IFPRI Discussion Paper 02190

May 2023

Is Women's Empowerment Bearing Fruit?

Mapping Women's Empowerment in Agriculture Index (WEAI) Results Using the Gender and Food Systems Framework

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ABSTRACT

We conduct a synthetic review of the literature examining relationships between domains of women's empowerment and food system outcomes. Many studies report significant positive associations between women's empowerment and intrahousehold gender equality with child dietary and nutrition outcomes, household food security, and agricultural production, but which aspect of empowerment matters for a particular outcome varies across contexts. Others document significant but mixed associations between empowerment indicators and women's dietary diversity scores. The findings suggest women's empowerment contributes to improved diets and nutritional status, especially for children, but that household wealth, gender norms and country-specific institutions remain important. Most papers reviewed were based on observational studies and therefore estimated associations; future research using experimental and quasi-experimental methods would add significantly to the evidence base.

Keywords: women's empowerment, gender and food systems, diets and nutrition, food security, agricultural production, well-being

ACKNOWLEDGEMENTS

This work was undertaken by the Poverty, Gender, and Inclusion (PGI) and Natural Resources and Resilience (NRR) Units as part of the Gender, Agriculture, and Assets Project Phase Two (GAAP2) and the recently concluded CGIAR Research Programs on Agriculture for Nutrition and Health (A4NH), and Policies, Institutions, and Markets (PIM). Funding support for this study was provided by the Bill & Melinda Gates Foundation (BMGF) [Grant number INV-008977], the United States Agency for International Development (USAID) [Grant number: EEM-G-00-04-00013-00], A4NH, and PIM. We thank Estela Zuzunaga for her contributions to the literature review.

ACRONYMS

2SLS	Two-stage Least Squares
3DE	Three domains of empowerment
5DE	Five domains of empowerment
A4NH	Agriculture for Nutrition and Health
A-WEAI	Abbreviated Women's Empowerment in Agriculture Index
BIHS	Bangladesh Integrated Household Survey
BMGF	Bill and Melinda Gates Foundation
BMI	Body Mass Index
CI	Composite Inadequacy Count Index
FAO	Food and Agriculture Organization
FS	Food security
FTF	Feed the Future
GAAP2	Gender, Agriculture, and Assets Project, Phase 2
GEE	Generalized Estimating Equations
GPI	Gender Parity Index
HAZ	Height-for-age z-score
HHDD	Household dietary diversity
HHDDS	Household dietary diversity score
IFPRI	International Food Policy Research Institute
IV	Instrumental Variable
LAZ	Length-for-age z-score
LPM	Linear probability models
MIMIC	Multiple Indicators Multiple Causes
NRR	Natural Resources and Resilience Unit
OLS	Ordinary least squares
OPHI	Oxford Poverty and Human Development Initiative
PGI	Poverty, Gender, and Inclusion Unit
PIM	Policies, Institutions, and Markets
Pro-WEAI	Project-level Women's Empowerment in Agriculture Index
SDG	Sustainable Development Goal
USAID	United States Agency for International Development
WASH	Water, sanitation, and hygiene
WAZ	Weight-for-age z-score
WDD	Women's dietary diversity
WDDS	Women's dietary diversity score
WE	Women's empowerment
WEAI	Women's Empowerment in Agriculture Index
WHZ	Weight-for-height z-score

1. INTRODUCTION

Worldwide, approximately 1.23 billion people are employed in food systems, and 3.83 billion live in households that are linked to or reliant on agricultural food systems in some way (Davis et al., 2023). Agricultural food systems can replicate broader inequalities, especially those related to gender, with women's contributions to and participation in food systems being undervalued or unrecognized (Quisumbing et al., 2021a). Conceptualizing, measuring, and tracking progress toward women's empowerment, as well as understanding how women's empowerment and gender equality may influence food systems outcomes, are critical steps to supporting more equitable food systems. To better understand the links between different domains of women's empowerment and a range of food systems outcomes, we conduct a synthetic review of the related literature.

The most widely used frameworks for understanding the empowerment of women and men build on earlier works on freedom and power (Freire, 1968; Lukes, 1974; Sen, 1985). An oft-used definition from Kabeer's (1999) more recent work conceptualizes empowerment as dynamic, a process of change in which people gain the ability to make strategic life choices, with resources, agency, and achievement as key distinct dimensions of generating and maintaining empowerment. These frameworks emphasize the intrinsic value of gender equality and the empowerment of women and girls, which is also the focus of Sustainable Development Goal (SDG) 5. Gender equality and women's empowerment have also been widely touted for their potential instrumental value (i.e., that they lead to other positive outcomes). High quality sex-disaggregated[1] data is important to track efforts towards this goal, as well as to understand relationships between aspects of empowerment and other SDG targets (Heckert & Fabic, 2013; Pryor & Seck, 2019; Richardson, 2018). Moreover, the increasing attention paid by agricultural development programs to women's empowerment objectives emphasizes the need to measure levels and assess changes over time. As a result, in the past decade, the number of tools available to assess women's empowerment has grown substantially and are now able to measure empowerment at the personal, relational, and environmental levels.

One of the most widely used measures of women's empowerment that focuses specifically on agrifood systems is the Women's Empowerment in Agriculture Index (WEAI) (Alkire et al., 2013). This paper focuses on both the original and more recent versions of WEAI, which assesses empowerment at the personal and relational levels (Alkire et al., 2013; Malapit et al., 2019a; Malapit et al., 2017). The WEAI suite of metrics enables the measurement of women's empowerment using tools that are

[1] We aim to study gendered social systems and collect data on the gendered experiences of individuals. At the same time, current methods of quantitative data collection and analysis (including what we review in this paper) do not focus on all genders and are limited to comparisons between women and men. Thus, we refer to sex-disaggregated data.

comparable across country and context. These tools collect survey data from women and men—facilitating gendered comparisons—and are decomposable into indicators that can be directly affected by food systems interventions (Alkire et al., 2013; Malapit et al., 2019a; Malapit et al., 2017). The availability of WEAI metrics has led to a large body of literature that examines the relationships between women's empowerment and gender equality and a whole range of food systems outcomes.

Our synthetic review includes studies that examine how gender equality and women's empowerment, as measured by the WEAI metrics, are associated with other outcomes as defined by the Gender and Food Systems Framework (Njuki et al., 2021). Our aims are threefold. First, we identify existing literature on the relationship between the different domains of women's empowerment measured by WEAI metrics and primary food systems outcomes to determine the direction of these relationships and hypothesize, to the extent possible, mechanisms behind these relationships. Second, we identify patterns in the findings and point out knowledge gaps that may be investigated in future research, Third, we discuss the policy implications of our findings.

2. CONCEPTUAL FRAMEWORK

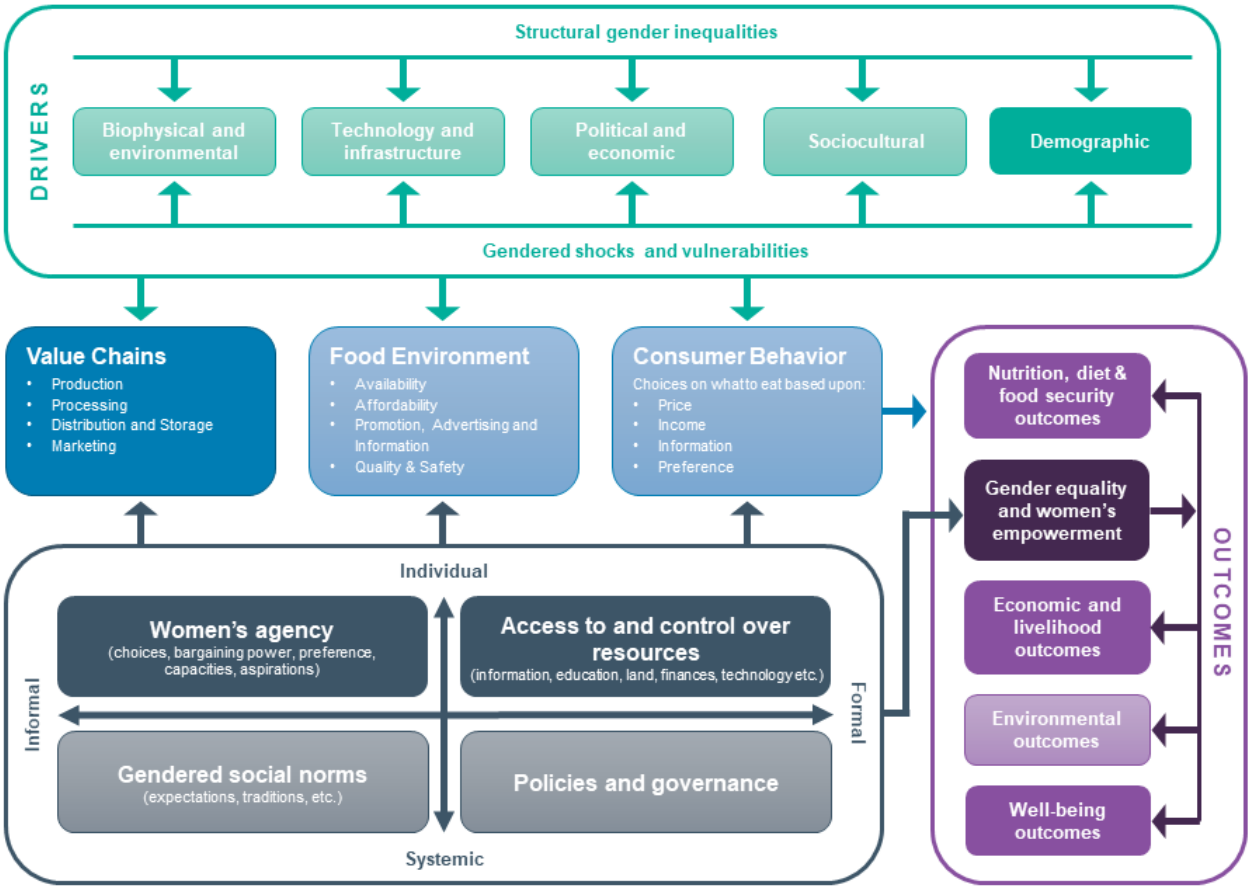
2.1 The Gender and Food Systems Framework

The gender and food systems framework (Njuki et al., 2021) is a useful starting point for analyzing gender equality and the empowerment of women in food systems. In this framework, which we have adapted slightly[2], gender is conceptualized as an important lever for progress across all aspects of food systems (*Figure 1*). Food system drivers are anchored in a gendered social, political, institutional, and economic system with structural gender inequalities. Because of these underlying inequalities, risks and shocks affect men and women differently, resulting in differential vulnerabilities and capacities to adapt. These drivers in turn influence the three main components of food systems – value chains, the food environments and consumer behavior – and their outcomes. Details about the various components of food systems and their interactions with four-dimensional space—individual, systemic, formal, and informal—are presented in Njuki et al.'s (2021) review. The lower right quadrant of *Figure 1* presents an array of food systems outcomes: diet, nutrition, and food security outcomes (including water, sanitation, and hygiene [WASH] outcomes); women's empowerment and gender equality; economic and livelihood outcomes (primarily in agriculture); environmental outcomes (interpreted to include natural resources outcomes); and outcomes related to well-being, such as life satisfaction and children's education.

Although well-being outcomes are not included in the original Njuki et al. (2021) framework, we include them because, despite the instrumental approach taken in this paper, acknowledging the relationship of empowerment with a person's own well-being brings us closer to its intrinsic value. We also include outcomes related to child schooling because this represents investment in the next generation. Given that these outcomes are interrelated, it makes sense to unpack these relationships and to ascertain how women's empowerment is related to these outcomes. The framework therefore provides an organizing frame of reference for our review.

[2] Specifically, we have expanded "dietary outcomes" to include "diet, nutrition, and food security outcomes"; added well-being outcomes, and added arrows to emphasize the reciprocal relationships among all five types of outcomes.

Figure 1. Gender and food systems framework



Source: Adapted from Njuki et al. (2021)

2.2 The Women's Empowerment in Agriculture Index (WEAI) suite of tools

In 2012, IFPRI, the Oxford Poverty and Human Development Initiative (OPHI), and United States Agency for International Development (USAID) launched the WEAI (Alkire et al., 2013). It was developed to monitor empowerment and inclusive agricultural growth in the US Feed the Future Initiative, which aims to combat global hunger, and was used in its population-based monitoring surveys in all 19 Feed the Future countries. WEAI uses 10 indicators across five domains – production, resources, abbreviated WEAI, or A-WEAI, to reduce the time and resources needed to collect empowerment data; it comprises six indicators across all five domains included in the original WEAI (Malapit et al., 2017). As interest in the WEAI tools grew over time, the project-level WEAI (pro-WEAI) was developed to meet demand for an additional tool designed specifically for project monitoring and evaluation (Malapit et al., 2019a). Pro-WEAI differs from WEAI and A-WEAI in that in lieu of five domains of empowerment, it focuses 10 indicators (and offers two optional indicators) spread across the three types of agency as defined by Rowlands (1997): intrinsic, instrumental, and collective agency. *Table 1* compares the

domains and indicators across WEAI, A-WEAI, and pro-WEAI. *Table 2* defines and compares the aggregate scores of WEAI, A-WEAI, and pro-WEAI. All WEAI versions have been informed by qualitative work, with pro-WEAI including a suite of qualitative protocols to complement the quantitative tool (Meinzen-Dick et al., 2019). Further, because the WEAI suite of tools are Alkire-Foster indices, they are additive and decomposable, allowing users to identify and quantify the areas in which women and men are most disempowered and to focus their efforts on addressing these inadequacies and reducing gender gaps (Alkire et al., 2013; Elias et al., 2021). As a multidimensional index, WEAI is well suited to studying the dynamic process of empowerment and the interrelationships of its various dimensions with food systems outcomes (Alkire et al., 2013; Malapit et al., 2019a; Meinzen-Dick et al., 2019).

Table 1. Comparing WEAI, A-WEAI, and Pro-WEAI domains and indicators

WEAI domain	WEAI indicator name	A-WEAI indicator name	Pro-WEAI domain	Pro-WEAI indicator name
			Intrinsic agency	Autonomy in income
			Intrinsic agency	Self-efficacy
			Intrinsic agency	Attitudes about intimate partner violence against women
			Intrinsic agency	Respect among household members (optional)
Production	Input in productive decisions	Input in productive decisions	Instrumental Agency	Input in productive decisions
	Autonomy in production			
Resources	Ownership of assets	Ownership of assets	Instrumental Agency	Ownership of land and other assets
	Purchase, sale, or transfer of assets			
	Access to and decisions over credit	Access to and decisions over credit	Instrumental Agency	Access to and decisions on financial services
Income	Control over use of income	Control over use of income	Instrumental Agency	Control over use of income
Leadership	Group member	Group member	Collective Agency	Group membership
	Speaking in public			
			Collective Agency	Membership in influential groups (optional)

WEAI domain	WEAI indicator name	A-WEAI indicator name	Pro-WEAI domain	Pro-WEAI indicator name
Time	Workload	Workload	Instrumental Agency	Work balance
	Leisure			
			Instrumental Agency	Visiting important locations

Table 2. Comparing WEAI, A-WEAI, and pro-WEAI aggregate scores

Aggregate scores	WEAI	A-WEAI	Pro-WEAI
Empowerment score	Percent of indicators in which a person has achieved adequacy		
Empowered (binary)	Respondent is adequate in at least 80% of the indicators		Respondent is adequate in at least 75-% of the indicators
Intrahousehold inequality score (household)	Difference between the empowerment scores of the man and woman within a household		
Gender parity (household)	Female respondent is empowered (binary) or at least as empowered at the male respondent		

Source: Alkire et al. (2013), Malapit et al. (2019, 2017)

3. METHODS

3.1 Terms, concepts, and indicators

We focus on studies that used the WEAI metrics and indicators defined in *Tables 1* and *2*. They include the indicators, which can be calculated for individual women and men, as well as the aggregate individual- and household-level indicators that comprise WEAI, A-WEAI, and pro-WEAI. We do not focus on the sample-level indicators that are commonly calculated as part of the WEAI metrics (Alkire et al., 2013; Malapit et al., 2019a), as these cannot be correlated with food systems outcomes measured at the individual- or household-level.

At the individual level, women's (and men's) empowerment scores are the weighted sum of the adequacies across each of the component indicators; women's (and men's) empowerment status reflects whether the individual meets the threshold for being defined as empowered. At the household level, the intrahousehold inequality score is the difference between the men's and women's empowerment scores; whether the household achieves gender parity is a binary variable also measured at the household level. Empirical studies examining the relationship between women's empowerment and food systems outcomes use the individual- and household-level indicators. We do note, however, that some studies erroneously report on associations with the five domains of empowerment (5DE) for WEAI and A-WEAI (known as the three domains of empowerment (3DE) for pro-WEAI) and the gender parity index (GPI). Upon closer investigation of their methods sections, we identify that these studies referred to the individual empowerment score as the 5DE and the intrahousehold inequality score or gender parity as the GPI. In these cases, we report the correct name of the indicator used.[3]

We use the Gender and Food Systems Framework (Njuki et al., 2021) to define the primary food systems outcomes in our review. Our measures of nutrition, diets, household food security, and WASH outcomes include anthropometric measures for children (height for age Z-score, weight-for-height Z-score) and body mass index (BMI) for women; individual dietary measures (child dietary diversity score, women's dietary diversity score, maternal dietary diversity score); household measures of dietary diversity and per capita calorie availability; and WASH practices. Because WEAI measures were initially developed for the agricultural sector, our economic and livelihood outcomes pertain mainly to agriculture, including agricultural production, yields, crop choice, and technology adoption. The wellbeing outcomes

[3] The original guidance on WEAI focused on its use as a population-based diagnostic and monitoring and evaluation tool and did not provide standard terminology for sub-indicators that can be used for individual- and household-level analyses. As a result, the early studies on WEAI (including those led by WEAI's codevelopers and ourselves) used different terminology even when using the same definitions of sub-indicators. We have since adopted standardized terminology in our own studies using WEAI and recommend that all users adopt the same terminology to facilitate the interpretation of analytical findings. A glossary is available at the WEAI Resource Center: https://weai.ifpri.info/files/2022/08/Pro-WEAI-Glossary-August-2023.pdf

included in our study are measures of life satisfaction and children's schooling, as several studies considered these linkages. We also included environmental and natural resources outcomes in our search.

3.2 Search strategy and inclusion criteria

We used an iterative search strategy to identify the literature to include in this synthetic review. We conducted an initial search for all publications that cited the original WEAI paper, Alkire et al. (2013) from 2013 through June 2020 via Google Scholar. As of July 2020, 626 papers were found, which we then restricted to include only literature published in English. We included journal articles and working papers. We further restricted papers to those that calculated a WEAI, A-WEAI, or pro-WEAI metric such as the WEAI empowerment score, the intrahousehold inequality, a singular WEAI indicator, a subset of indicators, or a combination thereof. We only included papers that reported the significance levels of their quantitative, food system outcomes (i.e., dietary, economic and livelihood, environmental, and/or wellbeing outcomes). We did not include literature that used individual WEAI, A-WEAI, or pro-WEAI survey items, or any that significantly adapted survey items and/or indicators.

We conducted a second, more recent search to capture literature published after June 2020. In this round, we searched Google Scholar for papers published between July 2020 through April 2022 that cited both the original WEAI and pro-WEAI papers, (Alkire et al., 2013; Malapit et al., 2019a). This second search yielded 434 results, which we restricted using the same criteria as in the first round. We further restricted these to journal articles and eliminated one in the post-screening stage because of incorrect econometric methodology. We added one more article on poverty transitions that we missed in our initial search. Summing both searches together, our literature review includes 29 papers that meet all criteria.

3.3 Data extraction

We categorized each paper meeting the inclusion criteria according to primary food system outcome, study country, type of data (cross-section or panel) and sampling design, empowerment measure used, key findings, and whether the estimated relationships with empowerment measures were positive, negative, mixed, or null (coefficient estimates that were statistically insignificant). We also identified whether studies attempted causal identification or were primarily observational (i.e., estimating associations rather than causal relationships).

4. RESULTS

4.1 Overview of studies

The 30 publications meeting our inclusion criteria covered agricultural and mostly rural populations in nine African and five Asian countries, with two studies covering multiple countries. Counting each country in multi-country studies separately, there are a total of 39 country-study observations, with the three most studied countries being Bangladesh (30.8% of studies), Ghana (15.4%) and Nepal (12.8%) (*Table 3*). No Latin American or Caribbean countries were included, indicating a gap in the literature.

Table 3. Distribution of papers by study country

Countries	Number of papers	Distribution
Africa		
Ghana	6	15.4
Kenya	2	5.1
Malawi	1	2.6
Mozambique	2	5.1
Niger	3	7.7
Rwanda	1	2.6
Tanzania	1	2.6
Uganda	1	2.6
Zambia	1	2.6
Asia		
Bangladesh	12	30.8
Cambodia	1	2.6
India	2	5.1
Nepal	5	12.8
Timor Leste	1	2.6
Total	39	100.0

Note: The number of papers exceeds the number of papers that met our selection criteria because some papers included multiple countries.

Table 4 presents a summary of the studies reviewed, the empowerment measure used, the main findings, and the methodological approach. Many of the studies with large sample sizes (>1000) used population-based surveys in the USAID Feed the Future Zones of Influence, which fielded the WEAI in 2011-13 (Malapit et al., 2019a). Most were multi-topic surveys that collected data on empowerment and food systems outcomes from the same households and individuals. The smaller surveys came from more geographically focused studies (Bonis-Profumo et al., 2021, with 160 households in Timor-Leste), discrete choice experiments (Joshi et al., 2019 in Maharashtra, with 377 female and 329 male farmers) and smaller-scale evaluations of technology adoption (Kassie et al., 2020, 711 households in Kenya;

Wouterse, 2017, 2019 in Niger, 500 households). Of the 30 papers included, 27 were cross-section studies and three were panel studies (*Table 4*). A clear majority of the studies (22) estimated associations or correlations, not causal relationships. Eight studies attempted to identify causal effects using quasi-experimental methods: six used instrumental variables (IV) and two used switching regression models.

Table 4. Relationships between empowerment and food systems outcomes [a]

Outcome	Study	Country	Type of data, sampling, and survey design	Empowerment measure(s)[b]	Result (statistically significant results only)	Positive, Negative, Null, or Mixed results	Methodological approach – potential biases or threats to identification
		Nutrition, diet, and food security outcomes					
Nutrition	Cunningham et al., 2015	Nepal[c]	Cross-section 4,080 HHs from 240 rural communities in 16 districts	Women's empowerment score 10 WEAI indicators	Women's empowerment score positively associated with LAZ. Three component indicators also positively associated with LAZ: satisfaction with leisure time, access to and decisions regarding credit, and autonomy in production.	Positive	Associations. OLS regressions to estimate association between WE and LAZ of children 6-24 months with controls for individual, HH, village covariates and clustering; mediation analysis to test whether dietary diversity and WASH mediated association between WE and LAZ, using standardized adjusted linear structural equation models.
	Cunningham et al., 2019	Nepal[c]	Cross-section 4,080 HHs from 240 rural communities in 16 districts	Women's empowerment score	Women's empowerment score positively associated with child (<2 years) LAZ.	Positive	Associations. OLS regressions to estimate association between WE and LAZ of children 6-24 months with controls for individual, HH, village covariates and clustering.
	Gupta et al., 2019	India	Cross-section 960 HHs, Chandrapur district, Maharashtra, 2013-2014	Women's empowerment score	Log odds of a poor iron status in women decline as women's empowerment score in agriculture improves.	Positive	Uses IV to address potential endogeneity of empowerment with respect to farming systems. Farming systems variables (food, cash) predicted as a function of age, age difference, HH access to irrigation, total area of agricultural plots owned by HH. Predicted FS variables then used to predict empowerment score. Predicted empowerment score is a regressor in equations on whether iron deficient or whether has iron deficiency anemia. Equations are estimated simultaneously. There are no diagnostics on the IVs.

Outcome	Study	Country	Type of data, sampling, and survey design	Empowerment measure(s)[b]	Result (statistically significant results only)	Positive, Negative, Null, or Mixed results	Methodological approach – potential biases or threats to identification
	Holland & Rammohan, 2019	Bangladesh[d]	Panel data, BIHS 2012 and 2015. Children from households where the primary female is in agriculture. 486 children observed in both rounds	Women's empowerment score Three of the five domains (excluding resources and time)	Women's empowerment score positively associated with HAZ for children aged between 6 and 59 months. Specific indicators positively associated with children's HAZ and a lower probability of stunting: (1) Input into productive decisions; (2) Speaking in public.	Positive	Associations. Alternative estimation methods: (1) pooled OLS; (2) panel fixed and random effects; (3) probit; (4) IV regressions with age difference between primary male and female and log (assets brought to marriage as instruments). Specification tests didn't reject exogeneity of empowerment variable, so study used OLS.
	Leroy et al., 2018	Bangladesh[d]	Cross-section. BIHS 2012, 5026 adolescent boys and non-pregnant non-lactating adolescent girls in 3015 households age 10-20 years who were not the head or partner of the household head	Women's empowerment score	Higher levels of empowerment of the primary female respondent reduced probability of girls not being thin (i.e., being a normal weight), but also increased the probability of girls having an adequate energy intake. WE positively associated with adequate iron intake in boys and girls. No other associations were found between woman's empowerment and adolescent nutritional outcomes.	Positive	Associations. Regressions controlled for confounders. Used household fixed effects to control for nonvarying household characteristics.
	Malapit & Quisumbing, 2015	Ghana[e]	Cross-section. 2027 women aged 15-49 and 1437 children under 5, from Ghana FTF 2012	Women's empowerment score Intrahousehold inequality score 10 WEAI indicators	Greater equality within the household favors boys' HAZ, e.g., reducing the intrahousehold inequality score by 10% points is associated with a 0.10 increase in boys' HAZ	Positive; differential associations by child gender	Associations. OLS regressions with controls for individual and household characteristics. Empowerment score, intrahousehold inequality score, and binary indicators of adequacy used as regressors (separately) in maternal nutrition regressions; WE indicators interacted with girl dummy in child regressions.

Outcome	Study	Country	Type of data, sampling, and survey design	Empowerment measure(s)[b]	Result (statistically significant results only)	Positive, Negative, Null, or Mixed results	Methodological approach – potential biases or threats to identification
	Malapit et al., 2015	Nepal[c]	Cross-section. Same study sample as Cunningham et al., 2019	Women's empowerment score Intrahousehold inequality score 10 WEAI indicators	Women's group membership, control over income, reduced workload, and overall empowerment associated with lower BMI. Control over income positively associated with HAZ, and a lower gender parity gap improves children's HAZ. WE mitigates the negative effect of low production diversity on HAZ.	Mixed	Associations. OLS regression has WE and production diversity as regressors, plus interaction term between WE and production diversity, controls for individual and household characteristics. Attempted to use IV to control for endogeneity of WE, but instruments performed poorly.
	Malapit et al., 2019b	Bangladesh[d]	Cross-section. 3,156 HHs with primary male and female interviewed, part of BIHS 2012. 1,776 coresident children <5, 2,308 coresident children 6-10, 1,911 coresident children 11-17	Women's empowerment score Intrahousehold inequality score Differences between men's and women's scores for each WEAI indicator	Differences between men's and women's scores in component indicators weakly correlated with children's HAZ, WHZ and WAZ: (1) Increase in women's credit decision-making relative to men's (smaller gender gap), improves HAZ for girls; (2) higher involvement of women in groups relative to men associated with girls' lower WHZ; (3) higher participation of women in groups relative to men's improves children's WAZ, but improves boys' WAZ more relative to girls.	Positive; differential associations by child gender	Associations. Child human capital outcomes (HAZ, WAZ, WHZ, education deviation from cohort mean) as a function of bargaining power variables, child gender, HH characteristics, and interactions with child gender. Bargaining power variables include education difference and the difference in empowerment scores or its component indicators. IV was tried, but instruments weak, so OLS regressions estimated.
	Quisumbing et al., 2021b	Bangladesh[d], Cambodia, Ghana[e], Mozambique, Nepal[c], Tanzania	Cross-section. Data from BIHS, Suaahara baseline, FTF surveys in Cambodia, Ghana, Mozambique, Tanzania	Women's empowerment score Intrahousehold inequality score 10 WEAI indicators	Women's empowerment score and gender equality positively associated with child HAZ. Lower intrahousehold inequality associated with lower women's BMI. A greater number of agricultural decisions, more autonomy in production, and a higher number of hours worked associated with lower BMI; comfort with speaking in public and satisfaction with leisure associated with higher BMI.	Mixed	Associations. OLS regressions on household, woman, child outcomes, with empowerment scores, intrahousehold inequality score, and component indicators as regressors in separate equations. Regressions include child, woman, and HH controls as appropriate.
	Ross et al., 2015	Ghana[e]	Cross-section. 2405 women in Ghana FTF 2012	CI 10 WEAI indicators	Women's BMI is negatively associated with (1) Autonomy in production and positively associated with (2) Ownership of assets; (3) Access to and decisions on credit; (4) Group membership; (5) Leisure.	Mixed	Associations. Uses a MIMIC model. Instead of the empowerment score, uses CI.

Outcome	Study	Country	Type of data, sampling, and survey design	Empowerment measure(s)[b]	Result (statistically significant results only)	Positive, Negative, Null, or Mixed results	Methodological approach – potential biases or threats to identification
	Sraboni et al., 2014	Bangladesh[d]	Cross-section. 3,213 HHs with 3,150 men and 3,263 women from BIHS 2012	Women's empowerment score Intrahousehold inequality score 10 WEAI indicators	No significant association between most WE indicators and adult BMI. Household wealth, education, and occupation are more important correlates of adult male and female nutritional status. Women's group membership and decision-making on credit negatively associated with adult male BMI.	Mixed	Associations. OLS regressions on measures of WE (women's empowerment score, land area, interaction between empowerment score and land area, individual indicators, gender parity gap, with controls for HH and individual characteristics. BMI regressions failed to reject exogeneity of empowerment measures so OLS used.
	Zereyesus, 2017	Ghana[e]	Cross-section. 1629 households with children < 5 and women of reproductive age (15-49), Ghana FTF 2012	CI Principal components from principal components analysis of WEAI 10 WEAI indicators	Women's empowerment score has a positive effect on household health status (i.e., the number of stunted children, the number of wasted children and the number of underweight women).	Positive	Associations. Uses a MIMIC model. Uses CI.
	Zereyesus et al., 2017	Ghana[e]	Cross-section, 1393 women < 50 with children < 5, Ghana FTF 2012	CI 10 WEAI indicators	There was no significant association between CI, the 10 WEAI indicators, and children's HAZ and WAZ scores.	Null	Associations. Uses a MIMIC model. Uses CI.
Individual diets	Bonis-Profumo et al., 2021	Timor-Leste	Cross-section. 160 households with child < 5 years chosen from four sites and two livelihood zones. HHs, visited four times between September 2017-2018 to capture seasonality of diets	Women's empowerment score[A] Women's empowerment status[A] 6 A-WEAI indicators	Both measures of empowerment – binary and aggregate score–as well as access to and decisions over credit, were significantly and positively associated with improved WDDS. Children 12–59 months whose mothers were empowered, participated in groups, and/or owned more assets were moderately more likely to achieve higher WDDS.	Positive	Associations. OLS regressions with controls. Tests for exogeneity did not reject the null hypothesis that empowerment measures were exogenous.

Outcome	Study	Country	Type of data, sampling, and survey design	Empowerment measure(s)[b]	Result (statistically significant results only)	Positive, Negative, Null, or Mixed results	Methodological approach – potential biases or threats to identification
	Kassie et al., 2020	Kenya	Cross-section. 711 farm HHs from 60 villages, 361 adopters of push pull technology and 350 nonadopters. Study collected A-WEAI from women respondents only, adult males were not interviewed	Women's empowerment score[A] 6 A-WEAI indicators	Women's empowerment score has a positive and significant effect on women's dietary diversity scores.	Positive	Treatment effects model, endogenous switching regression. In first stage, four treatments estimated depending on whether household was an adopter of push pull technology and whether woman was empowered. Instruments for empowerment variables: (1) education difference between male and female; (2) whether wife brought assets to marriage; (3) whether household had children<10. (1) and (2) were used for four binary indicators for production, resources, income, credit, leadership; (1) and (3) for workload. Dependent variable: various measures of WDD.
	Malapit & Quisumbing, 2015	Ghana[c]	Cross-section. 2027 women ages 15-49 and 1437 children under 5, from Ghana FTF 2012	Women's empowerment score Intrahousehold inequality score 10 WEAI indicators	Women's empowerment score strongly associated with the quality of infant and young child feeding practices, weakly associated with child nutritional status. Adequacy in credit decisions positively correlated with women's dietary diversity	Positive	Associations. OLS regressions with controls for individual and household characteristics. Empowerment score, intrahousehold inequality score, and binary indicators of adequacy used as regressors (separately) in maternal nutrition regressions; WE indicators interacted with girl dummy in child regressions.
	Malapit et al., 2015	Nepal[c]	Cross-section. 4080 households interviewed in 2012 in rural Nepal	Women's empowerment score Intrahousehold inequality score 10 WEAI indicators	Lower gender parity gaps improve children's diets. Women's group membership, control over income, reduced workload, and overall empowerment positively associated with improved maternal dietary diversity. WE mitigates the negative effect of low production diversity on maternal and child dietary diversity.	Positive	Associations. OLS regression has WE and production diversity as regressors, plus interaction term between WE and production diversity, controls for individual and household characteristics. Attempted to use IV to control for endogeneity of WE, but instruments performed poorly. Ended up using OLS.

Outcome	Study	Country	Type of data, sampling, and survey design	Empowerment measure(s)[b]	Result (statistically significant results only)	Positive, Negative, Null, or Mixed results	Methodological approach – potential biases or threats to identification
	Onah et al., 2021	Uganda, Rwanda, Malawi, Zambia, Mozambique	Cross-section. 10,041 married women in FTF Surveys in Africa	Women's empowerment score 10 WEAI indicators	Autonomy in production decisions, input in production decisions and activities, and comfort speaking in public positively associated with WDDS. Improved autonomy in production and input in production associated with improved likelihoods of consumption of dairy products, and fruits and vegetables including vitamin A-rich produce.	Positive	Associations. Examined relationship between WEAI and its binary indicators on WDDS and its component food groups. OLS used for WDDS, LPM for the food groups, with controls for covariates and clustering. Association, not causation.
	Quisumbing et al., 2021b	Bangladesh[d], Cambodia, Ghana[e], Mozambique, Nepal[e], Tanzania	Cross-section. Data from BIHS, Suaahara baseline, Feed the Future surveys in Cambodia, Ghana, Mozambique, Tanzania	Women's empowerment score Intrahousehold inequality score 10 WEAI indicators	Higher workload associated with more diverse child diets. Lower intrahousehold inequality associated with a higher likelihood of exclusive breastfeeding. A greater number of agricultural decisions, greater autonomy in production, a greater number of agricultural assets owned, and a greater number of income decisions associated with lower WDDS; greater confidence in speaking in public associated with higher WDDS.	Mixed	Associations. OLS regressions on household, woman, child outcomes, with empowerment scores, intrahousehold inequality score, and component indicators as regressors in separate equations. Regressions include child, woman, and HH controls as appropriate.
	Ross et al., 2015	Ghana[e]	Cross-section. 2405 women in Northern Ghana, FTF survey (2012)	CI 10 WEAI indicators	WDD negatively associated with Autonomy in production and positively associated with Ownership of assets; Access to and decisions on credit; Group membership; Leisure.	Mixed	Uses a MIMIC model. Instead of the empowerment score, uses CI.
	Sraboni & Quisumbing, 2018	Bangladesh[d]	Cross-section. 2,896 households with 7506 adults, 1786 children aged 11–17 years, 2015 children aged 5–10 years and 1024 children under 5 years of age, and a subsample of 2851 dual-adult households	Women's empowerment score 10 WEAI indicators	WE correlated with more diverse diets of children <5, but not consistently associated with increases in nutrient intake for this age group. WE positively and significantly associated with adult men's and women's dietary diversity and nutrient intakes. Empowerment does not benefit all individuals within the household equally, with gender bias favoring boys emerging in adolescence.	Positive, but differential effects across life cycle and gender	Associations.

Outcome	Study	Country	Type of data, sampling, and survey design	Empowerment measure(s)[b]	Result (statistically significant results only)	Positive, Negative, Null, or Mixed results	Methodological approach – potential biases or threats to identification
	Tsiboe et al., 2018	Ghana[c]	Cross-section. 2642 households, Ghana FTF 2012	Women's disempowerment score	Women's carbohydrate, protein, and fat intake negatively correlated with inadequacy are inadequate in the Income, Production and Leadership domains.	Positive relationship with empowerment (negative relationship with disempowerment)	IV approach used to account for endogeneity of empowerment, but diagnostics suggest instruments are weak.
Household-level food security and dietary diversity	Clement et al., 2019	Nepal	Cross-section. 600 households from 20 Village Development Committees that were part of an intervention (10 treated, 10 non-treated)	6 AWEAI binary indicators	Women's adequacy in access to and decisions about credit positively associated with a larger share of both vegetable and cereal production kept for home consumption. Women's adequacy in control over income associated with lower share of vegetables retained for household consumption. Women's adequacy in access to and decisions about credit associated with greater share of cereals kept for home consumption.	Mixed	Associations. Multivariate regressions with empowerment variables as regressors. Did not aim to establish causality but used qualitative work to deepen understanding of cultural context.
	Holland & Rammohan, 2019	Bangladesh[d]	Panel data, BIHS 2012 and 2015, nationally representative of rural Bangladesh	Women's empowerment score 10 WEAI indicators	WE score positively associated with better household dietary diversity.	Positive	Associations. Alternative estimation methods: (1) pooled OLS; (2) panel fixed and random effects; (3) probit; (4) IV with age difference between primary male and female and log (assets brought to marriage as instruments). Specification tests didn't reject exogeneity of empowerment variable, so study used OLS.

Outcome	Study	Country	Type of data, sampling, and survey design	Empowerment measure(s)[b]	Result (statistically significant results only)	Positive, Negative, Null, or Mixed results	Methodological approach – potential biases or threats to identification
	Seymour et al., 2019	Bangladesh[d]	Cross-section. 5124 HHs and 694 children 6-23 months old, BIHS 2012	Womens' empowerment score excluding time domain Intrahousehold inequality score	Larger empowerment gaps are associated with marginally lower household dietary diversity scores among non-poor, time poor, and doubly poor households.	Positive (negative impact of larger empowerment gaps)	Associations. OLS and GEE regressions of outcomes on whether time poor, whether income poor, whether doubly poor; and then with empowerment gap as regressor and interacted with poverty variables. Empowerment calculated with 4 of the 5 dimensions (excluding time) because of the separate time poverty regressor. Regressions include controls for individual and household characteristics.
	Sraboni et al., 2014	Bangladesh[d]	Cross-section. 3,213 HHs with 3,150 men and 3,263 women from BIHS 2012	Women's empowerment score Intrahousehold inequality score 10 WEAI indicators	WE positively associated with calorie availability and dietary diversity at the household level.	Positive	IV regressions. Per capita calorie availability, HHDD regressed on measures of WE, land area, interaction between empowerment score and land area, individual indicators, gender parity gap, with controls for HH and individual characteristics.
	Quisumbing et al., 2021b	Bangladesh[d], Cambodia, Ghana[e], Mozambique, Nepal[e], Tanzania	Cross-section. Data from BIHS, Suaahara baseline, FTF surveys in Cambodia, Ghana, Mozambique, Tanzania	Women's empowerment score Intrahousehold inequality score 10 WEAI indicators	Autonomy in production, control over income decisions, and satisfaction with time spent or leisure are all positively associated with HDDS.	Positive	Associations. OLS regressions on household, woman, child outcomes, with empowerment scores, intrahousehold inequality score, and component indicators as regressors in separate equations. Regressions include child, woman, and HH controls as appropriate.

Outcome	Study	Country	Type of data, sampling, and survey design	Empowerment measure(s)[b]	Result (statistically significant results only)	Positive, Negative, Null, or Mixed results	Methodological approach – potential biases or threats to identification
WASH	Cunningham et al., 2019	Nepal[c]	Cross-sectional. 4,080 HHs from 240 rural communities in 16 districts	Women's empowerment score 10 WEAI indicators	Empowered women had better WASH practices than disempowered women.	Positive	Associations. OLS regressions to estimate association between WE and LAZ of children 6-24 months with controls for individual, HH, village covariates and clustering; mediation analysis to test whether dietary diversity and WASH mediated association between WE and LAZ, using standardized adjusted linear structural equation models
		Economic and Livelihood Outcomes					
Agricultural production	Anik & Rahman, 2021	Bangladesh[d]	Panel data. 6500 rural households from BIHS 2012 and 2015	Women's empowerment score Intrahousehold inequality score	Both WE in agriculture and a reduction in the gender-gap in empowerment significantly increase production efficiency.	Positive	Associations. Uses stochastic frontier production approach to estimate elasticity of efficiency with respect to the empowerment score and the intrahousehold empowerment gap (in separate specifications), plus covariates.
	Clement et al., 2019	Nepal	Cross-section. 600 households from 20 Village Development Committees that were part of an intervention (10 treated, 10 non-treated)	A-WEAI binary indicators	Women's adequacy in access to and decisions about credit correlated with lower wheat productivity.	Negative	Associations. Multivariate regressions with empowerment variables as regressors. Did not aim to establish causality but used qualitative work to deepen understanding of cultural context.

Outcome	Study	Country	Type of data, sampling, and survey design	Empowerment measure(s)[b]	Result (statistically significant results only)	Positive, Negative, Null, or Mixed results	Methodological approach – potential biases or threats to identification
	De Pinto et al., 2020	Bangladesh[d]	Cross-section. 3010 households that own/operate land with complete information from 6500 households in BIHS 2015	Binary WEAI indicators and some continuous indicators	Women's input in decision- making and group membership associated with greater crop diversification (i.e., less land allocated to cereals and more to vegetables and fruits). Increased share of women's assets associated less crop diversification.	Mixed	Associations. Two main estimation methods: OLS (dependent variable: crop diversification index) and fractional multinomial logit regressions on different land allocation choices (cereals, vegetables, fruits). Used binary indicators from the WEAI and some continuous indicators in separate regressions (# productive assets owned, whether participated in group, proportion of agricultural activities in which woman reported having input in all or most decisions).
	Diiro et al., 2018	Kenya	Cross-section. 707 maize farming households in western Kenya	Women's empowerment score[A] six A-WEAI indicators	Women's empowerment score significantly increases maize productivity. Female- and male-managed plots experience significant improvements in productivity when the women who tend them are empowered.	Positive	IV regressions. Used A-WEAI, overall empowerment score and six binary indicators (separately). Instruments differed for the indicators. Candidate instruments: (1) number of types of associations in village: (2) age difference between primary male and female; (3) education difference; (4) whether woman brought assets to marriage; (5) years of residence in village (woman); (6) HH composition by age group.
	Joshi et al., 2019	India	377 female and 329 male farmers, Maharashtra	Women's empowerment score	Women's willingness to pay for attributes of direct seeded rice, including reduced seed costs, increased yields, and labor saving, increased as the empowerment score increased. Willingness to pay for labor saving attributes begins declining when the empowerment score is greater than 0.50.	Mostly positive	Associations. Discrete choice experiments to elicit willingness to pay for drum seeder, main equipment for direct seeded rice. Association between willingness to pay and WE score shown graphically, statistical significance in willingness to pay with respect to empowerment unclear.

Outcome	Study	Country	Type of data, sampling, and survey design	Empowerment measure(s)[b]	Result (statistically significant results only)	Positive, Negative, Null, or Mixed results	Methodological approach – potential biases or threats to identification
	Seymour, 2017	Bangladesh[d]	Cross-section. 4,026 plots from 3,119 households, BIHS 2012	Women's empo0werment score Intrahousehold inequality score	Reduced empowerment gap between spouses associated with higher levels of technical efficiency. This result extends to plots that women jointly manage with their spouses, as well as those they do not actively manage. Empowerment gap rather than individual achievement of empowerment significantly associated with inefficiency.	Positive (reduced empowerment gap)	Associations. Uses stochastic frontier analysis, with empowerment score or empowerment gap treated as exogenous variable in addition to other inputs.
	Tankari, 2018	Niger	Cross-section 338 dual adult households, primary male and female adults interviewed, excluding co-wives February-June 2016	Whether household achieves gender parity (based on WEAI) Intrahousehold inequality score (based on WEAI)	Gender parity negatively associated with adoption of inorganic fertilizers; gender parity is positively, but insignificantly, correlated with adoption of organic fertilizer. Similar results for the empowerment gap: as women have lower empowerment score than the primary man in their household, the household is more likely to use inorganic fertilizer.	Negative for inorganic fertilizer	Associations. Probit regressions of inorganic fertilizer adoption as a function of gender parity and covariates.
	Wouterse, 2017	Niger	Cross-sectional. 769 adults in 500 households surveyed in April—May 2015	Average household empowerment score (average of women's and men's empowerment scores)	More empowered households are more likely to have zai pits (type of planting pit common to the Sahel), and empowerment is associated with higher agricultural yields.	Positive	Endogenous switching regression. Analyzes productivity impact of zai pit adoption, where adoption of zai pits is treated as endogenous. First stage models adoption, 2nd stage models productivity in both adoption/non-adoption regimes.

Outcome	Study	Country	Type of data, sampling, and survey design	Empowerment measure(s)[b]	Result (statistically significant results only)	Positive, Negative, Null, or Mixed results	Methodological approach – potential biases or threats to identification
	Wouterse, 2019	Niger	Cross-sectional. 769 adults in 500 households surveyed in April—May 2015	Average household empowerment score (average of women's and men's empowerment scores)	Empowerment scores of the household positively affect the quantity of agricultural output. An increase of 1.0% in average empowerment would increase output by almost 1.0%. Empowerment interacts positively with returns to equipment and negatively with returns to fertilizer.	Positive. Because outcomes and empowerment scores are at household level, interpretation of returns to empowerment differ from other studies focusing on individual empowerment.	IV regressions. Uses 2SLS, with asymptotically correct standard errors. Estimates variable coefficients production function, where two human capital variables (education and empowerment) are interacted with traditional inputs. Excluded instruments: number of plots, number of adults 15+, share of prime aged adults 19-40, time to paved road, time to nearest potable water source, no, of months village accessible, whether village affected by transhumance.
Poverty transitions	Ahmed & Tauseef, 2022	Bangladesh[d]	Panel data from BIHS 2011-2012. 2015, 2019. 4756 households with information on women's empowerment and nonfarm employment	Women's empowerment score	Women's empowerment scores negatively correlated with the likelihood of households remaining in chronic and transient poverty	Positive (higher empowerment scores reduce probability of chronic and transient poverty)	Uses multinomial logit regressions on poverty transition matrices, simultaneous quantile regressions, and panel fixed effects models.

Outcome	Study	Country	Type of data, sampling, and survey design	Empowerment measure(s)[b]	Result (statistically significant results only)	Positive, Negative, Null, or Mixed results	Methodological approach – potential biases or threats to identification
		Well-being Outcomes					
Life satisfaction	Hossain et al., 2019	Bangladesh[d]	Cross-section. 3860 households with cohabiting couples from BIHS 2012	Women's and men's empowerment score 10 WEAI indicators	Empowerment score and life satisfaction positively associated for both women and men. Specific indicators positively associated with life satisfaction among women and men: (1) Input in productive decisions; (2) Purchase, sale or transfer of assets; (3) Ownership of assets; (4) Access to and decisions about credit; (5) Control over use of income; (6) Leisure; (7) Group membership.	Positive	IV regressions on satisfaction variable as a function of empowerment score, being female, and the interaction between female and empowerment score. Specifications include: (1) HH and regional fixed effects to capture HH and regional norms; (2) community fixed effects for local norms; (3) IV with participation of others in community activities as the IV (leaving out the individual). Results robust to problem of weak instruments; exogeneity rejected.
Educational Outcomes	Malapit et al., 2019b	Bangladesh[d]	Cross-section. 3,156 HHs with primary male and female interviewed, BIHS 2012. 1,776 coresident children <5, 2,308 coresident children 6-10, 1,911 coresident children 11-17	Women's and men's empowerment scores Intrahousehold inequality score	Fathers' empowerment is positively associated with younger children's schooling, while mothers' empowerment is more important for girls' education in general and in keeping older boys and girls in school.	Positive	Associations. Child human capital outcomes (HAZ, WAZ, WHZ, education deviation from cohort mean) regressed as a function of bargaining power variables, child gender, HH characteristics, and interactions with child gender. Bargaining power variables include education difference and the difference in empowerment scores. IV tried, but instruments weak, so OLS regressions estimated.

Notes:

[a] Acronyms used in this table are defined as follows: 2SLS: Two-stage Least Squares; BIHS: Bangladesh Integrated Household Survey; BMI: Body Mass Index; CI: Composite Inadequacy Count index; FS: Food security; FTF: Feed the Future; GEE: Generalized Estimating Equations; HAZ: height-for-age z-score; HHDD: Household dietary diversity; HHDDS: Household dietary diversity score; HHs: Households; IV: Instrumental variables; LAZ: Length-for-age z-score; LPM: Linear probability models; MIMIC: Multiple Indicators Multiple Causes; OLS: Ordinary least squares; WAZ: Weight-for-age z-score; WDD: Women's dietary diversity; WDDS: Women's dietary diversity score; WE: Women's empowerment; WHZ: Weight-for-height z-score.

[b] "Women's empowerment score" refers to the WEAI women's empowerment score, unless otherwise indicated. "Intrahousehold inequality score" is the difference between the men's and women's empowerment score within the same household. A superscript "A" indicates that the version used is A-WEAI. All others used the original WEAI.

[c] Nepal: Suaahara Survey

[d] BIHS: Bangladesh Integrated Household Survey, nationally representative of rural Bangladesh

[e] Ghana FTF: Northern Ghana Feed the Future Survey

Table 5 shows the number and distribution of studies according to the outcomes using the gender and food systems framework classifications and whether they used WEAI or A-WEAI (pro-WEAI, which was released in 2019, was too recent to have been used in studies that were already published when we conducted the search). We distinguish the number of studies and the number of papers: the number of studies we report here exceeds the number of papers and country studies reported earlier because we count studies according to the outcomes analyzed. A paper analyzing (for example) individual nutrition outcomes and household food security would be counted as two studies, which allows us to consider all forms of evidence that the paper is contributing. Almost three-quarters of the studies focus on relationships between empowerment and nutrition, individual diets, household food security, and WASH; ten studies analyze economics and livelihoods outcomes (agricultural production); and two focus on well-being outcomes. Two studies (Clement et al., 2019 in Nepal; Wouterse, 2017 in Niger) overlap economic and food security outcomes, and one study in Bangladesh (Malapit et al., 2019) covers both nutrition and well-being. Six studies tackle multiple themes of nutrition, diets, food security, and WASH. Although no study strictly focuses on environmental outcomes, two have environmental implications: one on adoption of zai pits (Wouterse, 2019), which is a soil management technique in which seeds of annual or perennial crops are planted in small pits, and one on crop diversification (De Pinto et al., 2020). The vast majority (25 out of 30 papers, 35 out of 40 studies) use WEAI rather than A-WEAI as the basis for their empowerment indicators (*Table 5*).

Table 5. Distribution of studies by topic and WEAI measure used

Topics	Number of studies	Distribution (%)	WEAI	A-WEAI
Nutrition	13	32.5	13	0
Women's and children's diets	9	22.5	7	2
Household food security and dietary diversity	5	12.5	4	1
WASH	1	2.5	1	0
Agricultural production and poverty transitions	10	25.0	8	2
Life satisfaction	1	2.5	1	0
Education	1	2.5	1	0
Distribution	40	100.0	35	5

Note: The number of studies reported in this table exceeds the number of papers identified, because several papers analyzed multiple outcomes, and we report these multiple outcomes as separate studies to consider the multiple forms of evidence they report.

4.2 Nutrition, diets, food security, and WASH

Nutrition

Seventy percent of studies (28 out of 40; see *Table 5*) analyze relationships between WEAI outcomes and nutrition, diets, household food security, and/or WASH outcomes. Studies on individual nutrition outcomes comprise half this category. A vast majority of the nutrition studies (12 out of 13) estimated associations rather than causal relationships; one study used IV regressions. Among studies on nutrition outcomes, eight reported positive associations between women's empowerment and nutrition outcomes, one reported a negative association (with male BMI), three reported mixed results (some positive, some negative, depending on the outcome and empowerment indicator used), and one reported null (insignificant) results. Two studies examined whether child gender moderated the association with the empowerment variable.

The strongest finding in this review is the positive relationship between women's empowerment and children's nutrition outcomes. Eight out of 13 studies document significant positive associations of women's empowerment, as measured by the empowerment score or the WEAI component indicators, with various children's nutrition outcomes (Cunningham et al., 2015; Cunningham et al., 2019; Holland & Rammohan, 2019; Leroy et al., 2018; Malapit et al., 2015; Malapit et al., 2019b; Quisumbing et al., 2021b; Zereyesus, 2017). While analyses using the aggregate empowerment score generally show positive associations, disaggregating empowerment into the component indicators show that different indicators matter in different contexts. For example, in Bangladesh, Holland & Rammohan (2019) find that *input in productive decisions* and *speaking in public* are positively associated with children's height-for age z-scores (HAZ) and a lower probability of stunting. In Nepal, Cunningham et al. (2015) find that *satisfaction with leisure time*, *access to and decisions regarding credit*, and *autonomy in production* were positively associated with length-for-age z-scores (LAZ) for children under 2, while for children under 5, Malapit & Quisumbing (2015) find that *control over income* is positively associated with HAZ.

Women's empowerment does not benefit all household members equally, indicating that tradeoffs exist. For example, Sraboni et al. (2014) find that, in Bangladesh, women's group membership and decisionmaking on credit are negatively associated with adult male BMI. Additionally, it is not only women's empowerment that matters for children's nutrition outcomes but also gender equality within the household, as measured by the intrahousehold inequality score. Greater equality within the household, as measured by a reduction in the intrahousehold inequality score, is positively correlated with HAZ in Nepal (Malapit et al., 2015), Ghana (Malapit & Quisumbing, 2015), and the multi-country pooled study including Bangladesh, Cambodia, Ghana, and Nepal (Quisumbing et al., 2021b). Another study by Malapit et al. (2019b) in Bangladesh analyzes gender gaps not only in the overall empowerment scores between men and women within the same household, but also the male-female differences in the

component indicators. They find that intrahousehold inequality is weakly correlated with children's nutrition outcomes, but with differences across boys and girls. Intrahousehold inequality in the component indicators has different associations with different anthropometric measures. For example, an increase in women's decisionmaking on credit (smaller gender gap), is positively associated with girls' HAZ, implying that when credit decisionmaking favors the primary female respondent, girls are more likely to be taller than their reference age group. In the WHZ regression, it appears that higher involvement in groups by women relative to men is associated with lower girls' WHZ. This could point to excessive demands on women time owing to group activities. Finally, while an increase in women's participation in groups (smaller gender gap), is positively associated with WAZ (weight-for-age z-score) for children in general, this has a differential effect that favors boys rather than girls (Malapit et al., 2019b). This could reflect differences in the association between women's empowerment and inputs into child nutrition as well as the timing of those inputs. HAZ reflects longer term nutritional status. The positive association of girls' HAZ with a reduced gender gap in credit decisionmaking points to the potential long-term impact of programs providing credit to women for girls. The mixed effects of group membership on short-term nutritional outcome measures (WHZ) for girls may be indicative of tradeoffs from women's participation in groups. Similarly, while WAZ is positively associated with a lower gender gap in women's group participation, there is a differential positive association for boys. The sensitivity of anthropometric measures indicative of short-term nutritional status to women's group participation might signal time tradeoffs. Women's empowerment does not also necessarily benefit girls; in societies where there is son preference, more empowered women may differentially invest in boys.

While there appear to be benefits to children's nutritional status associated with women's empowerment and gender equality within the household, women's empowerment does not have a clear positive association with their own nutritional status. For example, in Ghana, Ross et al. (2015) do not find a significant relationship between women's aggregate empowerment score and women's BMI in a Multiple Indicators Multiple Causes (MIMIC) model.[4] However, when the empowerment score is decomposed into its component indicators, they find that five indicators are significantly associated with higher BMI for women but with offsetting signs. They find that *asset ownership*, *credit decisions*, *group membership*, and *satisfaction with leisure* are all positively associated with women's BMI, but *autonomy in production* has an unexpected negative relationship. Upon further investigation, Ross et al. (2015) uncovered a significant negative association between autonomy and income, such that a woman in a higher income group has less autonomy in production. As women increase their economic activities and contribute more income to the household, they may feel pressure to make production decisions based on

[4] Although Ross et al. (2015) use BMI as a measure of health status, we treat it as an indicator of nutritional status.

others' expectations to avoid conflict. Alternatively, such women may surrender some autonomy in production so they can focus on other activities that are more important to them.

Similarly, the most striking result from the 6-country study by Quisumbing et al. (2021b) in Bangladesh, Cambodia, Ghana, Nepal, Mozambique, and Tanzania is the lack of significant association between the aggregate empowerment measures and most of the women's nutritional outcomes. However, analysis of the component indicators reveals more significant associations with offsetting signs, suggesting potential tradeoffs between different domains of empowerment. They find that greater intrahousehold equality (smaller gender gap), a greater *number of agricultural decisions*, more *autonomy in production*, and a higher *workload* are all associated with lower BMI, while comfort with *speaking in public* and *satisfaction with leisure* are associated with higher BMI. These tradeoffs may arise because women's increased participation in agriculture, which increases some components of the women's empowerment score, comes at the cost of increased workload, which may impinge on BMI in low-BMI populations (Quisumbing et al., 2021b).

Individual (maternal and child) diets

Of the eight studies on maternal and child diets, six were associational, one used a switching regressions framework, and one used IV techniques. Six reported positive relationships between empowerment and dietary outcomes and two reported mixed results (both positive and negative associations).

Similar to the results for nutritional status, both the overall empowerment score and specific aspects of empowerment matter for individual diets. The results for the individual indicators illustrate the tradeoffs between different dimensions of women's empowerment and dietary outcomes. For example, in Timor-Leste, *group membership* and *asset ownership* are positively associated with children's dietary diversity (Bonis-Profumo et al., 2021), whereas higher *workload* (which enters negatively in the empowerment score) is associated with higher children's dietary diversity in Bangladesh, Cambodia, Ghana, Mozambique, and Nepal (Quisumbing et al., 2021b).

Gender equality also has positive implications for individual diets and infant and young child feeding practices: greater intrahousehold equality is positively associated with child dietary diversity in Nepal (Malapit et al., 2015) and exclusive breastfeeding in Bangladesh and Cambodia, (Quisumbing et al., 2021b).

However, one cannot conclude that women's empowerment affects the diets of individuals within the same household equally. For example, in Bangladesh, Sraboni & Quisumbing (2018) find a positive association between women's empowerment and dietary quality of individuals within the household, but the strength of this association varies across the life course. Women's empowerment is correlated with more diverse diets of children under five, but empowerment measures are not consistently associated with

increases in nutrient intake for this age group. Women's empowerment is positively and significantly associated with adult men's and women's dietary diversity and nutrient intakes. However, empowerment does not benefit all individuals within the household equally, with gender bias favoring boys emerging in adolescence.

Nor can we assume that women's diets necessarily improve when they are more empowered in agriculture. Several studies document significant associations between women's empowerment indicators and women's dietary diversity scores (Bonis-Profumo et al., 2021; Kassie et al., 2020; Malapit et al., 2015; Onah et al., 2021). However, the component indicators show mixed results. For example, Quisumbing et al.'s (2021b) multi-country study finds that *speaking in public* is associated with improved women's dietary diversity, but the *number of agricultural decisions*, *autonomy in production*, *number of agricultural assets owned*, and *number of income decisions* are all associated with less diverse diets for women.

Household food security and dietary outcomes

The third category of nutrition-related outcome indicators comprises outcomes measured at the household level. They are broadly related to food security and include the share of specific types of food retained for home consumption, household dietary diversity, and household calorie availability. Four of five studies analyzing food security outcomes were associational, and one used IV regressions. Four reported positive associations between women's empowerment and these outcomes, while one reported mixed results.

Women's empowerment also appears to be positively correlated with household food security, as measured by the household dietary diversity score (HDDS) and per capita calorie availability. Sraboni et al. (2014), which examined both HDDS and per capital calorie availability, used IV regressions. The difference in ages between the primary male and female decisionmakers, and number of types of informal credit sources in the village were used as instruments for all the empowerment indicators. Specific indicators had additional instruments that were more closely related, such as using information on the number of community activities the woman participated in during the previous year for the empowerment scores and the group membership regression. Whether the homestead land has been inherited by the woman is used to instrument for both ownership of and rights over assets.

Several studies find positive associations between HDDS and women's aggregate empowerment score in Bangladesh (Holland & Rammohan, 2019; Sraboni et al., 2014), and Kenya (Kassie et al., 2020). Consistent with the findings on diets and nutrition outcomes, different component indicators matter in different contexts (Clement et al., 2019; Quisumbing et al., 2021b; Seymour et al., 2019). Gender inequality within the household also matters, according to one study in Bangladesh which finds that larger intrahousehold inequality (excluding the time domain) is associated with marginally lower HDDS among

non-poor, time poor, and doubly-poor (both income- and time-poor) households (Seymour et al., 2019). Seymour et al. (2019) suggest that reaching full gender equality can improve household dietary diversity by 0.5 food groups, which may be more meaningful for the doubly-poor who have on average 1.5 fewer food groups than non-poor and time-poor households.

One study in Nepal used a different indicator of household food security, namely, the share of vegetable and cereal production kept for home consumption (Clement et al., 2019). Clement et al. (2019) find that women who are adequate in *access to and decisions about credit* keep a significantly larger share of both vegetable and cereal production for home consumption. However, women who are adequate in *control over income* keep a significantly smaller share of the vegetable production for home consumption. In this context, cereal production and sales are considered to belong in the male domain, whereas homestead vegetable production and sales is within the female domain. Thus, it makes sense that women with greater control over income would sell more vegetables given that homestead vegetable production and sales are an important, and often the only, source of rural women's incomes (Clement et al., 2019).

Overall, the findings suggest that increasing women's empowerment and reducing intrahousehold inequality between women and men contribute to household food security, but household wealth, gender norms and country-specific institutions are also of critical importance. Quisumbing et al. (2021b) find that a large proportion of the variance in household and women's dietary diversity are accounted for by country fixed effects and household wealth, whereas women's empowerment only accounted for a small share. This pattern suggests that diets, nutrition, and food security outcomes cannot be expected to improve automatically without also addressing the underlying determinants of poor nutrition (Quisumbing et al., 2021b).

WASH

Only one study examined WASH outcomes; this was an associational study in Nepal that found a positive relationship between better WASH practices and women's empowerment (Cunningham et al., 2019).

4.3 Economic and livelihood outcomes: Agricultural production and poverty transitions

The next category includes studies that analyze economic and livelihood outcomes that focus on agricultural production, productivity measures, and poverty transitions. Out of ten included studies, seven were associational, two used IV regressions, and one used a switching regression model. Eight studies reported positive associations with women's empowerment, while two reported negative associations.

Several studies find positive associations between various empowerment measures and production indicators (Anik & Rahman, 2021; De Pinto et al., 2020; Diiro et al., 2018; Seymour, 2017; Wouterse, 2017, 2019). Women's overall empowerment is also positively associated with production

efficiency in Bangladesh (Anik & Rahman, 2021) and with increased productivity among maize farmers in Kenya (Diiro et al., 2018). Diiro et al. (2018), using IV regression, find that women's empowerment in agriculture significantly increases maize productivity, with female- and male-managed plots both experiencing significant increases in productivity when the women who tend them are empowered. In Bangladesh, De Pinto et al. (2020) find that women's *input in productive decisions* is associated with greater crop diversification, as less land is allocated to cereals and more land is allocated to vegetables and fruits. Women's participation in economic or social groups is also positively associated with greater crop diversification, but a higher share of women's assets is associated less crop diversification (De Pinto et al., 2020).

Wouterse's (2017, 2019) studies in Niger examine relationships between the average empowerment in a household (the average of men's and women's empowerment scores) and agricultural outcomes. Wouterse (2019) finds that the household's empowerment scores are positively associated with agricultural output, and that an increase of 1.0% in average empowerment would increase output by almost 1.0%. She also finds that empowerment interacts positively with returns to equipment and negatively with returns to fertilizer (Wouterse, 2019). In another study, Wouterse (2017) finds that more empowered households are more likely to have zai pits (planting pits), and empowerment is associated with higher agricultural yields.

Greater equality within the household is positively correlated with production efficiency in Bangladesh (Anik & Rahman, 2021; Seymour, 2017). Seymour (2017) finds that this result extends to plots jointly managed by women and their spouses, as well as those that women do not actively manage. Only two studies (Clement et al., 2019; Quisumbing et al., 2021) find potential tradeoffs between empowerment and agricultural outcomes. Clement et al. (2019) find that in Nepal women's *access to and decisions about credit* is significantly correlated with lower wheat productivity. In this case, the type of crop matters – cereals are generally considered a men's crop in Nepal (Clement et al., 2019).

The lone study on possible associations between women's empowerment and poverty transitions was conducted using three rounds of the BIHS: 2011-2012, 2015, and 2019. Ahmed and Tauseef (2022) find that higher women's empowerment scores are associated with a lower likelihood that a household is in chronic and transient poverty.

4.4 Well-being outcomes

We identified only two studies on well-being outcomes that met our inclusion criteria, both using the Bangladesh Integrated Household Survey. The study on life satisfaction used IV regressions, while the study on children's educational outcomes was associational. Both studies found positive relationships between empowerment measures and their studied outcomes.

Hossain et al. (2019) find that life satisfaction among women and men is positively associated with aggregate empowerment as well as seven of the component indicators: *input in productive decisions*; *purchase, sale, or transfer of assets*; *ownership of assets*; *access to and decisions about credit*; *control over use of income*; *leisure*; and *group membership*. The findings on child schooling are more nuanced. Malapit et al. (2019b) find that fathers' empowerment is positively associated with younger children's schooling, while mothers' empowerment is more important for girls' education in general and for keeping older boys and girls in school.

5. DISCUSSION

5.1 Pattern of findings

The availability of WEAI metrics allows us to examine more systematically how women's empowerment is associated with primary food systems outcomes across a range of different contexts. In our review of the evidence to date, we find that women's empowerment and gender equality are significantly associated with food systems outcomes, as summarized in *Table 6.* Eight (of 13) studies found that women's empowerment leads to improved outcomes for child nutrition and diet. However, women's empowerment does not have a clear positive relationship with their own nutritional statuses. As for household food security, four studies reported positive associations between women's empowerment and these outcomes, while one reported mixed results. The sole WASH study shows strong positive relationships with women's empowerment. There are only two studies addressing links between WEAI metrics and well-being outcomes, specifically life satisfaction and children's education, but they document strong positive relationships. Of the ten studies examining women's empowerment and economic and livelihood outcomes, seven found positive associations between empowerment measures and production indicators and one found positive associations between women's empowerment and the likelihood of not being in chronic or transient poverty. There are no studies examining women's empowerment and environmental and natural resources outcomes, discussed in greater detail below in the section about knowledge gaps. Most significantly, we find different aspects of empowerment matter for different outcomes in different contexts.

Table 6. Women's empowerment in relation to food systems outcomes

		Amount of evidence		
		Low (1 – 3 studies)	Medium (4 – 6 studies)	High (7 – 13 studies)
Degree of agreement among studies	Low			
	Medium		Women's nutrition and diets Household level food security and diets	Agricultural production
	High	Life satisfaction Children's educational outcomes WASH Poverty transitions		Child nutrition and diets

5.2 Knowledge gaps

Causal identification

The majority of the included studies are observational studies, implying that estimated relationships indicate associations, not causation. This reflects both the impossibility of randomly varying empowerment status and the scarcity of studies that randomly assign treatments with potential to influence empowerment. A few used IV and switching regression models to address the endogeneity of the empowerment variable. For example, Sraboni et al. (2014) used the difference in ages between the

primary male and female decisionmakers and the number of types of informal credit sources in the village as instruments for all empowerment indicators, and employed specific instruments for more closely related indicators (e.g., information on the number of community activities the woman participated in during the previous year for the empowerment scores and the group membership regression, and whether the homestead land was inherited by the woman for ownership of and rights over assets). While the instruments performed well based on IV diagnostics, the authors could not reject exogeneity of empowerment in the adult BMI regressions, which were then estimated using ordinary least squares This may reflect a broader pattern, in practice: the same factors that increase women's empowerment (such as education) may have a positive impact on other outcomes of interest as well.

Among the studies analyzing agricultural production outcomes, two studies from Niger (Wouterse, 2017, 2019) are among the three that attempt to model the endogeneity of the empowerment indicator. The study examining empowerment and productivity uses education and empowerment interacted with traditional inputs as regressors (Wouterse, 2017) while the study on zai pit (planting pit) adoption (Wouterse, 2019) instruments empowerment using the difference between the primary male and female in their capacity to be interviewed alone, as assessed by the household, and whether the household has access to generic information by radio. Note, however, that it may have been easier to find instruments for this study because both the outcome and empowerment variables were measured at the household level. The third such study, Diiro et al.'s (2018) study in Kenya, uses the number of types of collective organizations in the village, the differences in age and education between the primary male and female, whether the woman brought assets to marriage, the women's duration of residence in the village, and household composition by age group as instruments for empowerment.

Other studies complemented their associational analyses with in-depth qualitative work to better understand causal mechanisms behind their findings, such as the Clement et al. (2019) study in Nepal. Women with greater control over income would sell more vegetables given that homestead vegetable production and sales are an important source of rural women's incomes (Clement et al., 2019); those with access to credit could "afford" to keep more vegetables and cereals for home consumption because they could access cash more easily. In the absence of exogenously driven variation in women's empowerment, such qualitative work is important to understand the mechanism by which women's empowerment might affect outcomes. Future research could help fill the gap in identifying causal relationships between women's empowerment and food system-related outcomes of interest.

Environmental and natural resources outcomes

No specific study examined the relationship between empowerment and environmental and natural resources outcomes. This is a large gap in the literature given discussions about the role of women in climate change adaptation and mitigation but also the disproportionate impact that climate change will

have on women and their voice and agency (Takeshima et al., 2022). Two studies, however, are closely related to environmental outcomes: the studies on zai pits (planting pit; Wouterse, 2019) and on crop diversification (De Pinto et al., 2020). Understanding the links between empowerment and environmental and natural resources outcomes is an area that is ripe for future studies.

Limited geographic distribution

The included studies come mostly from Africa and South Asia, with more than a third coming from Bangladesh. Bangladesh generated many research findings because it was one of the few Feed the Future (FTF) surveys that also collected information on production from the same households. Moreover, Bangladesh is the only country with a panel data set, making it possible to track empowerment trends over time. The Ghana FTF survey, although generating many studies, only collected data on dietary and nutrition outcomes. The lack of published studies on Latin America, the Middle East, and other parts of Asia is a clear gap that limits our understanding of women's empowerment and gender equality across a broader range of contexts.

5.3 Policy implications

While there is growing recognition of the importance of women's empowerment as an objective in own right, the case for addressing women's empowerment in development programming is strengthened by evidence that empowerment contributes to other development objectives. Food systems are a particularly important area of focus, given their scale. However, these food systems can often perpetuate broader societal inequalities, including those related to gender, which makes the design and implementation of interventions with women's empowerment objectives and the continuous measurement, monitoring, and evaluation of women's empowerment and other food systems outcomes important for both policy and research.

The studies reviewed in this paper confirm that fostering women's empowerment may have a positive effect on many food system-related outcomes. Notably, women's empowerment seems to be closely linked to improved child nutrition, but is also associated with other outcomes, including household level food security and, to a lesser degree, to women's own diets and nutrition. Although there is evidence that women's empowerment and intrahousehold gender equity is also positively associated with agricultural productivity, the context and type of crop matter. Women's empowerment is also positively associated with a household not being chronic or transient poor, although this is based on only one study. Considerably more evidence is needed to establish the links between women's empowerment an individual or household well-being, WASH, and environmental and natural resources outcomes. As is often the case with studies involving empowerment, household, societal and institutional factors – wealth, class, norms, for example – often play critical moderating roles.

This synthetic review reinforces our knowledge about the instrumental value of women's empowerment to attaining many food systems outcomes. More recently, the recognition of the intrinsic value of women's empowerment and gender equality has led to the design and implementation of interventions with these goals as explicit objectives. Elias et al. (2021) argue that assessing women's empowerment in agricultural development programming is integral to supporting holistic projects, programs, and policies, monitoring how initiatives contribute to women's empowerment, building accountability and credibility, and challenging power relations. Impact assessments of these projects contribute to our knowledge of the strategies that are effective in promoting women's empowerment across different contexts. A synthesis of mixed methods impact evaluations of 11 agricultural development projects that were part of the Gender, Agriculture, and Assets Project, Phase 2 (GAAP2) (Quisumbing et al., 2022a) highlights the need for projects to design their strategies specifically for empowerment, rather than assume that projects aiming to reach and benefit women automatically empower them. In the GAAP2 portfolio, the projects that succeeded in empowering women were intentional about their project strategies, had activities adapted to culture and context, and paid attention to unintended consequences (whether backlash from men or increased workload). Another synthesis across four country case studies of the United Nations Joint Programme for Rural Women's Economic Empowerment (Quisumbing et al., 2022b) points to the potential of group-based approaches, the need to involve men, and being mindful of increased workload resulting from women's involvement in livelihood programs. Both syntheses, based on impact evaluations that used WEAI-based metrics in their impact assessments, show the value of both a common metric to compare empowerment impacts across projects and contexts and qualitative work to understand and contextualize these impacts. They recommend that agricultural development programs include empowerment measures as part of regular monitoring and evaluation to flag potential problems as they arise.

A notable feature of the impact evaluations mentioned above is their use of experimental and quasi-experimental methods to assess empowerment impacts, which helps to address the endogeneity of empowerment in the correlational studies that account for the majority of studies included in this synthetic review. Commitments to funding programs and gender-sensitive evaluations thereof is a first step to supporting holistic programs and monitoring whether they facilitate women's empowerment, and to what degree. Similarly, greater support for gender research from stakeholders in Latin America, the Middle East, and some parts of Asia would generate more evidence around which indicators of empowerment matter for enhanced food system outcomes in their respective contexts. Closing these knowledge gaps would further clarify how future policy might target different aspects of empowerment to make sound investments in food systems. The number of studies from Bangladesh using the BIHS data shows that collecting survey data on women's empowerment *along with* other outcomes can enable many

policy-relevant analyses. Moreover, such analyses can pave the way for the design of projects to enhance women's empowerment. For example, the Government of Bangladesh designed and implemented a pilot program, the Agriculture, Nutrition, and Gender Linkages project, based on the findings from the BIHS (Sraboni et al., 2014); IFPRI evaluated its empowerment impacts in a cluster randomized-controlled trial (Quisumbing et al., 2021c). Qualitative studies are also important to provide insights into how different domains of women's empowerment can lead to different outcomes across contexts. While particularly useful in complementing associational or quasi-experimental analyses, where attributing causality is complicated, the value of qualitative work in unpacking complex mechanisms even where causal identification is possible is often underestimated.

Given the importance of food systems, and the growing challenges to those food systems posed by conflict and climate change, it is critical that high quality gender-disaggregated data collection efforts are given their due importance. These efforts will serve as a critical steppingstone to building credibility and accountability for gender equality and food system outcomes (Heckert & Fabic, 2013; Pryor & Seck, 2019; Richardson, 2018) and will help strengthen stakeholders' ability to make informed, credible decisions and hold policy and programs accountable for their shortcomings and successes around their desired outcomes.

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