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**A Multi-Country Validation and Sensitivity Analysis of the Project-Level Women's Empowerment in Agriculture Index (Pro-WEAI)**

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## ABSTRACT

We discuss the evolution of the project-level Women’s Empowerment in Agriculture Index (pro-WEAI) from its initial launch in 2018 until early 2023. We explain the reasons motivating changes to the composition of pro-WEAI and the adequacy thresholds of several indicators and discuss the implications of both for the overall measurement of project impacts on women’s empowerment. We present supporting empirical results comparing projects’ impacts calculated using the abbreviated Women’s Empowerment in Agriculture Index (A-WEAI) (the predecessor to pro-WEAI with fewer indicators and less stringent indicator cut-offs), the pilot 12-indicator version of pro-WEAI, and the final, revised 10-indicator version of pro-WEAI, based on longitudinal data from six agricultural development projects in East and West Africa and South Asia as part of the Gender, Agriculture, and Assets Project, Phase 2 (GAAP2). In addition, we assess the sensitivity of the revised pro-WEAI to an alternative weighting scheme, namely inverse covariance weighting (ICW). Overall, we find that the revised pro-WEAI performs well: In comparison to A-WEAI, pro-WEAI—regardless of version—identifies larger and more frequently significant impact estimates, indicating that pro-WEAI is more sensitive to detecting project impacts on women’s empowerment than A-WEAI. And we find only minor differences in impact estimates produced using the 12-indicator, 10-indicator, or alternate weighting scheme versions of pro-WEAI. We conclude with reflections on six years of work on pro-WEAI during GAAP2.

**Keywords:** women’s empowerment, gender equality, impact evaluation, agricultural development, South Asia, West Africa, East Africa

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## ACRONYMS

|          |  |
|----------|--|
| 3DE      | Three Domains of Empowerment   |
| 5DE      | Five Domains of Empowerment  |
| A-WEAI   | Abbreviated Women's Empowerment in Agriculture Index   |
| AVC      | Agriculture Value Chains   |
| FAARM    | Food and Agricultural Approaches to Reducing Malnutrition  |
| FTF      | Feed the Future  |
| GAAP2    | Gender, Agriculture, and Assets Project, Phase 2   |
| GPI      | Gender Parity Index  |
| Grameen  | Building resilience of vulnerable communities in Burkina Faso  |
| IFPRI    | International Food Policy Research Institute   |
| ICW      | Inverse covariance weights   |
| IPV      | Intimate partner violence  |
| JP-RWEE  | UN Joint Programme on accelerating progress towards the economic empowerment of rural women in Ethiopia  |
| NGSE     | New General Self-Efficacy scale  |
| pro-WEAI | Project-level Women's Empowerment in Agriculture Index   |
| SDG      | Sustainable Development Goal   |
| SE LEVER | Soutenir l'Exploitation Familiale pour Lancer l'Élevage des Volailles et Valoriser l'Économie Rurale (Impact evaluation of an integrated poultry value chain and nutrition intervention) |
| USAID    | United States Agency for International Development   |
| WEAI     | Women's Empowerment in Agriculture Index   |
| WorldVeg | World Vegetable Center   |

## INTRODUCTION

The codification of women's empowerment and gender equality as the focus of the fifth Sustainable Development Goal (SDG5) recognizes their intrinsic value beyond their instrumental contribution to achieving development objectives related to health and nutrition (Sraboni and Quisumbing 2018; Heckert, Olney, and Ruel 2019) productivity (Seymour 2017; Diiro et al. 2018), and resource management (Sodhi, Davidar, and Rao 2010). Elevation to SDG5 also implies a global commitment to measure and monitor progress in achieving that goal. In line with their higher profile in the development agenda, women's empowerment and gender equality are often targeted by agriculture and food systems interventions (Elias et al. 2021). To assess the level of women's empowerment and whether interventions work in a variety of contexts and cultures, internationally comparable, validated measurement tools are needed. Such tools can be used to evaluate approaches for advancing women's empowerment and to understand how women's empowerment correlates with other development goals. This need is particularly true in the context of agriculture-dependent, low-income countries, where gender inequalities related to rights, resources, and responsibilities continue to constrain women's agency, productivity, and well-being despite progress in recent years.

Compared to women's empowerment, gender equality is relatively straightforward to conceptualize and measure. Recent years have seen rapid expansion in the availability of sex-disaggregated and intrahousehold data necessary for measuring aspects of gender equality (e.g., Living Standards Measurement Study – Integrated Surveys on Agriculture household survey project). Empowerment is a more complex concept, with a wider variety of proposed conceptual definitions. The Women's Empowerment in Agriculture Index (WEAI), the project-level Women's Empowerment in Agriculture Index (pro-WEAI; Malapit et al. 2019) and other recent measures of empowerment (Galiè et al. 2019; Narayanan et al. 2019) operationalize Kabeer's (1999) definition of empowerment: the process(es) by which those who have been denied the ability to make strategic life choices acquire or expand such

ability. In Kabeer's framework, empowerment can be thought of as exercising choice over three dimensions: resources (including not only access but also future claims to material, human, and social resources), agency (including decision-making and negotiation), and achievements (or well-being outcomes). Other conceptual definitions of empowerment exist, such as Rowlands' (Rowlands 1997; 1995) typology of power, which juxtaposes dominating or exerting "power over" with generative forms of empowerment, including "power within," "power to," and "power with (others)."

Launched in 2012 as a monitoring and evaluation tool for USAID's Feed the Future (FTF) initiative, the WEAI was one of the first direct, quantitative measures of women's empowerment focused exclusively on the agricultural sector (Alkire et al. 2013). The WEAI is an aggregate index, reported at the country or sub-national level, which assesses women's empowerment and inclusion in agriculture across five domains (production, resources, income, leadership, and time). Concerns about the length of the WEAI survey instrument and difficulties in administering it led to the development of a shorter, abbreviated version with the same five domains but fewer indicators, known as the Abbreviated WEAI (A-WEAI; H. Malapit et al. 2017).

Both WEAI and A-WEAI were designed for population-based monitoring and evaluation. In contrast, pro-WEAI was developed to meet the needs of agricultural development project designers and implementors. Specifically, these users needed a tractable, mixed-methods tool that captures the dimensions of empowerment they deemed to be most important for project success and is suitable for measuring project impacts on women's empowerment within a typical 2 to 5 year project implementation period. Malapit et al. (2019) describe the co-development of the pilot version of pro-WEAI with researchers from 13 agricultural development projects in East Africa, West Africa, and South Asia as part of the Gender, Agriculture, and Assets Project, Phase 2 (GAAP2), and initial validation of the index using quantitative and qualitative data from these projects, mostly from baseline surveys.

In this paper, we discuss the evolution of pro-WEAI during the years since its launch and present a version of the index that has been revised following user input and empirical testing. Analyzing longitudinal data from six GAAP2 projects for which complete data on pro-WEAI are available, we compare projects' impacts on empowerment calculated using A-WEAI, the 2019 version of pro-WEAI (henceforth "pilot pro-WEAI"), and the 2022 version of pro-WEAI (henceforth "revised pro-WEAI"). In addition, we respond to criticism of the weighting structure used by pro-WEAI and assess the sensitivity of revised pro-WEAI to alternative weighting schemes, namely inverse covariance weighting (Anderson 2008). Overall, we find that revised pro-WEAI performs well in all comparisons. In comparison to A-WEAI, pro-WEAI—regardless of version—produces impact estimates that are larger in magnitude and more frequently statistically significant. This finding suggests that pro-WEAI is more sensitive to detecting project impacts on women's empowerment than A-WEAI. Moreover, we find that impact estimates generated by revised pro-WEAI are largely robust to changes in indicator composition relative to both A-WEAI and pilot pro-WEAI and the use of alternate weighting schemes.

The paper proceeds as follows. The methodology section provides a technical overview of pro-WEAI, describes the various changes made to the index since its launch, and presents a revised version of pro-WEAI. The next section presents empirical results of the validation and sensitivity analysis. The paper concludes with reflections on six years of work on pro-WEAI during GAAP2 and recommendations for the future use of pro-WEAI in impact evaluations of agricultural development projects.

## **EVOLUTION OF PRO-WEAI DOMAINS AND INDICATORS**

### **Predecessors of pro-WEAI: WEAI and A-WEAI**

The Women's Empowerment in Agriculture Index (WEAI) is a survey-based index that measures the empowerment and gender parity of women who work in agriculture and assesses areas in which empowerment needs to be strengthened (Alkire et al., 2013). Based on the Alkire-Foster methodology for measuring multidimensional poverty (Alkire and Foster 2011), the WEAI was initially developed for population-based surveys in the FTF initiative but has also been used by many other organizations and researchers seeking to collect standardized empowerment indicators. It is the weighted sum of two subindexes: the Five Domains of Empowerment (5DE) and the Gender Parity Index (GPI). The 5DE assesses the degree to which women are empowered in five domains: (1) agricultural production decisions; (2) access to, and decision-making power over, productive resources; (3) control over use of income; (4) leadership roles within the community; and (5) time allocation. The 5DE is constructed from individual-level empowerment scores, which reflect each person's achievements in the five domains as measured by 10 indicators, with their corresponding weights. Each indicator measures whether an individual has surpassed a given threshold or has adequate achievement with respect to each indicator. For example, a respondent who is an active member of at least one community group is considered adequate in group membership. A woman is defined as empowered if she has adequate achievements in four of the five domains or has achieved adequacy in 80 percent or more of the weighted indicators. The 5DE reflects the prevalence of empowerment (i.e., the percentage of women who are empowered) and intensity of disempowerment (i.e., the weighted share of indicators in which disempowered women do not achieve adequacy). Gender parity in the WEAI is achieved by women who are empowered or whose achievements across the five domains of empowerment are at least as high as the men in their households. The GPI reflects the percentage of households that achieve gender parity and, for those households that

have not achieved gender parity, the empowerment gap that needs to be closed for women to reach the same level of empowerment as men in their households. The latter is also reflected in the intrahousehold inequality score, defined as the difference between the empowerment scores of the primary man and woman decision makers within a household.

Following the rollout of WEAI to 19 Feed the Future Initiative countries in 2012, WEAI users expressed demand for an abbreviated survey instrument that accurately reflected the content and coverage of the original index but dropped sections that were challenging to administer. Thus, A-WEAI reflects the same five domains of empowerment in agriculture as the WEAI but utilizes only 6 out of the 10 original indicators, based on a shorter, easier to implement survey instrument. The indicators retained in A-WEAI are: 1) input in productive decisions; 2) ownership of land and other assets; 3) access to and decisions on credit; 4) control over use of income; 5) group membership; and 6) workload. The questionnaire was further shortened by dropping the collection of secondary activities from the time use module and streamlining the sequence of decisionmaking questions to minimize repetition. Although the A-WEAI indicator weights have been adjusted to maintain equal weight across domains despite the reduced number of indicators, the methodology for calculating the index and thresholds for identifying an empowered individual remains the same as the WEAI.

### **Comparison of A-WEAI and pro-WEAI**

Pro-WEAI was developed to assess impacts and evaluate outcomes of agricultural development projects with women's empowerment objectives. Although pro-WEAI shares the same underlying methodology, mathematical properties, and structure as WEAI and A-WEAI, it differs from previous versions in several ways. First, instead of five domains of empowerment as in WEAI and A-WEAI, pro-WEAI explicitly maps empowerment to three domains: intrinsic agency (power within), instrumental agency (power to), and collective agency (power with) (Table 1). These three aspects of agency reflect the

generative types of power described by (Rowlands 1995; 1997). Though indicators measuring all three aspects of agency are present in WEAI and A-WEAI, the theoretical linkages to Rowlands’ typology are not explicit. Second, pro-WEAI includes three new indicators (self-efficacy, attitudes about IPV against women, and the ability to visit important locations) that are not part of WEAI and A-WEAI (Table 1). The remaining seven indicators in pro-WEAI are based on existing WEAI and A-WEAI indicators but, as implemented in pro-WEAI, use a stricter threshold to assess adequate achievement. These indicators measure, respectively, autonomy in income/production, input in productive/livelihood decisions, ownership of land and other assets, access to and decision on credit/financial services, control over use of income, workload/balance, and group membership (Table 1). The implementation of stricter adequacy thresholds reflects the purpose of pro-WEAI as an impact assessment tool for projects with explicit empowerment objectives. Third, pro-WEAI uses a different weighting scheme than WEAI and A-WEAI. In WEAI and A-WEAI, the five domains of indicators are evenly weighted, whereas in pro-WEAI, each indicator is equally weighted. Without *a priori* rationale for why some indicators should be considered more important than others, we opted against weighting each domain equally in pro-WEAI, which would have implicitly assigned a disproportionately heavy weight to group membership (the only collective agency indicator), compared to the nine intrinsic and instrumental agency indicators. Apart from these differences, pro-WEAI follows the same methodology for constructing the index as WEAI and A-WEAI. Further details on index calculation, including discussion of decomposition, are included in the Appendix and in Malapit et al. (2019).

**Table 1. Comparison of domains and indicators across WEAI, A-WEAI, and pro-WEAI**

| Domains    | WEAI                   | A-WEAI | Domains          | Pilot pro-WEAI                    | Revised pro-WEAI                  |
|------------|------------------------|--------|------------------|-----------------------------------|-----------------------------------|
| Production | Autonomy in production |        | Intrinsic Agency | Self-efficacy                     | Self-efficacy                     |
|            |                        |        |                  | Attitudes about IPV against women | Attitudes about IPV against women |
|            |                        |        |                  | Autonomy in income                | Autonomy in income                |

|                   | Input in productive decisions         | Input in productive decisions   |                                 | Input in livelihood decisions                 | Input in livelihood decisions                 |
|-------------------|---------------------------------------|---------------------------------|---------------------------------|---|---|
| <b>Resources</b>  | Purchase, sale, or transfer of assets |                                 | <b>Instrumental Agency</b>      |   |   |
|                   | Ownership of assets                   | Ownership of assets             |                                 | Ownership of land and other assets            | Ownership of land and other assets            |
|                   | Access to & decisions on credit       | Access to & decisions on credit |                                 | Access to and decisions on financial services | Access to and decisions on financial services |
| <b>Income</b>     | Control over use of income            | Control over use of income      |                                 | Control over use of income                    | Control over use of income                    |
|                   |                                       |                                 |                                 | Visiting important locations                  | Visiting important locations                  |
| <b>Time</b>       | Workload                              | Workload                        |                                 | Work balance                                  | Work balance                                  |
|                   | Leisure                               |                                 | Respect among household members |   |   |
| <b>Leadership</b> | Group membership                      | Group membership                | <b>Collective Agency</b>        | Group membership                              | Group membership                              |
|                   | Speaking in public                    |                                 |                                 | Membership in influential groups              |   |

### Feedback on pro-WEAI

As part of the iterative and consultative process of developing pro-WEAI, GAAP2 commissioned an external assessment following completion of projects' baseline data collection. Sixteen in-depth interviews were carried out across the 13 participating projects between April and May 2019 (ALINE 2019). These interviews were recorded and analyzed using thematic content analysis to highlight key themes emerging from the interviews.

The most common feedback was the need for a simpler and shorter survey instrument. The modules used to measure work balance and autonomy in income indicators, in particular, were noted as time consuming and challenging to implement by nearly half of respondents. Many respondents also noted having to implement pro-WEAI as a standalone survey as opposed to integrating it into their main project survey due to interview length, which had significant logistical and budget implications. While not unique

to pro-WEAI, another common implementation challenge was translation. Respondents noted that nuances in some parts of the questionnaire could be lost when translated into local languages, and thus, questions should be phrased as simply as possible. Finally, despite the above, respondents generally considered the questionnaire easy to understand and use. Respondents commended pro-WEAI for examining multiple dimensions of empowerment, for being well grounded in both empirical research and theory, and for enabling standardized assessment of women's empowerment.

We do not address the issue of questionnaire integration in this paper; other work (Seymour et al. under development) assesses the sensitivity of impact estimates to using a stand-alone pro-WEAI questionnaire compared to integrating pro-WEAI questions directly into an existing survey. Motivated by feedback from GAAP2 projects, as well as its co-developers and other users, we have, however, made several changes to pro-WEAI to address issues of length and clarity of wording, among other issues.

### **Changes to pro-WEAI**

We have implemented several changes to pro-WEAI since its launch. Two indicators, respect among household members and membership in influential groups, were dropped. Dropping these indicators leads to an estimated reduction in interview length by 10% (or 3.5 minutes). Adequacy threshold adjustments were made to self-efficacy, input in livelihood decisions, and ownership of land and other assets (see Table A1 in the Appendix for detailed descriptions of the adequacy thresholds used in pro-WEAI). The sub-sections below provide supporting details for each of the changes. Note that in addition to the changes discussed below, there have been numerous minor changes made to the statistical code for calculating pro-WEAI, which include error corrections and improved handling of missing information. All such changes are noted in the Stata **.do** files available on the WEAI Resource Center.

## ***Self-efficacy***

The self-efficacy indicator is based on the New General Self-efficacy Scale (NGSE), which is a validated scale to measure self-efficacy, or a person's capabilities and ability to reach their goals (Chen, Gully, and Eden 2001). Given the feedback we received on interview length, we considered many changes to shorten the survey. The pilot version of the self-efficacy module includes 8 statements reflecting four sub-constructs, with two statements for each sub-construct. Respondents indicate agreement or disagreement with each statement on scale of 1 to 5, where 1 indicates strong disagreement, 3 indicates neither agreement nor disagreement, and 5 indicates strong agreement. Their responses are summed to create a score, and scores above 32 for the 8-item version or 16 for the 4-item version are considered adequate, which equates to an average response of "agree" or greater across all items.

Our decision on which items to cut was informed by a variety of factors. First, the psychometric analysis leading to the development of the NGSE identified a single underlying latent factor for all eight items (Chen, Gully, and Eden 2001). Additionally, in the GAAP2 project data, pairwise correlations for all eight items were moderately strong (between .46 and .64). The eight items came from four sub-constructs. We tested including only one statement for each concept, retaining the item that used the simplest language, so that it would be easiest to translate accurately and for respondents to understand. In doing so, we found very minor changes to adequacy and impact estimates. In revised pro-WEAI, we therefore decided to include only four statements, one for each sub-construct. The statements retained are: (b) "When facing difficult tasks, I am certain that I will accomplish them;" (c) "In general, I think that I can obtain outcomes that are important to me;" (f) "I am confident that I can perform effectively on many different tasks;" and (h) "Even when things are tough, I can perform quite well." Statements no longer used in the construction of the index are: (a) "I will be able to achieve most of the goals that I have set for myself;" (d) "I believe I can succeed at most any endeavor to which I set my mind;" (e) "I will be able to

successfully overcome many challenges;” and (g) “Compared to other people, I can do most tasks very well.”

### ***Respect among household members***

Respect among household members was recommended as an indicator by GAAP2 projects during the initial consultation and development phase of pro-WEAI. Intrahousehold harmony also emerged as an important element of women’s empowerment during qualitative fieldwork conducted by eight GAAP2 projects between November 2016 and February 2018 (Meinzen-Dick et al. 2019). Women often cited harmonious relations with husbands and in-laws as supporting individual freedoms, such as greater capacity to move freely, attend group meetings, and earn income.

The indicator is constructed from questions about the respondent’s relationship with their partner/spouse or another adult decision-maker within the household if the respondent is single or their partner/spouse resides elsewhere. Respondents are considered adequate if all following conditions are met: (i) the respondent respects the other household member; (ii) the other household member respects the respondent; (iii) the respondent trusts the other household member to do things in their best interest; and (iv) the respondent is comfortable disagreeing with the other household member.

In practice, GAAP2 projects and other users reported that the questions and indicator were difficult to implement and interpret. Cognitive interviewing of this module in Bangladesh found that “respect” was often interpreted as “honor” and that trusting someone to do something in your best interest was often interpreted as that person being reliable (Hannan et al. 2020). Given that the identity of the referent household member can vary depending on household composition, the power dynamic of the relationship being assessed by the questions will not always be the same across households. For instance, some respondents may be asked about their spouses, but others may be asked about their adult child, parent-in-law, or sibling. This leads to inconsistency in interpretation, which are borne out in the GAAP2 data.

Adequacy levels in this indicator differed significantly depending on the relationship between respondents, especially in Asia. In addition, because the indicator assesses relationships between two adults, it cannot be calculated for households with only a single adult. Maintaining this indicator in pro-WEAI would, thus, mean that all single-adult households be excluded from the analytic sample, given that index calculation requires non-missing values for all indicators. The exclusion of such households would pose problems for accurately assessing empowerment impacts in settings where single-adult households are more prevalent, such as large parts of Africa. For these reasons, we ultimately chose to drop this indicator from pro-WEAI. Projects aimed at engendering respect among household members are encouraged to include these questions in their impact evaluations with the caveats that they are attentive to translation subtleties and undertake qualitative work to unpack these issues, but we do not recommend including the indicator in the calculation of pro-WEAI.

### ***Input in livelihood decisions***

The ability to make decisions within the household is one of the most common measures of agency (Laszlo et al. 2020; Donald et al. 2020; Ibrahim and Alkire 2007). In earlier WEAI versions, this was captured by the input in productive decisions indicator, which specifically focused on women's ability to make decisions on agricultural activities, including food and cash crop farming, livestock, and fisheries. In the pilot pro-WEAI, these questions were expanded to encompass both production and processing related activities, though the scope of the indicator remained limited to agriculture.

However, a focus on agricultural decision making may not be an appropriate measure of agency in all settings, particularly in contexts of structural transformation and associated diversification of rural livelihoods and greater involvement by women and men in non-agricultural employment (Alkire et al. 2013; Njuki et al. 2022). For example, a woman who shifts from contributing to the family farm to running her own non-farm business over the course of an agricultural development project could have

been viewed by pilot pro-WEAI (and earlier WEAI versions) as becoming less empowered, despite meaningfully expanding her ability to exercise agency in non-agricultural domains. From a measurement perspective, the possibility of such a conundrum in a tool specifically designed for assessing the impacts of agricultural development projects on women's empowerment would be an undesirable and potentially misleading feature. Thus, in revised pro-WEAI, we have broadened this indicator to include decision making in both agricultural (food and cash crop farming; large and small livestock; poultry, and fisheries) and non-agricultural activities (non-farm business and wage/salary employment). In addition to better capturing empowerment impacts in the context of rural transformation, this change permits the input into decisions indicator to be consistent with the control over use of income indicator, which has always included both agricultural and non-agricultural activities. To reflect these changes, we have renamed the indicator from input in productive decisions to input in livelihood decisions.

### ***Ownership of land and other assets***

As with the ability to make decisions within the household, control over household resources is often seen as an expression of agency (Laszlo et al. 2020; Pradhan, Meinzen-Dick, and Theis 2019). The original WEAI measured this in terms of both reported ownership and the ability to make decisions regarding the purchase, sale, or transfer of land and other household assets. Previous analysis indicated a strong positive correlation between self-reported ownership of an asset and being able to make decisions regarding the purchase, sale, or transfer for the asset, and thus, in A-WEAI the purchase, sale, or transfer of assets indicator was dropped to avoid redundancy and reduce interview length (Malapit et al. 2017).

Pilot pro-WEAI continued the same approach as A-WEAI, albeit with a stricter adequacy threshold. Whereas A-WEAI considers a respondent adequate if they report sole or joint ownership of at least one major asset (i.e., excluding poultry, non-mechanized farm equipment, or small consumer durables), pilot

pro-WEAI assigns adequacy based on whether a respondent owns, either solely or jointly, at least one of the following: (i) at least three small assets, (ii) at least two large assets, or (iii) land.

In practice, GAAP2 projects and other users found this complicated to implement and interpret. This was largely due to the distinction between small and large assets, which was sometimes perceived as not meaningful, such as in instances where a large volume of small assets was owned (e.g., a large flock of chickens or herd of guinea pigs) compared to, say, a single milk cow. To reduce confusion and avoid potential conundrums, we no longer distinguish between small and large assets in the revised pro-WEAI, and the adequacy threshold for this indicator is now simply whether the respondent owns land, which retains its higher prioritization, or any other three assets.

### ***Membership in influential groups***

Collective agency has always been present in the WEAI, though it has not always been referred to as such. Group membership was included in the leadership domain in both the original WEAI and A-WEAI. In pro-WEAI, we sought to expand the scope of collective agency that could be measured by the index. Hence, pilot pro-WEAI includes two indicators in the collective agency domain. The first, group membership, is identical to the indicator included in WEAI and A-WEAI. The second, membership in influential groups, is new. To be adequate in this indicator, a respondent must be an active member of at least one group that is perceived—by the respondent to have influence on life in the community beyond the group’s activities.

While membership in at least some group is important in bringing people together and creating some basis for collective agency in proposing this indicator in pilot pro-WEAI, we sought to capture something besides mere membership. However, the conditionality between the two indicators and ambiguity on what constituted an “influential” group proved problematic. Adequacy in membership in influential groups cannot be achieved without adequacy in group membership. As a result, these indicators show, by far, the

highest levels of correlation in the pooled dataset. Such high correlation is an undesirable feature in pro-WEAI, as it increases the implicit weight of group membership and risks skewing the comparison of empowerment impacts. To avoid these issues, we have dropped membership in influential groups from revised pro-WEAI.

## DATA

GAAP2 worked with a portfolio of 13 agricultural development projects to develop and validate pro-WEAI. The projects were implemented in nine countries in South Asia and Africa. In addition to women's empowerment, all projects aimed to improve nutritional outcomes and, in some cases, incomes. GAAP2 worked with the projects' existing evaluation design, providing additional funding to implement pro-WEAI and its associated qualitative protocols (Meinzen-Dick et al., 2019). Projects' evaluation designs varied between randomized controlled trials and quasi-experimental, difference-in-difference designs. In all cases, a control group was clearly established to allow empowerment impacts to be assessed relative to a well-defined counterfactual. Mixed methods evaluation results for 11 GAAP2 projects are presented in Quisumbing et al. (2022).

While all GAAP2 projects included pro-WEAI in their impact evaluations, differences in project timing relative to the development of pro-WEAI meant that several projects implemented interim versions of the questionnaire at baseline. The data analyzed in this paper come from the six GAAP2 projects for which complete data on pro-WEAI is available for at least two rounds of data collection. Details for these projects are shown in Table 2. Baseline/midline data collection for these projects occurred between 2015 and 2017, and endline data collection between 2018 and 2020. Because sample sizes are inconsistent across the projects, all analyses below use inverse project sample size weights to ensure results are not disproportionately driven by larger projects.

**Table 2. Description of GAAP2 projects and data used in this analysis**

| Project name  | Country      | Evaluation design           | Baseline/<br>midline | Endline | Total |
|---|--------------|-----------------------------|----------------------|---------|-------|
| Bangladesh agriculture Value Chains (AVC)                               | Bangladesh   | Randomized controlled trial | 1,000                | 985     | 1,985 |
| Food and Agricultural Approaches to Reducing Malnutrition (FAARM)       | Bangladesh   | Randomized controlled trial | 571                  | 885     | 1,456 |
| Building resilience of vulnerable communities in Burkina Faso (Grameen) | Burkina Faso | Quasi-experimental          | 760                  | 694     | 1,454 |

|   |              |                             |       |       |        |
|---|--------------|-----------------------------|-------|-------|--------|
| Integrated poultry value chain and nutrition intervention (SE LEVER)  | Burkina Faso | Randomized controlled trial | 3,342 | 3,117 | 6,459  |
| UN Joint Programme on accelerating progress towards the economic empowerment of rural women in Ethiopia (JP-RWEE) | Ethiopia     | Quasi-experimental          | 1,379 | 1,855 | 3,234  |
| Deploying improved vegetable technologies to overcome malnutrition and poverty in Mali (World Veg)                | Mali         | Quasi-experimental          | 1,408 | 1,378 | 2,786  |
|   |              |                             | 8,460 | 8,914 | 17,374 |

**Note:** Implementation of the FAARM intervention began in 2015; pro-WEAI was piloted as part of FAARM's midline data collection in 2017.

## SENSITIVITY ANALYSIS OF PRO-WEAI TO CHANGES IN MEASUREMENT DESIGN

In this section, we investigate the sensitivity of pro-WEAI to variations in measurement design. Our analysis proceeds along two lines. First, we compare key statistics and impact estimates generated using A-WEAI, pilot pro-WEAI, and revised pro-WEAI. These results inform our understanding of pro-WEAI’s ability to detect changes in empowerment and other implications of the changes made to pro-WEAI since launch. Second, we examine the robustness of pro-WEAI to alternative weighting schemes.

### Comparing aggregate empowerment outcomes

Table 3 compares aggregate empowerment outcomes according to A-WEAI, pilot pro-WEAI, and revised pro-WEAI using pooled baseline and endline data from the six included GAAP2 projects. Due to differences in the composition of indicators, there are large differences in outcomes between A-WEAI and both pro-WEAI versions. Overall, A-WEAI identifies a higher proportion of respondents as empowered and higher proportion of households as achieving gender parity, and produces higher mean empowerment scores and lower mean intrahousehold inequality scores compared to pro-WEAI. These differences, in turn, lead to higher 5/3DE, GPI, and A-WEAI/pro-WEAI scores. These differences can be attributed to differences in sample size, fewer indicators, and more lenient (lower) adequacy thresholds used by A-WEAI relative to pro-WEAI for those indicators that are common to both the indices (see Table 1).

**Table 3. Aggregate empowerment outcomes for A-WEAI, pilot pro-WEAI, and revised pro-WEAI**

|                         | A-WEAI      |             | Pilot Pro-WEAI |             | Revised Pro-WEAI |             |
|-------------------------|-------------|-------------|----------------|-------------|------------------|-------------|
|                         | Women       | Men         | Women          | Men         | Women            | Men         |
| <b>5/3DE score</b>      | <b>0.85</b> | <b>0.90</b> | <b>0.59</b>    | <b>0.74</b> | <b>0.63</b>      | <b>0.79</b> |
| Number of observations  | 8780        | 7816        | 8213           | 7494        | 8980             | 7869        |
| % achieving empowerment | 0.57        | 0.68        | 0.26           | 0.48        | 0.23             | 0.47        |

|  |             |      |             |      |             |      |
|--|-------------|------|-------------|------|-------------|------|
| Mean empowerment score                 | 0.80        | 0.84 | 0.56        | 0.68 | 0.59        | 0.72 |
| <b>Gender Parity Index (GPI) score</b> | <b>0.94</b> |      | <b>0.81</b> |      | <b>0.81</b> |      |
| Number of dual-adult households        | 7300        |      | 6687        |      | 7553        |      |
| % achieving gender parity              | 0.71        |      | 0.43        |      | 0.41        |      |
| Mean intrahousehold inequality score   | 0.04        |      | 0.12        |      | 0.13        |      |
| <b>A-WEAI/Pro-WEAI score</b>           | <b>0.86</b> |      | <b>0.62</b> |      | <b>0.65</b> |      |

**Source:** Pooled baseline and endline data from AVC (N = 1985), FAARM (N = 1456), Grameen (N = 1454), JP-RWEE (N = 3234), SE LEVER (N = 6,459), and WorldVeg (N = 2786).

**Note:** Weighted by inverse project sample size. Only includes respondents with complete information on the indicators. Difference between pilot and revised pro-WEAI for the GPI score is statistically significant at the 5% level; differences for all other outcomes are statistically significant at the 1% level.

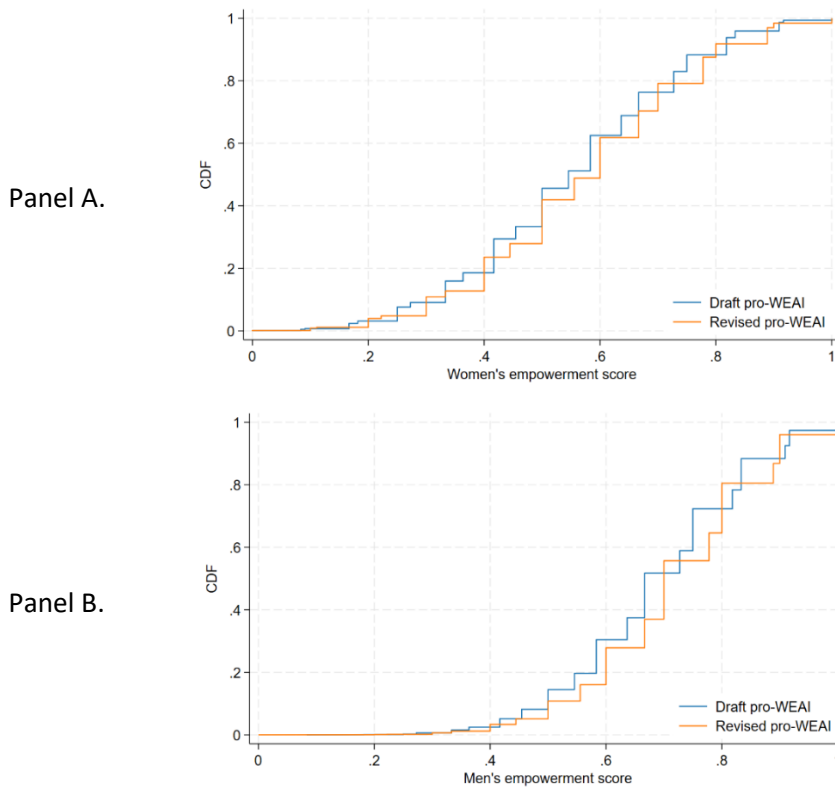
Comparing the alternative versions of pro-WEAI, we find slight, but statistically significant, differences. The 3DE and pro-WEAI scores are higher for the revised version. The GPI score is nominally the same. The mean intrahousehold inequality score is lower in the pilot version, and the share of households achieving gender parity lower in the revised version. The most noteworthy differences in outcomes are that the mean empowerment scores for women and men are higher for the revised version, while the shares of women and men achieving empowerment are lower. This suggests that the changes made to revised pro-WEAI may have disproportionately affected respondents at the top (or bottom) of the distribution.

The largest difference between the two versions of pro-WEAI is the sample size (Table 3). The revised version includes information from an additional 767 women and 375 men (8.5% and 4.8% of the sample) who are dropped during indicator construction for the pilot version due to incomplete information on the pro-WEAI indicators. The additional respondents retained in revised pro-WEAI can be attributed to the two indicators (respect among household members and membership in influential groups) that were dropped from pilot pro-WEAI, as well as minor changes made to the statistical code for calculating pro-WEAI.<sup>1</sup>

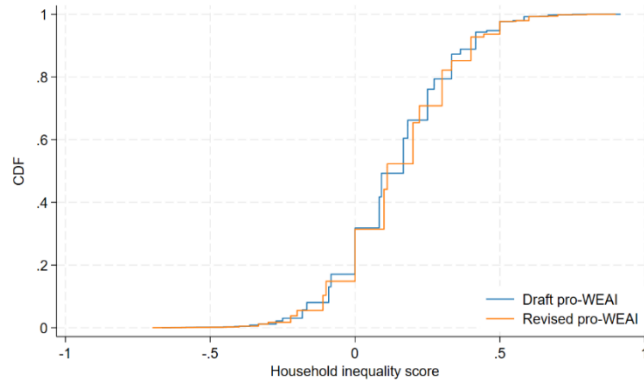
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<sup>1</sup> Our data do not allow us to thoroughly address the attribution of the sample size differences to missingness in respect among household members and membership in influential groups due to household composition vis-à-vis missingness due to other reasons.

To further assess the extent of differences between the pilot and revised versions of pro-WEAI, Figure 1 compares the cumulative distribution functions (CDFs) for women's and men's empowerment scores (Panels A and B) and the intrahousehold inequality score (Panel C). Visually, the CDFs are quite similar, and no distribution appears to dominate the other. We confirm this by conducting Wilcoxon signed-rank tests (Wilcoxon 1945) and fail to reject the null hypothesis that the CDFs are the same at the 1% level for all three metrics. Thus, despite the mean differences in Table 1, the distributions of the empowerment scores and intrahousehold inequality score generated by the revised and pilot versions are not, in fact, significantly different from each other.



Panel C.



**Figure 1. Cumulative distributions functions for women’s and men’s empowerment scores and the intrahousehold inequality score for pilot and revised pro-WEAI**

**Source:** Pooled baseline and endline data from AVC (N = 1985), FAARM (N = 1456), Grameen (N = 1454), JP-RWEE (N = 3234), SE LEVER (N = 6,459), and WorldVeg (N = 2786).

The similarities between pilot and revised pro-WEAI are further supported by rank correlation analysis of the empowerment scores and intrahousehold inequality scores. Table 4 shows the Spearman and Kendall tau-b rank correlation coefficients. Both coefficients are uniformly positive and high, indicating high concordance between the two versions of pro-WEAI.

**Table 4. Correlation between empowerment scores and intrahousehold inequality score for pilot and revised pro-WEAI**

|                                 |          |       |
|---------------------------------|----------|-------|
| Women’s empowerment score       | Spearman | 0.907 |
|                                 | Kendall  | 0.787 |
| Men’s empowerment score         | Spearman | 0.885 |
|                                 | Kendall  | 0.766 |
| Intrahousehold inequality score | Spearman | 0.903 |
|                                 | Kendall  | 0.782 |

**Source:** Pooled baseline and endline data from AVC (N = 1985), FAARM (N = 1456), Grameen (N = 1454), JP-RWEE (N = 3234), SE LEVER (N = 6,459), and WorldVeg (N = 2786).

**Note:** Weighted by inverse project sample size. Only includes respondents with complete information on the indicators.

### Comparing empowerment indicators

While comparison of aggregate empowerment outcomes across versions is broadly useful, differences in aggregate outcomes can mask differences at the indicator level if, for example, there are countervailing differences amongst indicators. Such differences may be uncovered by comparing the uncensored

adequacy headcount ratios for the indicators, as shown in Table 5. Overall, four indicators statistically significantly differ across versions: autonomy in income (men only), self-efficacy, input in livelihood decisions (women only), and ownership of land and other assets. Given that the autonomy in income indicator has identical definitions in both pilot and revised pro-WEAI, the observed difference can be attributed to changes in sample size due to the exclusion of membership in influential groups and respect among household members from revised pro-WEAI. For self-efficacy, recall that to reduce redundancy and interview fatigue, the self-efficacy survey module was reduced from 8 questions in pilot pro-WEAI to 4 questions in revised pro-WEAI. In Table 5, we see that this change leads to an increase (roughly 8 percentage points) in the shares of women and men adequate in the indicator. Nonetheless, the new headcount ratios remain within the same general range as the other indicators. For input in livelihood decisions, the inclusion of non-agricultural activities in the adequacy definition for revised pro-WEAI results in a slight decrease (roughly 1 percentage point) in the share of women adequate in the indicator. Thus, while the adoption of a broader definition of adequacy for this indicator is important conceptually—particularly in the context of rural transformation—in practice, it has little impact on adequacy levels within our sample. Lastly, the change in the adequacy definition for ownership of land and other assets, which no longer differentiates between small and large assets, results in an increase in the share of women adequate in the indicator and decrease in the share of men. This can be attributed to differences in sample sizes and also in the types of assets typically owned by women and men in the sample, specifically that women are more likely than men to own only small assets, such as poultry, pigs, or goats. For the remaining indicators, for which the adequacy definitions were unchanged between pilot and pro-WEAI, the observed differences are not statistically significant.

**Table 5. Uncensored adequacy headcount ratios for empowerment indicators for pilot and revised pro-WEAI**

| Indicator          | Pilot pro-WEAI |       | Revised pro-WEAI |       | Difference<br>(Revised – Pilot) |         |
|--------------------|----------------|-------|------------------|-------|---------------------------------|---------|
|                    | Women          | Men   | Women            | Men   | Women                           | Men     |
| Autonomy in income | 0.540          | 0.630 | 0.538            | 0.613 | -0.003                          | -0.017* |

|  |       |       |       |       |          |          |
|--|-------|-------|-------|-------|----------|----------|
| Self-efficacy  | 0.537 | 0.673 | 0.620 | 0.755 | 0.083*** | 0.082*** |
| Attitudes about domestic violence                    | 0.518 | 0.687 | 0.521 | 0.686 | 0.004    | -0.002   |
| Input in productive/livelihood decisions             | 0.723 | 0.766 | 0.709 | 0.761 | -0.014*  | -0.005   |
| Ownership of land and other assets                   | 0.824 | 0.993 | 0.861 | 0.990 | 0.037*** | -0.004*  |
| Access to and decisions on credit/financial services | 0.523 | 0.648 | 0.526 | 0.650 | 0.003    | 0.002    |
| Control over use of income                           | 0.458 | 0.649 | 0.472 | 0.654 | 0.014    | 0.005    |
| Workload/balance                                     | 0.396 | 0.717 | 0.407 | 0.717 | 0.011    | 0.000    |
| Visiting important locations                         | 0.601 | 0.731 | 0.605 | 0.728 | 0.004    | -0.003   |
| Respect among household members                      | 0.579 | 0.673 |       |       |          |          |
| Group membership                                     | 0.578 | 0.565 | 0.582 | 0.561 | 0.004    | -0.004   |
| Membership in influential groups                     | 0.412 | 0.430 |       |       |          |          |

**Source:** Pooled baseline and endline data from AVC (N = 1985), FAARM (N = 1456), Grameen (N = 1454), JP-RWEE (N = 3234), SE LEVER (N = 6,459), and WorldVeg (N = 2786).

**Note:** Weighted by inverse project sample size. Only includes respondents with complete information on the indicators. The uncensored headcount ratio reflects the percent of respondents who are classified as inadequate in the indicator. \* p < 0.10, \*\* p < 0.05, and \*\*\* p < 0.01.

### Comparing estimated impacts on aggregate empowerment outcomes

Next, we investigate differences in the ability of A-WEAI, pilot pro-WEAI, and revised pro-WEAI to detect impacts on empowerment. We consider the aggregate empowerment outcomes presented in Table 3 and the individual indicators that comprise each index. We generate impact estimates for each measure using simple difference-in-difference estimation utilizing baseline and endline data from six GAAP2 projects and controlling for respondents' age, education, and sex. Notably, we do not discern between treatment arms in these estimations, but rather broadly consider all treatment arms as a whole. In doing so, our aim is not to assess the extent to which the GAAP2 projects did or did not empower women and men, which is discussed in Quisumbing et al. (2022), but rather, to assess the sensitivity of the impact estimates to the choice of index.

Figure 2 compares estimated impacts on the aggregate empowerment outcomes. The estimates are broadly similar when compared across indices, with a few exceptions. The starkest differences occur between A-WEAI and pro-WEAI. We observe statistically significant differences between the estimated impacts on men's empowerment score for A-WEAI and either version of pro-WEAI, and similarly,

between the estimated impacts on men's empowerment status for A-WEAI and either version of pro-WEAI. Otherwise, none of the observed differences—including those between pilot and revised pro-WEAI—are statistically significant.

Overall, pro-WEAI appears significantly more sensitive to detecting impacts on empowerment than A-WEAI. Impacts on women's empowerment score and empowerment status, i.e., a binary indicator of whether the respondent is classified as empowered, are statistically significant and positive for all three indices, and on men's empowerment score and empowerment status for all except A-WEAI. Impacts on the intrahousehold inequality score are statistically significant and negative (indicating a reduction in the gap between men's and women's empowerment scores) for all three indices. Impacts on gender parity status are statistically significant and positive for pilot and revised pro-WEAI, but insignificant for A-WEAI. In sum, pro-WEAI, regardless of version, registers statistically significant estimated impacts on all six aggregate empowerment outcomes, compared to three out of six for A-WEAI.



**Figure 2. Difference-in-difference impact estimates on aggregate empowerment outcomes across A-WEAI, pilot pro-WEAI, and revised pro-WEAI**

**Source:** Baseline and endline data from AVC (N = 1985), FAARM (N = 1456), Grameen (N = 1454), JP-RWEE (N = 3234), SE LEVER (N = 6,459), and WorldVeg (N = 2786).

**Notes:** Weighted by inverse project sample size. Thick and thin lines reflect the 10% and 5% confidence intervals, respectively. Only includes respondents with complete information on the indicators. Unless noted below differences between indices are not statistically significant.

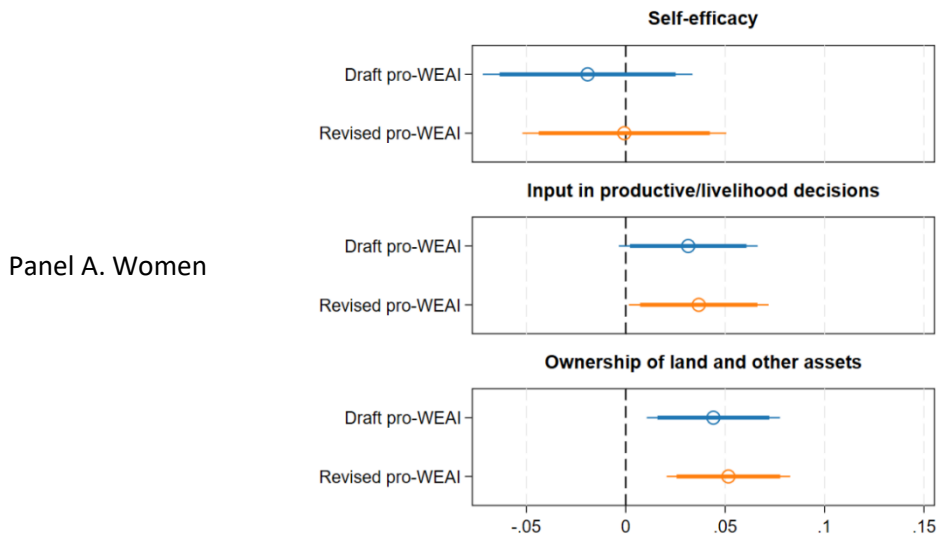
<sup>a</sup> Differences between A-WEAI and pilot pro-WEAI and between A-WEAI and revised pro-WEAI are statistically significant at the 5% and 1% levels, respectively.

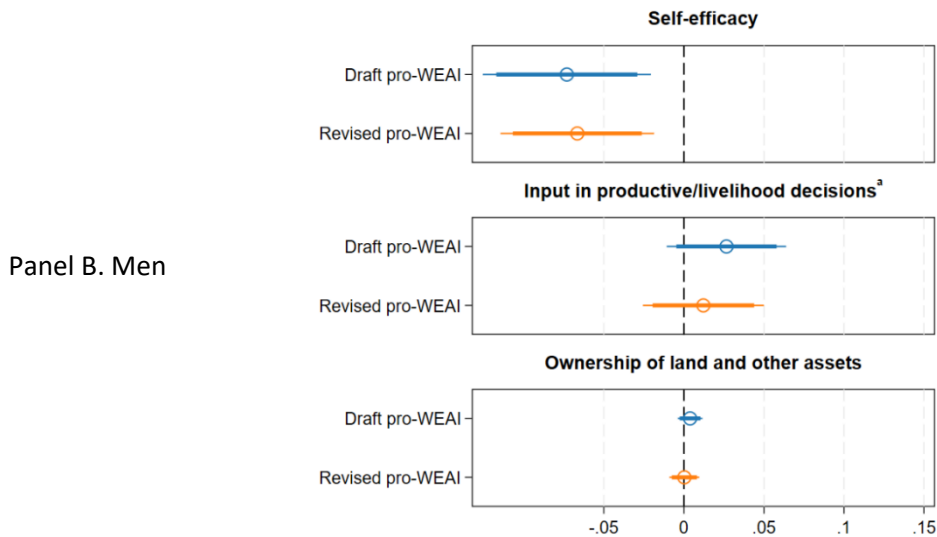
<sup>b</sup> Differences between A-WEAI and pilot pro-WEAI, between A-WEAI and revised pro-WEAI, and between pilot pro-WEAI and revised pro-WEAI are statistically significant at the 5% level, 1% level, and 5% level, respectively.

## Comparing estimated impacts on empowerment indicators for pilot and revised pro-WEAI

### WEAI

Although the estimated impacts on the aggregate empowerment outcomes do not substantially vary between pilot and revised pro-WEAI, aggregate outcomes may mask variation in estimated impacts among the three indicators for which the adequacy definitions differ between pilot and revised pro-WEAI: self-efficacy, input in productive/livelihood decisions, and ownership of land and other assets. To investigate this, we generate impact estimates for each indicator using the same difference-in-difference estimation procedure as above. Figure 3 shows the results. As above, only slight differences exist between the two versions. Both pilot and revised pro-WEAI register statistically significant positive impacts for women on input in productive/livelihood decisions and ownership of land and other assets and negative impact for men on self-efficacy. The only indicator for which the estimated impacts significantly differ is input in productive/livelihood decisions for men only. Otherwise, none of the observed differences are statistically significant.





**Figure 3. Difference-in-difference impact estimates on select indicators across pilot and revised pro-WEAI**

**Source:** Baseline and endline data from AVC (N = 1985), FAARM (N = 1456), Grameen (N = 1454), JP-RWEE (N = 3234), SE LEVER (N = 6,459), and WorldVeg (N = 2786).

**Note:** Weighted by inverse project sample size. Only includes respondents with complete information on the indicators. Only indicators for which the adequacy definition changed between pilot and revised pro-WEAI are shown. Thick and thin lines reflect the 10% and 5% confidence intervals, respectively. Unless noted below differences are not statistically significant.

<sup>a</sup> Difference is statistically significant at the 5% level.

In sum, while we observe considerable differences in the estimated impacts on the aggregate empowerment outcomes between A-WEAI and pro-WEAI, we observe very few differences in the estimated impacts on empowerment, whether measured at the aggregate or indicator level, between the two versions of pro-WEAI. Thus, the methodological improvements made to the revised version of pro-WEAI, resulting in substantially shorter interview times and fewer dropped observations, do not appear to have a significant effect on pro-WEAI's ability to detect impacts on empowerment.

## **Comparing impact estimates by weighting structure**

How to weight indicators is a key normative choice required in the construction of any index, which involves multiple considerations including feasibility, technical and statistical rigor, ease of communication, and legitimacy (Alkire et al. 2015). This involves reasoned assessment of the potential use of the index and how the choice of indicators and weights will best motivate action. Weights define the theoretical relationship between indicators and the construct being measured (e.g., empowerment) and have direct implications for an index’s ability to detect indicator-level changes. Pro-WEAI uses an explicit weight scheme, in which all indicators, regardless of domain, receive equal weight (Malapit et al. 2019). The motivations for this choice include ease of construction, comparability, and communication. The weights associated with each indicator in pro-WEAI remain the same regardless of where or when data are collected and are, thus, easily compared across contexts. Moreover, equal weights are straightforward to describe and can be easily communicated to audiences irrespective of technical expertise.

As an alternative to the explicit weights used in pro-WEAI, implicit weights can be generated and assigned to indicators using a data-driven process. One example, increasingly used in impact evaluations as a solution to multiple hypotheses problems is inverse covariance weighting (Janzen et al. 2018; Haushofer and Shapiro 2016). Anderson (2008) proposes a generalized least-squares procedure to create a summary index of multiple related outcomes using inverse covariance weights, which highly correlated indicators receive less weight than uncorrelated indicators. This makes intuitive sense in the context of impact evaluation as it highlights program impacts on those indicators that most represent “new” information, relative to the information provided by highly correlated indicators. On one hand, the Anderson (2008) approach is more flexible than pro-WEAI. It does not require complete information for all indicators—indicators with missing information are ascribed lower weights—and can be applied to

both continuous and binary indicators. On the other hand, the procedure used to generate inverse covariance weights is, at least outwardly, more complex than pro-WEAI. Moreover, because the weights depend on the inter-indicator correlations present in the data, the same indicators may be weighted differently depending on when or where data are collected, which may limit comparability. These factors combine to make the Anderson (2008) approach more challenging to communicate to diverse audiences vis-à-vis the comparatively simple approach used in pro-WEAI. Nonetheless, inverse covariance weighting represents a reasonable alternative to the equal weighting used in pro-WEAI.

To further investigate the potential advantages of an inverse covariance weighting approach, we assess differences in the impact estimates produced using revised pro-WEAI depending on whether we weight indicators equally or using inverse covariance weights following the Anderson (2008) approach. We use the same simple difference-in-difference estimation procedure as above to generate impact estimates for each measure using baseline and endline data from 6 GAAP2 projects and controlling for respondents' age, education, and sex. The inverse covariance weights are generated using the *swindex* Stata command (Schwab et al. 2020). Figure 4 presents the results. The use of inverse covariance weights results in little change in the impacts on men's and women's empowerment scores and empowerment status. We observe no change in the statistical significance for any of these outcomes when switching from equal weights to inverse covariance weights, and the only statistically significant difference in impacts is for women's empowerment score. Differences in impacts are more dramatic for other outcomes. Switching from equal weights to inverse covariance weights leads to decreases in magnitude of the impacts on the intrahousehold inequality score and gender parity status. Whereas the impacts on both outcomes are statistically significant when estimated using equal weights, these impacts become statistically insignificant when estimated using inverse covariance weights. This suggests that despite the lack of statistically significant differences in the impacts on men's and women's empowerment scores and

empowerment status the two weighting approaches are not equivalent and, moreover, that pro-WEAI is not entirely robust to the choice of indicator weights.



**Figure 4. Difference-in-difference impact estimates on aggregate empowerment outcomes for revised pro-WEAI calculated with equal weights and inverse covariance weights (ICW)**

**Source:** Baseline and endline data from AVC (N = 1985), FAARM (N = 1456), Grameen (N = 1454), JP-RWEE (N = 3234), SE LEVER (N = 6,459), and WorldVeg (N = 2786).

**Notes:** Weighted by inverse project sample size. Only includes respondents with complete information on the indicators. Thick and thin lines reflect the 10% and 5% confidence intervals, respectively. Unless noted below differences between indices are not statistically significant.

<sup>a</sup> Difference is statistically significant at the 5% level.

<sup>b</sup> Difference is statistically significant at the 1% level.

Both weighting approaches merit consideration. The added flexibility of the Anderson (2008) approach is appealing, yet the “black box” nature of the approach makes it less compelling for use in pro-WEAI. Not only are equal weights simpler to use when calculating pro-WEAI, equal weights are better suited for consistent comparison across multiple projects (such as within a portfolio). Inverse covariance weights will vary depending on the distribution of adequacy among indicators within a particular sample and may not yield results that are generalizable across a project portfolio. These findings lend support to the current recommendation to calculate pro-WEAI using equal weights.

## CONCLUSIONS

In this paper, we discuss the evolution of pro-WEAI and present a revised version of the index. This version reflects our cumulative experience using pro-WEAI during the years since its launch, 2019-2023. We explain the reasons for dropping two of the pilot pro-WEAI indicators and the revisions to the adequacy thresholds of several indicators. We also empirically assess the implications of these changes for the overall measurement of project impacts on women's empowerment. Among the net results of these changes are an increase in data utilization (i.e., fewer dropped observations) and an estimated reduction in interview length by 10% (or 3.5 minutes) compared to the pilot pro-WEAI. These changes improve the applicability of pro-WEAI by ensuring that single-adult households are included in the analytic sample and reduce the costs associated with implementation.

While WEAI, A-WEAI and pro-WEAI were developed particularly for population-based and project impact assessment, they can also be valuable for other types of research. WEAI and A-WEAI have been used in numerous studies to examine relationships between women's empowerment and food systems outcomes, namely women's and children's nutritional outcomes, agricultural production, and life satisfaction (Myers et al. 2023) and to assess how factors such as household structure and position affect women's empowerment (Doss et al. 2022). The more refined conceptualization of empowerment and the additional indicators available in pro-WEAI can enhance such analyses, such as showing how freedom of movement can contribute to earning income.

The results of our empirical analyses, using longitudinal data from six GAAP2 projects in East and West Africa and South Asia, support these changes. We find that revised pro-WEAI performs well in comparison to both A-WEAI and pilot pro-WEAI. In comparison to A-WEAI, pro-WEAI—regardless of version—produces larger and more frequently significant impact estimates, indicating that pro-WEAI is more sensitive to detecting project impacts on women's empowerment than A-WEAI. In addition, we find

that pro-WEAI is largely robust to the changes made to the index since launch, based on various distributional and individual-level comparisons using pooled data and comparison of impact estimates.

Finally, we assess the robustness of impact estimates produced by the revised pro-WEAI to the use of an alternative weighting scheme, namely inverse covariance weights as proposed by Anderson (2008). Despite small differences in the magnitude of impact estimates, we stand by the current recommendation for calculating pro-WEAI using equal weights due to its simplicity and comparability. The small differences in the magnitude of impact estimates across versions of pro-WEAI and different weighing schemes suggest that this multi-year project has succeeded in accomplishing its twin objectives of developing an index that implementors find useful for detecting impacts on outcomes of interest within the typical time frame of agricultural development projects, and building an evidence base on what contributes to women's empowerment.

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## APPENDIX

**Table A1. Adequacy cutoffs used in revised pro-WEAI**

| Indicator   | Definition of adequacy   | Difference relative to pilot version  |
|---|--|---|
| <b><i>Intrinsic Agency</i></b>                          |  |   |
| Autonomy in income                                      | Identifies with the autonomous motivation vignette AND does NOT identify with BOTH the external motivation and introjected motivation vignettes  | No change in cutoff   |
| Self-efficacy   | "Agree" or greater, on average, with self-efficacy questions (total score $\geq 16$ )  | Module reduced from 8 questions to 4 questions; total score required for adequacy reduced adjusted proportionally, but cutoff remains conceptually the same |
| Attitudes about intimate partner violence against women | Believes husband is NOT justified in hitting or beating his wife in ALL 5 scenarios:<br>1) She goes out without telling him<br>2) She neglects the children<br>3) She argues with him<br>4) She refuses to have sex with him<br>5) She burns the food  | No change in cutoff   |
| <b><i>Instrumental Agency</i></b>                       |  |   |
| Input in livelihood decisions                           | Meets at least ONE of the following conditions for ALL agricultural and non-agricultural activities they participate in<br>1) Makes decisions solely<br>2) Makes decisions jointly and has at least SOME input into decisions<br>3) Feels could make decision if wanted to at least a MEDIUM extent  | Cutoff expanded to include non-agricultural activities  |
| Ownership of land and other assets                      | Owens, either solely or jointly, at least ONE of the following:<br>1) Land<br>2) At least THREE categories of assets   | Removed distinction between small and large categories of asset   |
| Access to and decisions on financial services           | Meets at least ONE of the following conditions:<br>1) Belongs to a household that used a source of credit in the past year AND participated in at least ONE sole or joint decision about it<br>2) Belongs to a household that did not use credit in the past year but could have if wanted to from at least ONE source<br>3) Has access, solely or jointly, to a financial account | No change in cutoff   |
| Control over use of income                              | Has at least SOME input in decisions related to the use of BOTH income and output from ALL agricultural activities they participate in AND at least SOME input in decisions related to the use of income from ALL non-agricultural activities they participate in  | No change in cutoff   |
| Work balance  | Workload of less than 10.5 hours per day, where workload is defined as time spend on paid and unpaid work as a primary activity + (1/2) time spent on childcare as a secondary activity  | No change in cutoff   |
| Visiting important locations                            | Meets at least ONE of the following conditions:<br>1) Visits at least TWO locations (urban area, market, family/relative) at least ONCE PER WEEK<br>2) Visits least ONE location (health facility, public meeting) at least ONCE PER MONTH   | No change in cutoff   |
| <b><i>Collective Agency</i></b>                         |  |   |
| Group membership  | Active member of at least ONE group  | No change in cutoff   |

## Calculating pro-WEAI

Below we describe the steps involved in calculating pro-WEAI, 3DE, and GPI. Further guidance can be obtained online at the WEAI Resource Center (<https://weai.ifpri.info/>).

### ***Three Domains of Empowerment Index (3DE)***

The 3DE measures empowerment at an individual level. Respondents are classified as either adequate or inadequate in a given indicator by comparing their responses to the survey questions with a given threshold. Respondents' empowerment scores are calculated as the weighted average of their adequacy status in each of the 10 indicators, where all indicators receive equal weight. Respondents are then classified as either empowered or disempowered based on whether their empowerment score meets or exceeds a threshold of 80% (or 8 out of 10 indicators), referred to as the empowerment cutoff.

Person  $i$  is considered adequate if his or her level of achievement,  $x_{ij}$ , in indicator  $j$  is equal to or greater than the adequacy cutoff,  $z_j$ , for the indicator, i.e.,  $x_{ij} \geq z_j$ . Person  $i$ 's inadequacy score, is calculated by summing the inadequacy status of all indicators, each multiplied by their corresponding weight, i.e.,  $c_i = \sum_{j=1}^{10} w_j \times g_{ij}$ , where  $w_j = 1/10$ . Person  $i$  is considered empowered if their inadequacy score,  $c_i$ , is less than or equal to the disempowerment cutoff,  $k$ , i.e.,  $c_i \leq k$ , when  $k = 2$ .

The 3DE is based on the Alkire-Foster methodology and reflects the percentage of women in the sample who are empowered and the mean empowerment score among disempowered women in the sample. Together these components reflect how widespread empowerment is within the sample, and how close disempowered women are to becoming empowered.

The 3DE is calculated using the following formula:

$$3DE = 1 - (H_p \times A_p).$$

$H_p$  refers to the disempowerment headcount ratio and is calculated as follows:

$$H_p = \frac{q}{n}$$

where  $q$  is the number of disempowered women in the sample and  $n$  is the number of women in the sample.  $A_p$  refers to the average inadequacy score of disempowered and is calculated as follows:

$$A_p = \frac{\sum_{i=1}^n c_i(k)}{q}$$

### **Gender Parity Index (GPI)**

The GPI measures empowerment at the household level, based partly on comparison of the empowerment scores of the respondent and her spouse, or the male respondent, in each household. Households are classified as achieving gender parity if either of the following conditions are true: (a) the respondent is empowered or (b) the respondent's empowerment score is equal to or greater than the male respondent's empowerment score. Thus, all empowered women are classified as having achieved gender parity.

The GPI is based on the Foster-Greer-Thorbecke Poverty Gap (Foster, Greer, and Thorbecke 1984) and measures two aspects of empowerment (at the household-level) in the sample: the proportion of households that achieve gender parity and the mean difference between men's and women's empowerment scores in households that lack gender parity. The GPI is calculated using the following formula:

$$GPI = 1 - (H_{GPI} \times I_{GPI}).$$

$H_{GPI}$  refers to proportion of households achieving gender parity and is calculated as follows:

$$H_{GPI} = \frac{r}{m},$$

where  $r$  is the number of households that lack gender parity and  $m$  is the number of dual-adult households in the sample.  $I_{GPI}$  refers to the empowerment gap and is calculated as follows:

$$I_{GPI} = \frac{1}{h} \sum_{i=1}^h \frac{c'_i(k)^M - c'_i(k)^W}{1 - c'_i(k)^M},$$

where  $c'_i(k)^W$  and  $c'_i(k)^M$  are the censored inadequacy scores of the woman and man, respectively, living in household  $i$  and  $h$  is the number of dual-adult households that lack gender parity.

### ***Pro-WEAI***

Pro-WEAI is the weighted average of index of the 3DE and GPI, where the 3DE receives 9/10 weight and the GPI receives 1/10 weight. These weights reflect the greater overall importance of individual empowerment. The smaller weight assigned to GPI acknowledges the importance of empowerment dynamics within the household, but also recognizes that the GPI can only be calculated in households where both men and women respondents are present.

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