnutritionreport.org/reports/2022-global-nutrition-report/>.
- Haddad, L., Hawkes, C., Webb, P., Thomas, S., Beddington, J., Waage, J., Flynn, D., 2016. A new global research agenda for food. *Nature* 540, 30–32. <https://doi.org/10.1038/540030a>.

- Harris, J., 2019. Narratives of nutrition: alternative explanations for international nutrition practice. *World Nutri.* 10, 99–125. <https://doi.org/10.26596/wv.201910499-125>.
- Harriss-White, B., Gathorne-Hardy, A., Rodrigo, G., 2019. Towards lower-carbon Indian agricultural development: an experiment in multi-criteria mapping. *Rev. Dev. Change* 24, 5–30. <https://doi.org/10.1177/0972266119845952>.
- Hawkes, C., Jewell, J., Allen, K., 2013. A food policy package for healthy diets and the prevention of obesity and diet-related non-communicable diseases: the NOURISHING framework. *Obes. Rev.* 14, 159–168. <https://doi.org/10.1111/obr.12098>. <https://www.foodsystemsdashboard.org/resources/publication-42.pdf>.
- Hawkes, C., Walton, S., Haddad, L., Fanzo, J., 2020. 42 Policies and Actions to Orient Food Systems towards Healthier Diets for All. Centre for Food Policy, City, University of London, London.
- Herforth, A., Ahmed, S., 2015. The food environment, its effects on dietary consumption, and potential for measurement within agriculture-nutrition interventions. *Food Secur.* 7, 505–520. <https://doi.org/10.1007/s12571-015-0455-8>.
- Hill, R., Gonzalez, W., Pelletier, D.L., 2011. The formulation of consensus on nutrition policy: policy actors' perspectives on good process. *Food Nutr. Bull.* 32, S92–S104. <https://doi.org/10.1177/15648265110322S206>.
- HLPE, 2017. Nutrition and Food Systems: A Report by the High Level Panel of Experts on Food Security and Nutrition (No. 12). Committee on World Food Security, Rome. <https://www.fao.org/3/i7846e/i7846e.pdf>.
- Hoey, L., Pelletier, D.L., 2011. The management of conflict in nutrition policy formulation: choosing growth-monitoring indicators in the context of dual burden. *Food Nutr. Bull.* 32, S82–S91. <https://doi.org/10.1177/15648265110322S205>.
- Holdsworth, M., Kruger, A., Nago, E., Lachat, C., Mamiro, P., Smit, K., Garimoi-Orach, C., Kameli, Y., Roberfroid, D., Kolsteren, P., 2015. African stakeholders' views of research options to improve nutritional status in sub-Saharan Africa. *Health Pol. Plann.* 30, 863–874. <https://doi.org/10.1093/heapol/czu087>.
- Kugelberg, S., Bartolini, F., Kanter, D.R., Milford, A.B., Pira, K., Sanz-Cobena, A., Leip, A., 2021. Implications of a food system approach for policy agenda-setting design. *Global Food Secur.* 28, 100451. <https://doi.org/10.1016/j.gfs.2020.100451>.
- Lang, T., Heasman, M., 2015. *Food Wars: the Global Battle for Mouths, Minds and Markets*, second ed. Routledge <https://www.routledge.com/Food-Wars-The-Global-Battle-for-Mouths-Minds-and-Markets/Lang-Heasman/p/book/9781138802629>.
- Lawrence, M., 2013. Case study 2: mandatory flour fortification with folic acid. In: Lawrence, M. (Ed.), *Food Fortification: the Evidence, Ethics, and Politics of Adding Nutrients to Food*. Oxford University Press, p. 0. <https://doi.org/10.1093/acprof:oso/9780199691975.003.0006>.
- Leach, M., Nisbett, N., Cabral, L., Harris, J., Hossain, N., Thompson, J., 2020. Food politics and development. *World Dev.* 134, 105024. <https://doi.org/10.1016/j.worlddev.2020.105024>.
- Lobstein, T., Millstone, E., Jacobs, M., Stirling, A., Mohebbati, L., 2006. Policy Options for Responding to Obesity: UK National Report of the PorGrow Project. SPRU – Science and Technology Policy Research. University of Sussex. <http://sro.sussex.ac.uk/id/eprint/15213>.
- Lubogo, D., Orach, C.G., 2016. Stakeholder perceptions of research options to improve nutritional status in Uganda. *BMC Nutr.* 2, 26. <https://doi.org/10.1186/s40795-016-0067-5>.
- Marshall, Q., Fanzo, J., Barrett, C.B., Jones, A.D., Herforth, A., McLaren, R., 2021. Building a global food systems typology: a new tool for reducing complexity in food systems analysis. *Front. Sustain. Food Syst.* 5. <https://doi.org/10.3389/fsufs.2021.746512>.
- Medeiros, G.C.B.S. de, Azevedo, K.P.M. de, Garcia, D., Oliveira Segundo, V.H., Mata, Á. N. de S., Fernandes, A.K.P., Santos, R.P., dos, Trindade, D.D.B. de B., Moreno, I.M., Guillén Martínez, D., Piuvezam, G., 2022. Effect of school-based food and nutrition education interventions on the food consumption of adolescents: a systematic review and meta-analysis. *Int. J. Environ. Res. Publ. Health* 19, 10522. <https://doi.org/10.3390/ijerph191710522>.
- Morris, S.S., Cogill, B., Uauy, R., 2008. Effective international action against undernutrition: why has it proven so difficult and what can be done to accelerate progress? - the Lancet. *Lancet* 371, 608–621. [https://doi.org/10.1016/S0140-6736\(07\)61695-X](https://doi.org/10.1016/S0140-6736(07)61695-X).
- OECD, 2021. Making Better Policies for Food Systems, OECD Food, Agriculture and Fisheries Papers. OECD, Paris. https://www.oecd-ilibrary.org/agriculture-and-food/making-better-policies-for-food-systems_ddfba4de-en.
- Pelletier, D.L., Frongillo, E.A., Gervais, S., Hoey, L., Menon, P., Ngo, T., Stoltzfus, R.J., Ahmed, A.M.S., Ahmed, T., 2012. Nutrition agenda setting, policy formulation and implementation: lessons from the Mainstreaming Nutrition Initiative. *Health Pol. Plann.* 27, 19–31. <https://doi.org/10.1093/heapol/czr011>.
- Pelletier, D.L., Menon, P., Ngo, T., Frongillo, E.A., Frongillo, D., 2011. The nutrition policy process: the role of strategic capacity in advancing national nutrition agendas. *Food Nutr. Bull.* 32, S59–S69. <https://doi.org/10.1177/15648265110322S203>.
- Raven, R., Ghosh, B., Wiczorek, A., Stirling, A., Ghosh, D., Jolly, S., Karjantimapon, E., Prabudhanitisarn, S., Roy, J., Sangawongse, S., Sengers, F., 2017. Unpacking sustainabilities in diverse transition contexts: solar photovoltaic and urban mobility experiments in India and Thailand. *Sustain. Sci.* 12, 579–596. <https://doi.org/10.1007/s11625-017-0438-0>.
- Ross, A., Stirling, A., 2004. Deliberative Mapping Briefing 5: Using the Multi-Criteria Mapping (MCM) Technique. University of Sussex, Brighton. <http://users.sussex.ac.uk/~prfb0/DM%20Briefing%205.pdf>.
- Ruel, M.T., Alderman, H., 2013. Nutrition-sensitive interventions and programmes: how can they help to accelerate progress in improving maternal and child nutrition? *Lancet* 382, 536–551. [https://doi.org/10.1016/S0140-6736\(13\)60843-0](https://doi.org/10.1016/S0140-6736(13)60843-0).
- Ruel, M.T., Quisumbing, A.R., Balagamwala, M., 2018. Nutrition-sensitive agriculture: what have we learned so far? *Global Food Secur.* 17, 128–153. <https://doi.org/10.1016/j.gfs.2018.01.002>.
- Shiffman, J., Smith, S., 2007. Generation of political priority for global health initiatives: a framework and case study of maternal mortality. *Lancet* 370, 1370–1379. [https://doi.org/10.1016/S0140-6736\(07\)61579-7](https://doi.org/10.1016/S0140-6736(07)61579-7).
- Sol, J., van der Wal, M.M., Beers, P.J., Wals, A.E.J., 2018. Reframing the future: the role of reflexivity in governance networks in sustainability transitions. *Environ. Educ. Res.* 24, 1383–1405. <https://doi.org/10.1080/13504622.2017.1402171>.
- Stirling, A., 2010. Keep it complex. *Nature* 468, 1029–1031. <https://doi.org/10.1038/4681029a>.
- Stirling, A., 2008. Opening up" and "closing down": power, participation, and pluralism in the social appraisal of technology. *Sci. Technol. Hum. Val.* 33, 262–294. <https://doi.org/10.1177/0162243907311265>.
- Stirling, A., 2006. Analysis, participation and power: justification and closure in participatory multi-criteria analysis. *Land Use Policy, Resolving Environmental Conflicts. Combin. Participat. Multi-Criteria Anal.* 23, 95–107. <https://doi.org/10.1016/j.landusepol.2004.08.010>.
- Swinburn, B., Sacks, G., Vandevijvere, S., Kumanyika, S., Lobstein, T., Neal, B., Barquera, S., Friel, S., Hawkes, C., Kelly, B., L'Abbé, M., Lee, A., Ma, J., Macmullán, J., Mohan, S., Monteiro, C., Rayner, M., Sanders, D., Snowdon, W., Walker, C., Informas, 2013. INFORMAS (international network for food and obesity/non-communicable diseases research, monitoring and action support): overview and key principles. *Obes. Rev.* 14, 1–12. <https://doi.org/10.1111/obr.12087>.
- Thompson, B., Amoroso, L., 2014. Improving Diets and Nutrition: Food-Based Approaches. CABI. <https://doi.org/10.1079/9781780642994.0000>.
- Tontisirin, K., Nantel, G., Bhattacharjee, L., 2002. Food-based strategies to meet the challenges of micronutrient malnutrition in the developing world. *Proc. Nutr. Soc.* 61, 243–250. <https://doi.org/10.1079/PNS2002155>.
- White, R., Stirling, A., 2013. Sustaining trajectories towards Sustainability: dynamics and diversity in UK communal growing activities. *Global Environ. Change* 23, 838–846. <https://doi.org/10.1016/j.gloenvcha.2013.06.004>.
- WHO, 2021. Assessing the Existing Evidence Base on School Food and Nutrition Policies: a Scoping Review. World Health Organisation. <https://www.who.int/publications-detail-redirect/9789240025646>.
- WHO, 2018. Global Nutrition Policy Review 2016–2017: Country Progress in Creating Enabling Policy Environments for Promoting Healthy Diets and Nutrition. World Health Organisation. <https://www.who.int/publications-detail-redirect/9789241514873>.