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Measuring the end of hunger: Knowledge politics in the selection of SDG food security indicators

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Abstract
Ending world hunger remains one of the central global challenges, but the question of how to measure and define the problem is politically charged. This article chronicles and analyses the indicator selection process for SDG 2.1, focusing in particular on the Food Insecurity Experience Scale (FIES) indicator. Despite alleged efforts to separate political and technical aspects in the indicator selection process we find that they were entangled from the start. While there was significant contestation around which indicators should be selected, the process was characterized by pathway lock-in: The complexity of food security quantification and the resource constraints in the process favored already established data infrastructures and milieus of expertise, locking in the position of FAO and its established food security indicators. The SDG 2.1 indicators frame food insecurity in terms of caloric supply and demand and individual experience, arguably excluding dimensions of democratic agency, sustainability and other dimensions and drivers of food insecurity. The lock-in has thus embedded a narrow concept of food security in the major global indicator framework for food security monitoring. This is likely to have significant effects on how food insecurity is addressed nationally and internationally. Addressing the knowledge politics of food security indicators is important to broaden and open the agenda for sustainable transformation of food systems. Statistics and indicators are important tools in this agenda, but a diversity of approaches and data infrastructures from the local to the international level are needed to understand the multiple dimensions and drivers of food insecurity.

Keywords Food security · Nutrition · Indicators · Sustainable development goals · Data infrastructures · Organizational path dependence

Abbreviations

SDGs	Sustainable Development Goals
FAO	Food and Agriculture Organization
UN	United Nations
WFP	World Food Programme
IFAD	International Fund for Agricultural Development
PoU	Prevalence of Undernourishment
FIES	Food Insecurity Experience Scale
FCS	Food Consumption Score
IAEG-SDGs	Inter-agency and Expert Group on SDG Indicators
UNSD	United Nations Statistical Division
UNSC	United Nations Statistical Commission

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Introduction

The UN member states have agreed to end hunger by 2030. This ambitious goal is the second of the 17 Sustainable Development Goals (SDGs) adopted in 2015. SDG 2 boldly aims to "*End hunger, achieve food security and improved*

nutrition and promote sustainable agriculture". It consists of eight targets and 14 indicators. The process of selecting indicators to measure progress towards SDG 2 was characterized by knowledge politics from the outset, with the complexity of measuring food security and scarce global data locking in certain indicators.

The standard definition of food security stems back to the 1996 World Food Summit (WFS): "*Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life*" (WFS, 1996). This definition is multidimensional and difficult to quantify (Barrett 2010; Westengen and Banik 2016). Food security indicators may focus on food *availability* (adequate food supplies for a given population), *access* (ability to access available food), *utilization* (nutritional intake and absorption), *stability* (over time), or a combination of these (Jones et al. 2013; Upton et al. 2016). Recently, the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security (CFS) proposed to update the definition to also include the dimensions *agency* (decision power) and *sustainability* (environmental resilience) (HLPE-CFS, 2020).

Given the multidimensionality of food security it is difficult to identify suitable quantitative indicators (Maxwell et al. 2014). The concept *indicator* refers to systematic, comparative organization of information that allows for comparison among units or over time (Merry 2016). While targets and goals specify objectives, indicators are supposed to quantify progress towards them. However, indicators and goals are often conflated. Indicators can thus influence both knowledge and governance (Merry 2016; Völker et al. 2019). The effects of SDG indicators, including those on food security and agriculture, have global impact (Fukuda-Parr and McNeill 2019).

Each Goal of the 17 SDG has several quantified targets, which in turn are measured by indicators. The first five targets of SDG 2 (2.1–2.5), are related to food security and agricultural sustainability. The last three (2a–2c) are market-related targets. This article investigates the process of selecting food security indicators for SDG Target 2.1: "*By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round.*" Two food security indicators were selected to monitor this target. The first is the Prevalence of Undernourishment (PoU) indicator developed by the UN agency Food and Agricultural Organization (FAO). This is FAO's traditional indicator used to monitor food security and hunger at national and global levels. The second indicator is the household level experienced-based food security indicator Food Insecurity Experience Scale (FIES), developed by the FAO in 2013. FAO serves as both SDG indicators' custodian agency, with the responsibility to design their data collection and reporting system.

Figure 1 shows the global measurements of food insecurity based on PoU and FIES from 2014 to 2021.[1] The difference in underlying concepts of food security and measurement methods for the two indicators results in considerably different figures of global hunger and food insecurity. Measured with the PoU indicator, 768 million people suffered from undernourishment globally in 2021. Measured with FIES, approximately 2.3 billion people suffered from moderate or severe food insecurity in 2021, and 924 million of these were classified as severely food insecure (FAO et al. 2022).

Agri-food systems are increasingly subject to scholarly attention with regards to the power relationships and politics involved (Leach et al. 2020). The field of political agronomy focuses on contestation in agricultural research, a discipline traditionally regarded as an objective and technical discipline focused on practical problems (Sumberg 2017; Sumberg and Thompson 2012). Political agronomy aims to unearth the knowledge politics of how agronomy is constructed as a discipline and practice, illustrating the tensions within the discipline's self-representation as a purely evidence-based science removed from questions of values, context, and politics (Taylor et al. 2021). The politics and history of quantification of food security has hitherto received much less scholarly attention. We address this gap in the field of food security statistics, arguing that the SDG indicator selection process locked in FAO's indicators and that this has consequences for food security policy and practice that deserves more debate.

The first objective is to investigate how food security indicators were selected to monitor the SDGs, as well as how they frame food security. The second objective of the article is to provide an empirical evaluation of the role of politics in food security measurement. The article proceeds as follows: First, we present the theory of path dependence and the methods employed in this study. Second, we present approaches to measure food insecurity. Third, we present our analysis. Finally, we conclude and draw key policy lessons.

Theory and methods

The term *path dependency* was initially conceived to describe how the initial advantage of specific actors or random shocks determine how the history of a phenomenon unfolds (David 1985). This concept of path dependency

[1] Global data collection for FIES was initiated in 2014.

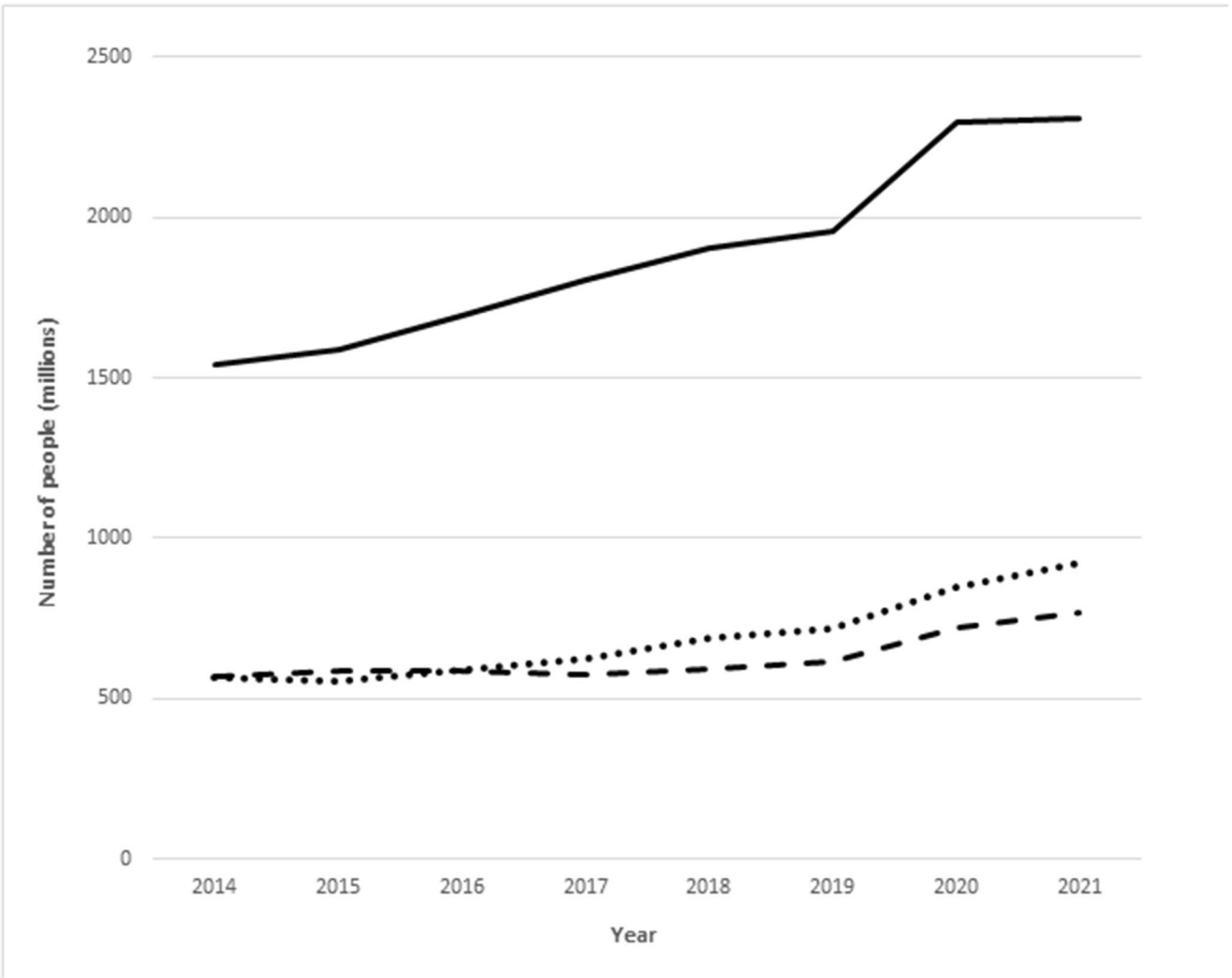

Fig. 1 Measurements of global food insecurity by SDG 2.1 indicators (FAOSTAT, 2022). The solid line indicates number of people affected by moderate or severe food insecurity globally (FIES). The dotted line indicates number of affected by severe food insecurity (FIES). The dashed line indicates number undernourished people (PoU)

was cast in terms of initial probabilism and eventual determinacy in outcomes. We apply the concept of organizational path dependence which frames path dependency as a progressive elimination of the scope of decision making (Sydow et al. 2009). In this perspective present and future scopes for action are limited by previous choices, but not pre-determined. A minimum condition for breaking a lock-in is the effective restoration of choices. The development of organizational path dependence is defined as a three-stage process of (1) preformation phase, (2) formation phase and (3) lock-in phase.

The preformation phase can be characterized as an open situation with no significant restrictions on the scope of action. The preformation phase however does not start from scratch. The transition to the formation phase is triggered by an event leading to a critical juncture. This phase is typically characterized by the emergence of a narrower organizational path caused by self-reinforcing mechanisms, constituting a certain pattern of social practice which increasingly dominates the alternatives. The formation phase thus favors a particular type of decision or action pattern. The transition to the lock-in phase is characterized by a further restriction of the scope for choices, replicating the action pattern even more. This lock-in may be of a cognitive, normative, and resource-based nature. Organizational processes are not likely to amount to a full state of determinacy, but rather self-reinforcing dynamics that brings about a certain action pattern which gets deeply embedded in practice and hence replicated.

To explore the mechanisms that enforce certain pathways in food security quantification, we refer to the knowledge politics of food (Sumberg et al. 2012; Taylor et al. 2021), and engage with perspectives presented by Leach et al. (2020) on pathways in food science and technology. Power

and politics infuse the food system. The playing fields of food science and technology are not level, as the distribution of power influences the scientific pathways and direct them to fit the interests of presiding actors. Lack of diversity in potential pathways for food science and technology can in turn enforce pathway lock-in. This brings our attention to the dominant interests in food quantification as well as the democratic, social and sustainability outcomes of the prevalent pathways of food security quantification.

Another central analytical concept is *data infrastructures*. Infrastructures of measurement, in the sense of the material and technological basis for data collection, selection and analysis, both enable and constrain what can be measured (Merry 2019). As we will show, measurement of food security is particularly constrained by the scarcity and concentration of such infrastructures at the international scale.

Furthermore, we take inspiration from Merry (2016)'s approach to developing genealogies of indicators, combining in-depth interviews with archival analysis in an effort to investigate the process of selecting food security indicators to monitor the SDGs. The article draws on 15 in-depth interviews with key informants from the *Inter-agency and Expert Group on SDG Indicators* (IAEG-SDGs), which is the body that is mandated with crafting an indicator framework for the SDGs, as well as national statistical offices, bureaucracies, diplomatic missions and UN agencies. It also includes a review of 53 documents from the SDG indicator selection process. A list of documents is included in the electronic supplementary material.

Our attention is directed to the role of custodian agencies drawn from the UN and other international organizations in shaping the indicator framework. Interviewees were therefore chosen to gather information on the role of custodian agencies in developing the indicator framework from a range of perspectives by key actors at different levels of the SDG process. The selection includes statisticians and policy professionals working on food security in all the Rome-based UN organizations, statisticians from national statistical bureaus that are members or observers in the IAEG-SDGs as well as bureaucrats in national ministries and diplomatic missions.[2] This wide variety of relevant backgrounds ensures a plurality of perspectives and accounts of the process of selecting indicators for SDG target 2.1. All interviews were conducted on a prior informed consent basis. The individuals interviewed are anonymized. The interviews were semi-structured and to a large extent process-oriented (Tavory 2020), emphasizing the how, who, when, and where of the SDG indicator selection process. The NVIVO software was used to identify, organize, and code relevant themes for the purpose of data analysis. To Ryan and Bernard (2003, p. 87), the terms *theme* and *expression* connote the fundamental concepts we are trying to describe when analyzing. They describe themes as conceptual linkages of expressions. The specific themes identified in the analysis of interview material will be elaborated upon in the coming section.

Path dependency in SDG indicator selection

We find that the process of SDG 2.1 indicator selection corresponds with the general phases of organizational path dependency. This path dependency was caused in part by constraints on resources and data infrastructures. The outcomes in terms of knowledge politics are analyzed at the end of the section.

The SDG 2.1 indicators

To set the stage for the discussion of path dependency and knowledge politics in the SDG indicator selection process, we here briefly outline the history and measurement methods of the two indicators chosen to monitor SDG Target 2.1.

The FAO has since its establishment in 1945 been the key player in providing statistics on food and agriculture. However, the quality of these statistics has been the subject of wide-ranging criticisms (Berry 1984; Hill 1984; Nature Plants 2019). With the establishment of the SDGs, FAO arguably increased its importance as custodian of agri-food system statistics. The organization is designated custodian agency for SDG 2 and has custodian responsibility for 9 out of 14 SDG 2 indicators (UNSC 2021). In addition, FAO is responsible for compiling and verifying country data and metadata for 22 SDG indicators and contributes to another five (UNSD 2021). The two key indicators of special interest here, FIES and PoU, are both produced by FAO and purport to measure access to food (FAO 2013, 2016). They are however based on different methodologies and conceptualizations of food security, which in turn lead to rather different measurements of food security (see Fig. 1). As a basis for understanding potential implications of different approaches to measure SDG 2.1 progress, we first outline their technical foundations.

The PoU chosen as SDG indicator 2.1.1 is FAO's flagship indicator. It was first published by Sukhatme (1961) and was also previously a key indicator for the Millennium Development Goals (MDGs). PoU is the central indicator in the most cited publication on global food insecurity development, the *State of Food Security and Nutrition in the*

[2] The Rome-based organizations are Food and Agriculture Organization (FAO), World Food Programme (WFP) and International Fund for Agricultural Development (IFAD). They constitute the lead international agencies for food security.

World (SOFI). The SOFI is an annual report produced by the Rome-based UN agencies as well as UNICEF and WHO. The PoU reports the proportion of undernourished people in a population with undernourishment defined as a condition of "*continued inability to obtain enough food*" (FAO et al. 2021, p. 156).

Calculation of the PoU relies on the estimation of the availability of food, as well as the caloric requirements and intake distribution in the population. Supply of calories is used as a proxy to measure caloric consumption in the population and is derived from the National Food Balance Sheets reporting food availability for 179 countries and territories by source of supply for a range of food items, from domestic agricultural production as well as international trade, while also attempting to account for food waste (FAOSTAT 2021). Differences in access to food in the population is calculated on the basis of nationally representative household surveys on income, expenditure, or consumption. For countries or years with no survey data, values are imputed or measured indirectly. The PoU corresponds to the probability that after randomly selecting an individual from the population, it will be under the energy consumption threshold for undernourishment called the Minimum Dietary Energy Requirement (FAO et al. 2020). This nutritional threshold is set to the level of dietary energy considered necessary for an individual with a normal active and healthy life. The threshold for the entire population is the weighted average of the threshold of the different age or sex groups in the population (FAO 2003). Demographic data on the projected and historical population structure by sex and age is extracted from the biannual World Populations Prospects. Information on the median height in each sex and age group is derived from the most recent Demographic and Health Surveys or other surveys that collect demographic anthropometric data (FAO et al. 2020). When the minimum dietary energy requirement, mean caloric consumption and coefficient of variation have been calculated, the PoU can be estimated.

The PoU has been the target of much criticism despite its status as a cornerstone of food security measurement. It does not measure undernourishment below two and a half percent and is thus not sensitive to low levels of undernourishment (FAO et al. 2020). It has been criticized for measuring a narrow, reductive, and insufficient concept of food insecurity characterized by a productivist understanding of food systems that centers national production, trade, and availability of calories (Fukuda-Parr and Orr 2014; Lappé et al. 2013; Pogge 2016). Availability of food at the subnational level is however generally not considered the decisive factor for determining undernutrition or famine (De Waal 2017; Sen 1981). Furthermore, the PoU is said to rely on problematic assumptions about the human body's ability to lower metabolism when experiencing low energy intake (Svedberg 2001), assuming that the basal metabolic rate is the same across different regions (Hayter and Henry 1994) and for over-estimating the variability of consumption (Svedberg 2001). Since the PoU is designed for national and global measurements, it cannot be disaggregated to track differences between different groups at sub-national level (Fukuda-Parr and Orr 2014).

On the other hand, FIES, SDG indicator 2.1.2, is a so-called experience-based food security indicator used to measure food security at the household and individual level. Experience-based food insecurity indicators attempt to capture behavioral and psychosocial indications of food insecurity from household surveys (Coates et al. 2007). Parts of the methodology that FIES builds on was published early in the 90s in the USA following Reagan-era worries about the lack of data on hunger in the country (Radimer et al. 1990, 1992). Experience-based food insecurity measurement is thus older than FIES. Different experience-based food security indicators are in use around the world, mainly in the Americas. Each country has obtained its own scale and thresholds, but these are not directly comparable across countries. In 2017, FIES was for the first time included in the SOFI with measurements of numbers of *food secure or marginally insecure* or *severely food insecure* (FAO et al. 2017). As of 2019, SOFI also included FIES measurements of *moderate or severe food insecurity* (FAO et al. 2019). FAO provides technical support and works towards the inclusion of FIES in surveys and national censuses (FAO 2016).

The indicator is available both in individual and household versions (FAO 2020), but in the context of the SDGs it is used as an individual indicator. Data for FIES is collected using a survey that poses the eight *yes* or *no* questions in Table 1.

FIES is based upon the Rasch model, which in turn is derived from Item Response Theory (IRT). IRT refers to a group of statistical models originally developed for purposes of educational testing that attempt to explain the relationship between latent characteristics and attributes (e.g., food insecurity or educational ability) and their measurable manifestations. The Rasch-model is a one-parameter IRT-model. Its central feature is the construction of a linear, continuous, and unidimensional measurement scale that is invariant across individuals (Nord 2014; Stemler and Naples 2021). The manifestations of latent attributes are obtained from data that represent the responses given to a set of chosen questions (FAO et al. 2019). FIES uses the number of affirmative responses to the survey questions (raw score) to measure the probability that each respondent is beyond a certain threshold of food security (Cafiero et al. 2018). The extent to which respondents' raw scores corresponds the survey questions' ranking of severity, can in turn be tested.

Table 1 FIES survey questionnaire

1	During the last 12 MONTHS, was there a time when you were worried you would not have enough food to eat because of a lack of money or other resources?
2	Still thinking about the last 12 MONTHS, was there a time when you were unable to eat healthy and nutritious food because of a lack of money or other resources?
3	Was there a time when you ate only a few kinds of foods because of a lack of money or other resources?
4	Was there a time when you had to skip a meal because there was not enough money or other resources to get food?
5	Still thinking about the last 12 MONTHS, was there a time when you ate less than you thought you should because of a lack of money or other resources?
6	Was there a time when your household ran out of food because of a lack of money or other resources?
7	Was there a time when you were hungry but did not eat because there was not enough money or other resources for food?
8	During the last 12 MONTHS, was there a time when you went without eating for a whole day because of a lack of money or other resources?

A prevalence rate of food insecurity can in principle be calculated for any specified threshold along the severity scale. FAO uses three categories, as defined by two global thresholds: *food secure or marginally insecure*, *moderately food insecure* and *severely food insecure*. The two thresholds are set to correspond to the severity levels of questions 5 and 8. By studying how many respondents report different experiences, one establishes the continuous one-dimensional scale of severity that ranks of each experience (Nord 2014). Experiences reported by a larger number of interviewees are deemed less severe and vice versa. The frequency of positive responses thus determines the level of severity of each question. Differences in responses between countries will therefore yield different scales and thresholds for classifying food insecurity in different countries (FAO 2021).

The objective of FAO when it launched the Voices of the Hungry Project in 2013 was to ensure comparable experience-based food security data across countries (FAO 2016). The result was FIES, which aimed to be a new standard for measuring global and national food insecurity. Worldwide data collection for FIES was started by FAO in 2014 and done by the private company Gallup World Poll. Gallup is a worldwide survey conducted since 2006 (Cafiero et al. 2018). The randomized samples are intended to represent the entire civilian, non-institutionalized adult population of the country. Gallup mainly uses telephone surveys in middle and high-income countries. In what Gallup refers to as the *developing world*, it uses face-to-face interviews with randomly sampled households. Exceptions include areas where the safety of the enumerators is threatened (Gallup 2020).

The innovation of FIES is the calibration of national severity scales to a global reference scale, which functions as a common metric (FAO 2016). According to FAO, the global reference scale enables cross-national comparability and global aggregation of measurements. In the 2019 edition of SOFI, FAO included FIES data from 153 countries or territories worldwide to establish the global severity scale (FAO et al. 2019). Converting FIES-based measures obtained in a national scale into measures expressed on the global reference scale requires the identification of *anchor points* for which measures in the two scales are known. These points are questions to which responses from different national scales differ in severity by less than a specified margin (Cafiero et al. 2018).

Establishing the architecture for the SDG indicator process: the critical juncture

In this section, we describe the critical juncture that marked the transition from the preformation to the formation phase in the SDG2.1 indicator selection process: The establishment of the institutional architecture for the indicator selection process. An important principle in the design of the SDGs was the division between the political negotiations of goals and targets, and the supposedly technical work of selecting indicators. The formulation of the goals and targets was intentionally set up as a process of political negotiations amongst states, while a group of statisticians from national statistical offices got the mandate to approve the indicator framework.

The Open Working Group (OWG) was given a mandate by the Rio + 20 UN Conference on Sustainable Development to develop SDG goals, targets, and proposals for indicators. This structure was copied from the precursory MDGs. From the outset, quantitative indicators were thus the chosen method of monitoring progress, excluding qualitative methods of evaluation. The OWG was a political body consisting of representatives from member states and developing countries. The OWG concluded its work with a proposal to the UN General Assembly in September 2014, with suggestions for 17 goals and 169 targets (UNGA 2014).

The formal process of establishing an indicator framework was initiated only after the OWG negotiations were completed. The OWG did however publish a series of consultative statistical notes mapping suitable indicators and their data requirements, including a note on food security and nutrition outlining potential SDG food security indicators and their data limitations (UNSD and FoC 2014). The UN Statistical Commission, which is the highest body of the global statistical system facilitated a series of events and key reports in 2015 to prepare the grounds for the process for establishing an indicator framework. In February, an

Expert Group Meeting on SDG indicators recommended the establishment of the IAEG-SDGs, a body with the authority to approve or reject indicators (Dodds et al. 2017).

The following month, the Statistical Commission held its 46th session (UNSC 2015a). It was at this meeting that the Statistical Commission and its member states formally established the IAEG-SDGs, passing the responsibility from the OWG to the IAEG-SDGs. It stated that the "*development of a high quality and robust indicator framework is a technical process*" (UNSC 2015a, p. 11). The IAEG-SDGs was intended to be a purely technical body. All 27 representatives in the IAEG-SDGs are statisticians from national statistical offices, each of them representing a group of member countries. These are supplemented by representatives from regional and UN organizations who have status as observers but provide input and support (UNGA 2017). NGOs, academia, and private business also contribute to the process, for instance through commenting upon specific indicators. The IAEG-SDGs have designated a custodian agency chosen among UN agencies and other relevant international organizations for each indicator. The United Nations Statistics Division (UNSD), mandated to coordinate and fulfill needs in the global statistical system, took on the role as secretariat to the IAEG-SDGs. At the same session, a technical report was presented by the Statistical Commission, containing 304 indicators proposed for the SDGs by experts in various UN and other international agencies, providing a starting point for the IAEG-SDGs (UNSC 2015b). In addition, agencies were requested to provide for their proposed indicators the possible data source and the name of the potential custodian agency that would be responsible for global monitoring.

Custodian agencies are charged with the task of designing a data collection and reporting system in the SDG indicator framework. They also have the responsibility to support countries in data use and analysis, regional and global aggregation, harmonization of data, reporting to the Global SDG Database and developing statistical methodology. SDG indicators were in turn grouped into three tiers: Tier I (Indicator conceptually clear, established methodology and standards available and data regularly produced by countries), Tier II (Indicator conceptually clear, established methodology and standards available but data are not regularly produced by countries) and Tier III (Indicator for which there are no established standards or methodology/standards are being developed/tested) (Dodds et al. 2017).

We interpret the formation of the IAEG-SDGs as a critical juncture in the development of a monitoring system for the SDGs, narrowing the decision space for the indicator framework of the SDGs. In the following sections, we argue that this specific institutional architecture limited the indicator alternatives available for serious consideration, due to the interplay between the IAEG-SDGs and its custodian agencies.

The SDG target 2.1 indicator selection process

The OWG background note on food security and nutrition discussed a wide range of indicators for consideration. These included indicators of undernourishment and energy deficiency, national food balance sheets, experience-based indicators, resilience indicators, composite indicators, indicators of malnutrition and indicators of dietary diversity and quality (UNSD and FoC 2014). The indicator selection process however quickly revolved almost exclusively around the FAO-indicators PoU and FIES. The well-known global food security indicator PoU was adopted as a Tier I indicator already in the first meeting in the IAEG-SDGs (UNSD 2015a). But while PoU was approved from the outset, FIES was met with considerable skepticism from national experts.

In the technical report for the 46th session of the Statistical Commission, each indicator proposal was ranked from A to C by experts from national statistical systems according to criteria of feasibility, suitability, and relevance. FIES received the lowest given rank C for feasibility, B for suitability and B for relevance. This meant that it was considered difficult to implement even with strong effort due to concerns with the methodology and data availability, and only somewhat relevant. The result for suitability indicated a widespread wish from the statisticians to "*discuss and/or consider*" other indicators of food security (UNSC 2015b, p. 10).[3] As we will show in the coming sections, the decision space would however narrow with the formal initiation of the indicator process. PoU meanwhile received a B for feasibility, A for suitability and A for relevance.

This technical report provided the foundation for the proposed indicator list used in the first meeting of the IAEG-SDGs in June 2015. UNSD compiled the previous suggestions into a list of proposed indicators. In addition to previous details, agencies were also requested to provide metadata on the proposed indicators. In cases where multiple indicators were proposed under one target, precedence was in general given to the proposals made by potential custodian agencies with a mandate in the specific area or those already responsible for global monitoring of the specific indicator (UNSD 2015a).

Following the poor ranking by national experts, FIES was omitted from the list of proposed indicators for the first meeting of the IAEG-SDGs (UNSD 2015a). In its note on SDG 2 indicator metadata, FAO (2015, p. 1) responded by insisting for FIES to be included in the indicator framework

[3] Rank A was given if 60% or more of statisticians chose A. C was given if 40% or mor of statisticians chose C. B was given if none of these criteria were fulfilled.

in a strongly worded remark. Here, they argued that FIES is an ideal indicator for the SDGs due to what it claims to be a universal design which makes it applicable to both developing and developed countries: "*Retaining the PoU while excluding the FIES undermines the effort to provide a more meaningful, comprehensive and timely metric for food access in the SDG era, essentially sticking to the already established MDG indicator. Furthermore, this choice undermines the universality ambition of the SDGs, by selecting an indicator that is primarily designed for developing countries (the PoU) rather than an indicator that is applicable to both developed and developing countries (the FIES).*" It is notable that the argument was grounded in the overall mission statement of the SDGs that it should be a break with the MDGs, in that indicators should apply both to developing and developed countries equally.

A formal proposal for the inclusion of FIES was made by the Rome-based agencies with its inclusion on a list of indicator proposals from custodian agencies in July 2015 (UNSD 2015b). In the list, the same agencies suggested the inclusion of the food security indicator Food Consumption Score (FCS). The FCS is a household survey food security indicator developed by the UN World Food Programme, which is based on data on dietary diversity and food consumption frequency.

During an open consultation for members and observers in the run-up to the second meeting of the IAEG-SDGs, a group of UN chief statisticians, including representatives from FAO, suggested the demotion of the FCS to an *additional indicator*, as opposed to FIES and PoU-indicators which were categorized as *priority indicators* (UNSD 2015c). During the consultation, a wide range of alternative indicators were proposed by a heterogenous group of actors but were quickly discarded as none of the additional suggestions were included in the list of indicator proposals for the second meeting of the IAEG-SDGs.

In the report from the July 15 meeting, almost fifty submitted remarks from NGOs, the private sector and academia emphasized the need for indicators for Target 2.1 that capture elements of food security such as dietary diversity, malnutrition, micronutrient deficiency, public welfare schemes, public financing, the presence of food security legislation, agricultural technology investment, crop yields, food safety, the impact of climate change, freshwater availability, resilience, sustainability, self-sufficiency, and breastfeeding (UNSD 2015d). There were also repeated calls for disaggregation of SDG 2.1 indicators into groups of gender, ethnicity, age, and disability. Countries also suggested several indicators for Target 2.1 such as indicators of dietary diversity among women and national food balance sheets which eventually were left out (UNSD 2015d). The same was the case for alternative proposals by the United Nations Development Programme such as the composite macro-indicator Global Hunger Index. The IAEG-SDGs did not budge from its pathway.

Following its demotion, the FCS was also excluded from the list of proposed indicators crafted by the second meeting of the IAEG-SDGs in October 2015 (UNSD 2015e). Despite low initial rankings, considerable skepticism, and wide range of alternative indicator suggestions, FIES was included along with PoU in the list. FIES was initially ranked as a Tier I indicator but was in November 2017 reclassified as a Tier II indicator following concerns with data availability (UNSD 2017). After a data availability review in October 2019 claiming the availability of FIES for 136 out of 193 countries, FIES was again reclassified as a Tier I indicator (UNSD 2019), fulfilling the indicator's journey to become an international standard for global food security monitoring.

The IAEG-SDG's approval of FIES in the October 2015 meeting marks the transition from the formation phase to the lock-in phase for the SDG Target 2.1 indicator selection. Despite the abundance of suggestions for food security indicators both during the preformation and formation phases, only the FAO-indicators PoU and FIES were given serious consideration as SDG indicators, with the FCS in practice quickly excluded by demotion to status as an *additional indicator* in an indicator framework that does not operate with such categories. To explain why so few of the suggested indicators were thoroughly evaluated, we continue our analysis of path dependency in the SDG indicator process.

Forming the SDG lock-in: resource constraints and data availability

To examine the pathway to lock-in, we analyze the interplay between the IAEG-SDGs, FAO and other custodian agencies. The IAEG-SDGs faced a range of resource constraints that affected the development of the indicator framework. They had to work under intense time pressure, and while they were tasked with evaluating new indicators, they also had to evaluate indicators that were already part of the MDG legacy.

A member of the IAEG-SDGs highlighted the significant extent of dependency on the initial set of indicators proposed by UN and other international organizations, as well as the time constraint: "*For the IAEG one constraint was time and the other was that we were given a set of indicators that were proposed by international agencies. Some of those came from the MDGs, but most of them were new.*"[4] The time constraint had enhanced the position of the custodian

[4] Interview, country representative of the IAEG-SDGs 22 November 2018.

agencies like FAO with already established indicators. Firstly, developing indicators from scratch was not viable with the short time allocated. Secondly, it left the IAEG-SDGs in a position where they could mainly react to proposals from UN and international organizations. In sum, it left potential custodian agencies in a powerful position.

Two members of the IAEG-SDGs specifically argued that the choice of indicators by custodian agencies was not based on technical grounds but rather driven by self-interest.[5] Another member argued that custodian agencies promoting the use of their own indicators should not necessarily be seen as negative. This is because it is recognized that they possess a competence in relevant policy-fields in which the IAEG-SDGs was lacking:

> *When they are pushing for one of those indicators or several of those indicators, there is a program or work or a project or an idea that they want to push for their own sake. Which on the other hand does not mean that it is a bad thing. It may be good because that is the way the phenomena has to be addressed and there are public policies that they want to encourage. Of course, you may have agendas which are very personal because some director would like to have that project. So, it is very difficult to qualify those interests. But of course, I think there are interests in the agencies in proposing one or another indicator.*"[6]

A related constraint frequently brought up in the interviews is the structure of expertise in the IAEG-SDGs, which consists exclusively of members from national statistical offices, with UN, international and regional organizations participating as observers.[7] Statisticians, who may not be very familiar with measurement of sustainability or food security, found themselves charged with the responsibility of selecting indicators that could capture these new and complex ambitions (Elder and Olsen 2019). A member of the IAEG-SDGs stated that a division of work between the body and custodian agencies is needed due to its constrained expertise.[8] Custodian agencies are particularly focused on indicators that are not part of the traditional portfolio of national statistical offices.[9] This statement made by a FAO food security statistician corroborates the central importance of custodian agencies as providers of expertise:

> *I think that the most difficult aspect is that the IAEG-SDGS as I said has been mandated with a very broad area of responsibility. Where they have failed sometime, is to mobilize the most appropriate resources from each field. […] So they have relied a lot on professionals or people working institutionally with the agencies.*"[10]

The interviews exemplify how the advantages of custodian agencies over the process of indicator selection has several features. Since the very beginning of the indicator selection process, custodian agencies have been drawn upon as crucial sources of expertise and resources. This is partly due to the agencies' respective areas of work and expertise frequently not being a part of the traditional portfolios of national statistical offices or covered by official statistics. Secondly and conflating this effect, potential custodian agencies initially proposed all the SDG indicators for the IAEG-SDGs' consideration. Thirdly, agencies like FAO that are well positioned to fulfill custodian responsibilities have received preferential treatment, as precedence was given to indicator proposals by agencies with a relevant mandate or already responsible for global monitoring. Custodian agencies have therefore had special leverage in the process of suggesting and selecting indicators.

This creates a potential conflict of interest for the custodian agencies within the IAEG-SDGs. The expertise of custodian agencies is needed under the current institutional architecture. However, custodian agencies are themselves producers of global indicators in their respective field of work and they will inevitably have an interest in promoting their use. The case of FAO's role in the SDG 2.1 indicator selection process supports previous findings that producers of indicators actively seek an audience for their indicators (Barman 2016; Merry 2016). The potential benefits of promoting an indicator to be a part of global SDG monitoring are significant in terms of funding opportunities (Jerven 2017), building reputation, greatly expanding the indicator's use and authority, as well as through having effects on other actors through impacting governance and knowledge (Merry 2016). In the case of the SDGs, such governance and knowledge effects are global in their ramifications.

Due to its mandate, it was in principle possible for the IAEG-SDGs to fully revise the SDG indicator framework. A decision was however made to give the potential custodian agencies such as FAO advantages in suggesting indicators and formulating an initial indicator framework. Custodian agencies in turn used their resources and expertise to fill the space created by the time constraints of the IAEG-SDGs. Thus, what was framed as an open-ended process,

[5] Interview IAEG-SDGs 22 November 2018.Interview, country representative of the IAEG-SDGs 5 February 2019.

[6] Interview IAEG-SDGs 22 November 2018.

[7] Interview, country representative of the IAEG-SDGs 14 December 2018.

[8] Interview, country representative of the IAEG-SDGs 1 November 2018.

[9] Interview IAEG-SDGs 1 November 2018.

[10] Interview FAO food security statstician 10 May 2019

soon became path dependent. The outcome was an indicator framework heavily impacted by custodian agencies' preferences and interests.

There are also pragmatic dimensions to this path dependency. Infrastructures of measurement both enable and constrain what can be measured (Merry 2019). Particularly costs affect how states and organizations gather and use statistics, as new indicators can require the expensive collection of new data and construction of novel infrastructure (Jerven 2017). The outcome is often data inertia, where entrenched indicators are used to measure new problems (Merry 2016).

This kind of data inertia is particularly pronounced in measuring global food security. With regards the Food Balance Sheets that the PoU depend on, FAO has (primarily through national authorities) been collecting data and standardizing procedures since the 1940s (FAO 1949). The FIES was meanwhile created through a global data collection efforts in 2014, which was crucial input for the establishment of its global severity scale, enabling comparison of measurements from different countries (FAO 2016). These data collection efforts have continued and been bolstered through the annual SOFI-reports. Both the PoU and FIES thus already had well-established global data infrastructures.

International organizations that have the capacity to establish and manage global data infrastructures are thus well-positioned to make their indicators relevant and attractive for the SDGs. As a UN agency, the FAO was in a particularly advantaged position in terms of leveraging its global data collection infrastructure. The alternative indicators have not been subject to worldwide long-term data collection, treatment, and standardization efforts.

The knowledge politics of food security measurement

Food security measurement was arguably more vulnerable to path-dependency than other SDG targets like poverty and health. Measurements of food insecurity in the population is not commonly part of national official statistics, leaving the IAEG-SDGs with a gap that to a large extent was filled by FAO data and statistical expertise. In this way, rather than opening space for a more pluralistic approach, the IAEG-SDG process locked in the position of the dominant monitoring machinery for food security and hunger.

The contestation surrounding FIES provides an illustrative example of how food security quantification is characterized by ambiguity in concepts, classifications, and measurement. The difficulties of separating technical and political elements in indicator selection is amplified in the context of food security, distinguished by a lack of gold standards and benchmarks that can be employed to effectively challenge methods and measurements (Upton et al. 2016). When no numbers can be exactly *right* or *wrong*, neither in theory nor practice, it is hard to contest quantitative measurements on epistemic grounds.

FAO's mandate, expertise and sheer size enabled it to position its own indicators for uptake in the SDGs. Despite a wide range of alternative indicator suggestions, the ability to freely choose how to measure hunger and food security was quite limited due to the organization's position as the obvious custodian of most SDG2 indicators. The few alternatives available in terms of global macro indicators comparable to PoU for instance, tend to also depend heavily on FAO data (Concern Worldwide and Welthungerhilfe 2020; Economist Intelligence Unit 2020). The measurement of PoU in turn depends on living standard surveys, population data and self-published macro Food Balance Sheets. It thus requires levels of expertise and financial resources that are unavailable to smaller organizations. This shows how the inherent complexity in food security quantification favors input from dominant and resource-rich actors within the field, serving as a powerful example of how scientific pathways can be self-reinforcing by limiting the array of alternatives and allocating power to incumbents (Leach et al. 2020).

The political implications of selecting food security indicators for the SDGs are however not limited to the context of specific international processes and organizations. Analysis of knowledge politics is needed to widen the narrow solution framing suggested by the SDG food security indicators, which have potential consequences for food security policy and practice. Such a broadening can in turn open the agenda for food system transformation.

FIES complements the PoU as an indicator for the SDGs due to its exclusive reliance on survey data and broader conception of food security. It can provide measurements of food insecurity in both poor and wealthy countries, that can be disaggregated to monitor vulnerable groups. The PoU due to its emphasis on calories and insensitivity to low measures remains mainly relevant in poor countries. It is built on top off a productivism that centers national availability of calories. The overall picture is, thus, that the SDG indicators frame food insecurity first and foremost as an issue of caloric supply and demand and individual experience, while the dimensions of democratic agency and environmental sustainability promoted by the HLPE-CFS (2020) remain elusive. It is therefore a risk that policies and programs with indirect and long-term effects on food security receive less attention than more direct and short-term interventions.

Opening the decision space to a more pluralistic set of interests and perspectives can facilitate quantification of food security that better represents its multidimensionality (Leach et al. 2020). Alternative conceptualizations of food security exist in a wide range of discourses on food

systems in academia, social movements, NGOs as well as international agencies like FAO. The agency and sustainability dimensions of food security are already increasingly influencing food security indicator discussions outside the SDG framework. A recent HLPE-CFS report (2022) on food security data collection and analysis for instance provides valuable insights into how indicators can give voice to the people most affected by food security policy.

Clapp et al. (2021) suggested the use of sustainability indicators such as soil health parameters, agrobiodiversity indicators, water quality or the use of sustainability certification, or more integrative indexes and frameworks. SDG indicator 2.4.1 attempt to measure the share of productive and sustainable agriculture incorporate and includes some of these measures. It however still lacks data and has been a heavily contested indicator (McNeill 2019). An indicator suggested by Sterling et al. (2017) that could capture the resilience element of sustainability is asking households if they had a stable food supply the last year, and recording whether the food was subsistence-based, bought, or sourced through exchange.

Agency at both the individual and collective level is important for food security outcomes (Clapp et al. 2021). The FIES survey module could be expanded to better capture individual agency in food security. It is however less suited to capture collective democratic participation at national or local levels, key in the approach advocated by actors in the food sovereignty movement (Agarwal 2014; McMichael 2014). Some indicators that can give us insights into collective levels of agency are measuring national commitments to uphold the right to food (te Lintelo et al. 2014), as well as levels of self-sufficiency, market concentration, prevalence of fair trade, and participation in member-based associations, cooperatives, or unions (Clapp et al. 2021). There is not a plethora of suitable qualitative indicators. Monitoring the presence of food security legislation has however been suggested (UNSD 2015d). The right to be free from hunger is for instance enshrined in the Indian constitution, which in principle makes its government legally accountable for national and individual food security (Banik 2016).

The numerous suggestions for alternative indicators in the SDG process furthermore included indicators that may be suited to capture other elements of agency in food security and nutrition, such as emancipation for marginalized groups. The Women's Empowerment in Nutrition Index (Narayanan et al. 2022), Women's Empowerment in Livestock Index (Galiè et al. 2019), and Women's Empowerment in Agriculture Index (IFPRI, 2012) are tailored to capture women's agency in agriculture, livestock management, and nutritional outcomes.

The alternatives generally lack the global data infrastructures and comparability of the SDG 2.1 indicators. Avoiding data inertia through more pluralistic measurement of global food security therefore requires alternative infrastructures that enable data gathering, treatment and standardization on an international scale. A handful of relevant initiatives are currently being undertaken (Countdown 2022; Gallup 2022; IMMANA 2022). These however mainly emphasize nutrition rather than a broad concept of food security.

Conclusion

The technical and political aspects of the SDGs are deeply entangled, despite conscious efforts to separate them. Here we have shown that rather than opening space for a more pluralistic approach, the SDG2.1 indicator selection process was characterized by path dependency and locked in FAO's food security indicators from an early stage. Key enforcers of this path dependency were resource constraints and limited availability data: The chosen FAO indicators were among few options with well-established global data infrastructures.

The important SDG 2.1 thus arguably encapsulated a narrow understanding of food systems. The ultimate reason that we should care if certain indicators attain political or institutional advantages over others is that methods of measuring food security have real effects not only on the discourse surrounding food insecurity but also on how it is addressed in policy and practice. Further investments in alternative data infrastructures are needed to adequately capture the multidimensionality of food security through statistics.

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Declarations

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References

Agarwal, B. 2014. Food sovereignty, food security and democratic choice: critical contradictions, difficult conciliations. *Journal of Peasant Studies* 41: 1247–1268.

Banik, D. 2016. The hungry nation: Food policy and food politics in India. *Food ethics* 1 (1): 29–45.

Barman, E. 2016. *Caring capitalism*. New York: Cambridge University Press.

Barrett, C. B. 2010. Measuring Food Insecurity. *Science* 327: 825–828.

Berry, S. S. 1984. The food crisis and agrarian change in Africa: A review essay. *African Studies Review* 27: 59–112.

Cafiero, C., S. Viviani, and M. Nord. 2018. Food security measurement in a global context: The food insecurity experience scale. *Measurement* 116: 146–152.

Clapp, J., W. G. Moseley, B. Burlingame, and P. Termine. 2021. Viewpoint: The case for a six-dimensional food security framework. *Food Policy* 106: 102164.

Coates, J., S. Swindale, and P. Bilinsky. 2007. *Household Food Insecurity Access Scale (HFIAS) for measurement of food access: Indicator guide*. Washington DC: USAID.

Worldwide, Concern, and Welthungerhilfe. 2020. Global Hunger Index: One Decade to Zero Hunger - Linking Health and Sustainable Food Systems. In *Global Hunger Index*.

Countdown. 2022. *Countdown to 2030*. Thompson: University of Manitoba.

David, P. A. 1985. Clio and the Economics of QWERTY. *The American Economic Review* 75: 332–337.

De Waal, A. 2017. *Mass starvation: The history and future of famine*. New Jersey: John Wiley & Sons.

Dodds, F., D. Donoghue, and J. L. Roesch. 2017. *Negotiating the sustainable development goals: A transformational agenda for an insecure world*. London: Routledge.

Economist Intelligence Unit. 2020. *Global Food Security Index 2019*. London: Economist Intelligence Unit.

Elder, M., and S. H. Olsen. 2019. The design of Environmental Priorities in the SDGs. *Global Policy* 10: 70–82.

FAO. 1949. *Food Balance Sheets*.

FAO. 2003. Proceedings: Measurement and Assessment of Food Deprivation and Undernutrition: International Scientific Symposium. Rome: Food and Agricultural Organization.

FAO. 2013. *New approaches to the measurement of food security*. Rome: Food and Agricultural Organization.

FAO. 2015. *FAO goal 2 Metadata*. Rome: Food and Agricultural Organization.

FAO. 2016. Voices of the Hungry - Technical Report. Rome: Food and Agricultural Organization.

FAO. 2020. *Voices of the hungry - Frequently asked questions*. Rome: Food and Agriculture Organization.

FAO. 2021. *Voices of the hungry - Frequently asked questions*. Rome: Food and Agricultural Organization.

FAO, Unicef, I. F. A. D., WFP, and WHO. 2017. *The state of food security and nutrition in the world*. Food and Agriculture Organization, International Fund for Agricultural Development, Unicef, World Food Programme and World Health Organization.

FAO, Unicef, I. F. A. D., WFP, and WHO. 2019. *The state of food security and nutrition in the world*. Food and Agriculture Organization, International Fund for Agricultural Development, Unicef, World Food Programme and World Health Organization.

FAO, Unicef, I. F. A. D., WFP, and WHO. 2020. *The state of food security and nutrition in the world*. Food and Agriculture Organization, International Fund for Agricultural Development, Unicef, World Food Programme and World Health Organization.

FAO, Unicef, I. F. A. D., WFP, and WHO. 2021. *The state of food security and nutrition in the world*. Food and Agriculture Organization, International Fund for Agricultural Development, Unicef, World Food Programme and World Health Organization.

FAO, Unicef, I. F. A. D., WFP, and WHO. 2022. *The state of food security and nutrition in the world*. Food and Agriculture Organization, International Fund for Agricultural Development, Unicef, World Food Programme and World Health Organization.

FAOSTAT. 2021. *New food balances*. Rome: Food and Agricultural Orgnization.

FAOSTAT. 2022. *Food and agriculture data*. Rome: Food and Agricultural Organization.

Fukuda-Parr, S., and D. McNeill. 2019. Knowledge and politics in setting and measuring the SDGs: Introduction to special issue. *Global Policy* 10: 5–15.

Fukuda-Parr, S., and A. Orr. 2014. The MDG hunger target and the competing frameworks of food security. *Journal of Human Development and Capabilities* 15: 147–160.

Galiè, A., N. Teufel, L. Korir, I. Baltenweck, A. Webb Girard, P. Dominguez-Salas, and K. Yount. 2019. The women's empowerment in livestock index. *Social Indicators Research* 142: 799–825.

Gallup. 2020. *How does the Gallup World Poll work?* Washington D.C.: Gallup Inc.

Gallup. 2022. *Global Diet Quality Project Aims to Bridge Data Gap*. Washington D.C.: Gallup Inc.

Hayter, J., and C. Henry. 1994. A re-examination of basal metabolic rate predictive equations: The importance of geographic origin of subjects in sample selection. *European Journal of Clinical Nutrition* 48: 702–707.

Hill, P. 1984. The poor quality of official socio-economic statistics relating to the rural tropical world: With special reference to south India. *Modern Asian Studies* 18: 491–514.

HLPE-CFS. 2020. *Food security and nutrition: Building a global narrative towards 2030*. HLPE Report 15. Rome: High Level Panel of Experts on Food Security and Nutrition and the Comittee on World Food Security.

HLPE-CFS. 2022. *Data collection and analysis tools for food security and nutrition - Towards enhancing effective inclusive evidence-informed decision making*. Rome: High Level Panel of Experts on Food Security and Nutrition and the Comittee on World Food Security.

IFPRI. 2012. *Women's Empowerement in Agriculture Index*. Washington DC: International Food Policy Research Institute.

IMMANA. 2022. *Welcome to IMMANA (innovative methods and Metrics for Agriculture and Nutrition actions)*. London: Agriculture, Nutition and Health Academy.

Jerven, M. 2017. How much will a data revolution in development cost? *Forum for Development Studies* 44: 31–50.

Jones, A. D., F. M. Ngure, G. Pelto, and S. L. Young. 2013. What are we assessing when we measure food security? A compendium and review of current metrics. *Advanced Nutrition* 4: 481–505.

Lappé, F. M., J. Clapp, M. Anderson, R. Broad, E. Messer, T. Pogge, and T. Wise. 2013. How we count hunger matters. *Ethics & International Affairs* 27: 251–259.

Leach, M., N. Nisbett, L. Cabral, J. Harris, N. Hossain, and J. Thompson. 2020. Food politics and development. *World Development* 134: 105024.

Maxwell, D., B. Vaitla, and J. Coates. 2014. How do indicators of household food insecurity measure up? An empirical comparison from Ethiopia. *Food policy* 47: 107–116.
McMichael, P. 2014. Historicizing food sovereignty. *Journal of Peasant Studies* 41: 933–957.
McNeill, D. 2019. The contested discourse of sustainable agriculture. *Global Policy* 10: 16–27.
Merry, S. E. 2016. *The seductions of quantification - Measuring human rights, gender violence, and sex trafficking*. Chicago: The University of Chicago Press.
Merry, S. E. 2019. The Sustainable Development Goals confront the infrastructure of measurement. *Global Policy* 10: 146–148.
Narayanan, S., E. Lentz, M. Fontana, and B. Kulkarni. 2022. Rural women's empowerment in Nutrition: A framework linking food, health and institutions. *The Journal of Development Studies* 58: 1–18.
Nature Plants. 2019. Quis custodiet FAO? *Nature Plants* 5: 331.
Nord, M. 2014. *Introduction to item response theory applied to food security measurement*. Rome: Food and Agricultural Organization.
Pogge, T. 2016. The hunger games. *Food Ethics* 1: 9–27.
Radimer, K. L., C. M. Olson, and C. C. Campbell. 1990. Development of indicators to assess hunger. *The Journal of nutrition* 120: 1544–1548.
Radimer, K. L., C. M. Olson, J. C. Greene, C. C. Campbell, and J.-P. Habicht. 1992. Understanding hunger and developing indicators to assess it in women and children. *Journal of Nutrition Education* 24: 36S–44S.
Ryan, G. W., and H. R. Bernard. 2003. Techniques to identify themes. *Field methods* 15 (1): 85–109.
Sen, A. K. 1981. *Poverty and famines - an essay on entitlement and deprivation*. Oxford: Oxford University Press.
Stemler, S. E., and A. Naples. 2021. Rasch Measurement v. Item Response Theory: knowing when to cross the line. Practical Assessment, Research and Evaluation, *26*.
Sterling, E. J., C. Filardi, A. Toomey, A. Sigouin, E. Betley, N. Gazit, J. Newell, S. Albert, D. Alvira, and N. Bergamini. 2017. Biocultural approaches to well-being and sustainability indicators across scales. *Nature ecology & evolution* 1: 1798–1806.
Sukhatme, P. V. 1961. The world's hunger and future needs in food supplies. *Journal of the Royal Statistical Society: Series A (General)* 124: 463–508.
Sumberg, J. 2017. *Agronomy for development: The politics of knowledge in agricultural research*. London: Taylor & Francis.
Sumberg, J., and J. Thompson. 2012. *Contested agronomy: Agricultural research in a changing world*. London: Routledge.
Sumberg, J., J. Thompson, and P. Woodhouse. 2012. *Contested agronomy: Agricultural research in a changing world*. In: *Contested agronomy: Agricultural research in a changing world*, edited by James Sumberg and John Thompson, 1–21. New York: Routledge.
Svedberg, P. 2001. Undernutrition Overestimated. In *Seminar Paper No. 693*. Stockholm: Institute for International Economic Studies, Stockholm University.
Sydow, J., G. Schreyögg, and J. Koch. 2009. Organizational path dependence: Opening the black box. *Academy of Management Review* 34: 689–709.
Tavory, I. 2020. Interviews and inference: Making sense of interview data in qualitative research. *Qualitative Sociology* 43: 449–465.
Taylor, M., R. Bargout, and S. Bhasme. 2021. Situating political agronomy: The knowledge politics of hybrid rice in India and Uganda. *Development and Change* 52: 168–191.
te Lintelo, D. J., L. Haddad, R. Lakshman, and K. Gatellier. 2014. *The Hunger and Nutrition Commitment Index (HANCI 2013): Measuring the political commitment to reduce hunger and undernutrition in developing countries*. Brighton: Institute of Development Studies.
UNGA. 2014. *Report of the Open Working Group on Sustainable Development Goals established pursuant to General Assembly resolution 66/288*. New York: United Nations General Assembly.
UNGA. 2017. *Terms of reference for the inter-agency and expert group on sustainable development goals indicators*. New York: United Nations General Assembly.
UNSC. 2015a. *Report on the forty-sixth session*. New York: United Nations Statistical Commission.
UNSC. 2015b. Technical report by the Bureau of the United Nations Statistical Commission (UNSC) on the process of the development of an indicator framework for the goals and targets of the post-2015 development agenda. New York: United Nations Statistical Commission.
UNSC. 2021. *Tier classification for global SDG indicators as of 29 March 2021*. New York: United Nations Statistical Commission.
UNSD. 2015a. *Proposed Priority Indicator List*. New York: United Nations Statistics Division.
UNSD. 2015b. *List of proposals July 7 2015*. New York: United Nations Statistics Division.
UNSD. 2015c. *Open consultation for members and observers (as of 15 September 2015)*. New York: United Nations Statistics Division.
UNSD. 2015d. *Open consultation: Detailed inputs from civil society, academia and private sectors*. New York: United Nations Statistics Division.
UNSD. 2015e. *Results of the list of indicators reviewed at the second IAEG-SDG meeting*. New York: United Nations Statistics Division.
UNSD. 2017. *Sixth Meeting of the Inter-Agency and Expert Group on the sustainable development goal indicators - report*. New York: United Nations Statistics Division.
UNSD. 2019. *Tier classification of SDG indicators 11 December 2019*. New York: United Nations Statistics Division.
UNSD. 2021. *Tier classification for global SDG indicators*. New York: United Nations Statistics Division.
UNSD and FoC. 2014. *Statistical note 3: Food security and nutrition*. New York: United Nations Statistics Division and Friends of the Chair Group on Broader Measures of Progress.
Upton, J. B., J. D. Cissé, and C. B. Barrett. 2016. Food security as resilience: Reconciling definition and measurement. *Agricultural Economics* 47: 135–147.
Völker, T., K. Blackstock, Z. Kovacic, J. Sindt, R. Strand, and K. Waylen. 2019. The role of metrics in the governance of the water-energy-food nexus within the European Commission. Journal of Rural Studies.
Westengen, O., and D. Banik. 2016. The state of food security: From availability, access and rights to food systems approaches. Forum for Development Studies 43 (1).
WFS. 1996. *Rome Declaration on World Food Security and World Food Summit Plan of Action*. Rome: World Food Summit and Food and Agricultural Organization.

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