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Indicators of Gendered Control Over Agricultural Resources: A Guide for Agricultural Policy and Research

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INTRODUCTION

Measuring gender gaps in agriculture

Although the importance of women's contribution to the agricultural sector in developing countries is now widely acknowledged, there is little systematic evidence on how gender gaps in control over resources have changed over time in response to agricultural policy and technological interventions. In particular, few large-scale, national-level studies examine these effects for developing countries. This is surprising in light of the pervasive impact of agricultural technology and policy innovation on gender differences in control over productive resources for agriculture. Women are farmers and agricultural laborers in every part of the world. They are often responsible for the storage and processing of agricultural products. In some parts of the world, they play a key role in marketing crops. In almost all contexts, they play a central role in ensuring household food security, a goal that in turn affects crop choice and other agricultural decisions. Thus, every agricultural intervention is likely to impact women and, depending on the particular context of gender relations, impact them differently from men (Meinzen-Dick et al 2011).

This gap in research is an anomaly given the current pressure on agricultural research and development (R&D) to demonstrate and document reductions in gender inequality (FAO 2010; World Bank 2012; ISPC 2014). Although studies investigating gender gaps in control over agricultural resources have recently increased in number and scope, the absence of national level data means these studies are often based on small samples and descriptive rather than analytical. This limits our ability to predict how technology and policy-based innovations will affect gender inequality and how gender might affect choices about technology, land, labor, and other productive resources.

There is an unmet need for relatively simple, robust indicators that can be used for tracking short-to-medium outcomes of innovative technology, policy, and organizational interventions in an agricultural production process. This type of monitoring is especially needed to inform the design of interventions that may otherwise inadvertently change gender relations, and to provide timely corrective feedback if these generate or exacerbate gender gaps in unanticipated ways. This paper aims to guide the development of new indicators useful for seeking sharply focused feedback on a specific innovation in an agricultural production process. Specific innovation refers to the introduction of a new crop variety, livestock management regime, cropping system, resource conservation practice, or marketing arrangement, for example. Use of any of these can be constrained by gender inequality and can also alter it.

In this respect, this analysis differs from efforts to build comprehensive measures of women's control or empowerment that aggregate such effects. The paper argues that a change in one or more specific indicators of a gender gap in control over resources will not necessarily

correlate with a change in women's empowerment. Nonetheless, the indicators evaluated in this paper will be useful for monitoring whether an innovation in the agricultural production process is on track toward reducing gender equality and increasing the well-being of women and men.

The development of suitable indicators for this purpose faces a number of difficulties. Apart from a deficit of national-level data, there is a lack of agreement about the definition and measurement of indicators of gender gaps in control over agricultural resources. Developing robust indicators requires a level of conceptual clarity on causal pathways, on the definition of "control" over resources, and on appropriate data collection procedures – such as the question of who should be interviewed and whether the appropriate unit of analysis is an individual or household. Furthermore, the indicators and data collection methods chosen must strike a balance between conceptual clarity and logistical feasibility, particularly if the goal is to track the indicators over time.

Despite these difficulties, this paper explores the extent to which it is possible to define simple, robust indicators of gender gaps in use and control over resources that are likely to impact and be affected by agricultural innovation. To address this question, the paper makes the following contributions to the literature:

1. The identification of conceptual criteria of particular importance for developing robust, rich indicators of change in gender gaps and for evaluating their utility
2. Analysis of the robustness and feasibility of the gender gap indicators used by published studies, from which we generate a "menu" of potentially useful indicators
3. Recommendations for indicators based on evaluation of the menu of indicators identified in (2)
4. A review of sources of national-level data currently available and suggestions for data that need to be collected for constructing these indicators

The target audience for recommendations are researchers and development practitioners involved in designing and implementing agricultural innovations who need to monitor the direct and indirect impacts. These indicators are relevant primarily for users whose main objective is not the study of gender relations but who need evaluations of the effect of specific innovations on women's ability to control resources.

With this application in mind, the paper also proposes a short "dashboard" of indicators. The purpose of the dashboard is to provide feedback in the short term to ensure that innovators are alerted if gender gaps seem to worsen. The dashboard is intended to make it easy for innovators to re-evaluate the design and implementation of an intervention in an agricultural production process while it is in progress. By short term, we mean within no more than three to five years after the introduction of an innovation while there is still time for the intervention to self-correct, and before final impacts can be measured or even achieved. The dashboard we have compiled based on available data or existing data collection instruments has several

limitations, discussed later in the paper. However, based on the information in this paper, potential users could adapt this dashboard to serve their goals.

This analysis is motivated by the conviction that gender inequality matters for "evaluative" reasons, as a desirable end in itself (Sen 1999). Although it is tempting to argue that decreases in gender inequalities in turn result in greater adoption and use of agricultural innovations, the evidence on this is somewhat mixed, in part because the innovations themselves have often been generated without consideration of gender relations. Although this paper does not address gender inequalities in the development of technologies, , there is a need for greater consideration of women's needs and voices in the research and development process that leads to the development of agricultural technology.

What do we seek to measure?

The central question that that each of the recommended indicators will help answer is "What are the gender differences in control over key resources in the agricultural production process?" As discussed in detail in the next section, developing a refined notion of control is a necessary prelude to answering this question.

Definition of control in an agricultural production process

These indicators are restricted to understanding the agricultural production process, which are the transactions (human, financial, natural, political, and social) that occur on a farm or in a farming system supporting the agricultural livelihoods of men, women, and children. Land, livestock, common property resources such as water and forest resources, financial assets, and labor power are the key resources in this production process.[1] In each case, we then recommend indicators of women's ability to exercise rights over these resources as well as equivalent indicators for men's ability to exercise rights over these same resources; both are necessary to measure changing gender gaps. We also consider measures of women's and men's ability to control household income and participate in extra-household collective decision-making processes. These are important indicators of the extent to which individuals are able to influence the economic and political contexts that will shape their access to resources in the future (Meinzen-Dick et al 2011).

[1]This report uses the definition of data, metrics, and indicators employed in the 2014 ISPC report on Data, Metrics and Monitoring in CGIAR (ISPC 2014). Metrics are thus computed by aggregating raw data, while indicators are summary measures that reflect system properties. The ISPC report argues that metrics become indicators when they are used for decision-making; thus, "all indicators are metrics, but not vice versa."

Computation of gender gaps

For each indicator we recommend, we present two components: one that measures women's rights over that particular resource and one that measures men's. Table 1 illustrates how these two measures comprise the constituent elements of any measure of a gender gap although computation of the gender gap itself can take many forms. As summarized in Table 1, a gender gap can be expressed in terms of the ratio of the female measure to the male measure, the absolute difference between the male and female measures, or the percentage difference between them, with either the male or the female measure as the baseline.[2]

Table 1: Computing a gender gap indicator

Constituent measures:

1. Indicator of men's resource rights, for example, the proportion of men who own land, m1
2. Indicator of women's resource rights, for example, the proportion of women who own land, f1

As an example, if f1 = 10% or 0.1 and m1 = 50% or 0.5.

Forms of the gender gap:

1. A ratio of the female to male measure: f1/m1
where 1 signals no gender gap,
<1 indicates a gender gap in favor of men, and
>1 indicates a gender gap in favor of women.
In this case: gap = 1/5 or 0.2.

2. The difference between the female and male measures: f1 – m1
where 0 signals no gender gap,
<0 indicates a gender gap in favor of men, and
>0 indicates a gender gap in favor of women.
In this case, gap = 0.1 – 0.5 = –0.4.

3. The percentage difference between the female and male measures, with the male measure as the base: 100* (f1 – m1)/m1
where 0 signals no gender gap,
<0 signals a gender gap in favor of men, and
>0 signals a gender gap in favor of women.
The size of the gender gap is normalized against the proportion of male landowners. In this case, gap = –80%.

4.The percentage difference between the female and male measures, with the female measure as the base: 100* (f1 – m1)/f1
where 0 signals no gender gap,
<0 signals a gender gap in favor of men, and
>0 signals a gender gap in favor of women.
The size of the gender gap is normalized against the proportion of female landowners. In this case, gap = –400%.

[2] For simplicity, we prefer the ratio of the female measure to the male measure, expressed as a percentage. This is a gender gap measure that is familiar in that it resembles the components of the UN Gender Inequality Index, while also being relatively easy to interpret.

Interpretation of gender gaps

Whatever the form of the final gender gap computation, a narrowing of the gender gap is not desirable if it is the result of a "race to the bottom" – when the gap is narrowed entirely because rural men are worse off, as, for example, when they lose control over resources. It is therefore important for researchers to establish a baseline and maintain data on the constituent elements of any gender gap calculation.

Decreasing gender gaps within agriculture (even where there is no "race to the bottom") does not necessarily imply an overall increase in women's empowerment. The debate is ongoing about the degree to which a feminization of the agricultural workforce is occurring in different parts of the world, but what is less controversial is the fact that agriculture across most of Asia, Latin America, and Africa is the "lesser half" of a diversified livelihood structure in which nonfarm work, often in urban and peri-urban areas, is key to mobility and income growth (Razavi 2009). Thus, women's increasing control over agricultural resources and decision-making may not imply that they necessarily have a greater voice or power in the local or national economy.

In this respect, our goal is complementary to, but distinct from, recent projects such as the Women's Empowerment in Agriculture Index (WEAI), which creates a single index of women's overall degree of empowerment in agricultural societies, both within and outside of agricultural production processes (Alkire et al 2013). We do not seek to measure overall empowerment but rather gender gaps in control over specific resources in the agricultural production process. For agricultural R&D, when designing and implementing specific interventions, such as the introduction of a new crop variety or livestock feeding regime, identifying an effect on aggregate empowerment may be difficult to detect and not very informative. For example, a decrease in aggregate empowerment correlated with the introduction of a new variety begs the question of whether gender differences in preferred varietal traits or access to seed, fertilizer, land, or extension training were the primary obstacle. Without information on specific gender gaps and their contribution to a particular outcome, it is difficult for to correct the intervention.

Thus, we are not proposing a single index, but rather a range of indicators along with criteria for evaluating the contexts in which they may work best. The type of monitoring and evaluation process we aim to support with recommended indicators needs to generate feedback about changes in gender equality in the short and medium term in order to self-correct. Therefore, the proposed indicators build on existing data and are both specific and sensitive to change in the short as well as medium to long term. As noted below, measures of the value (rather than quantity) of resources controlled by men and women may be especially well suited

to capturing changes in the short term, even if they remain logistically difficult to generate (Doss et al 2013).

In the following section, we begin by discussing the criteria that emerged out of the literature review as well as some of the potential challenges of trying to satisfy these criteria. We then apply these criteria to generate a set of recommended indicators and evaluate the extent to which they meet our various criteria.

CRITERIA FOR MEASURING GENDER GAPS IN RESOURCES

This section presents ten criteria derived from the literature review that can be used to evaluate the utility of indicators proposed for measuring gender gaps in control over resources used in an agricultural production process. Of these, five are conceptual while the remaining relate to issues of measurement. Conceptual criteria are important because the statement that a woman or man "has control over a resource" raises a number of difficult questions. Do we mean this individual is the only one with control? Or do we mean this individual has shared (or joint) control? (Deere and Doss 2006). And, what do we mean by control, since use, control, and ownership are related but somewhat different sets of rights (Meinzen-Dick et al 2011). Furthermore, rights that exist "on paper" (de jure rights) may not always exist on the ground (de facto rights). If we want to measure gender gaps in such rights, there is also the complication that rights over resources have traditionally been measured at the level of the household and that the focus has often been on the physical quantity, rather than the value, of resources (Doss et al 2015). In this section, we begin by discussing the conceptual criteria that we apply to identify robust indicators of such gender gaps.

Collecting the data for indicators that meet these criteria raises measurement issues. We therefore also develop and discuss criteria for evaluating indicators against these measurement issues. For example, given the complex conceptual issues that are raised by an attempt to measure gender gaps in agricultural resources, more nuanced indicators are also likely to be somewhat resource intensive to construct and track over time. Our aim is to minimize the resource intensity of data collection to the extent possible, but some indicators perform better on that criterion than others.

We recommend only indicators that meet at least the first four conceptual criteria and the first two measurement criteria summarized in Box 1. As discussed in the review of the literature that follows in the next section, and is summarized in the tables in Appendix 2, we evaluate our indicators against all of the criteria and note the degree to which these criteria are met.

Box 1. Criteria for evaluating indicators of gender gaps in control over productive resources

Conceptual issues: Does the indicator of a gender gap

- capture the differences between control and use rights: where rights to control (to manage, exclude others or alienate the resource) may not be the same as rights to use (to access the resource and withdraw the output)?
- capture de facto rights in preference to de jure rights?
- measure joint rights (shared among individuals but not necessarily equal) as well as sole rights?
- disaggregate rights and decision-making by sex of the respondent rather than by sex of the household head?
- measure the value of resources as well as (or instead of) the quantity of resources?

Measurement issues: Is the gender gap indicator based on

- quantitative data, with qualitative validation?
- data that can be readily collected at several different points in time?
- data that are easily replicable across sites, countries, or regions?
- data that are not resource intensive to collect because they are already being collected at scale or could feasibly be included in a large-scale survey?
- short- or medium-term outcomes (as distinct from impacts that take a long time for measureable change to occur), especially gaps related to use and to the value of resources?

1. Does the gender gap indicator capture layered rights: use, control, and ownership?

In the conventional economics literature, ownership is equated with individual property rights, in particular the rights to exclude and alienate. The argument made is that such rights maximize the incentives of resource owners to invest in and improve the productivity of their resources. However, in a paradox often noted by feminists, the advocacy of this system appears to end where the household begins (Agarwal 1994, 1997). Economists have been content to measure ownership at the household rather than individual level, and to assume that the (male) household head is the owner of such property (Deere and Doss 2006). And, while in the last two decades the notion of the "unitary household" has fallen out of favor in mainstream analyses of consumption and labor allocation, few data exist on the intra-household distribution of wealth and property. In agricultural settings, we have learned a great deal about women's participation in agricultural labor (as family and wage workers), but far less about their use of and control over other productive resources, including the labor of others.

More recently, a small body of literature has begun to examine the extent and implications of intra-household gender gaps in asset ownership. These studies show that women across the world tend to own fewer assets and own assets of lower value than men (Deere and León 2001, Doss et al 2014b). However, this literature also shows that traditional measures of asset ownership collected at the household rather than intra-household level can

sharply underestimate the extent to which women claim and exercise rights over productive assets, including in agriculture (Twyman et al 2015). The lack of data on such rights at the intra-household level then means that agricultural intervention programs may not be reaching household members with the de facto ability to affect the uptake of new agricultural production technologies.

Conceptually, thinking about the distribution of property rights within households requires thinking about the layering of rights since different members of the household may have different rights ranging from use to control, and to the right to alienate (Johnson et al 2015). Thus, the husband may claim the right to sell or rent the home, but the wife uses and may participate in decision-making about improvements to the home. She may thus have substantial incentives to maintain and upgrade her home even in the absence of rights to alienate and exclude. Indeed, efforts to maintain and upgrade the home may fail without her cooperation and active participation.

These critiques of mainstream understandings of property rights echo those in the literature on common pool resources. There too, layers of rights exist across different community members, producing incentives for resource maintenance and improvement that do not always align with the predictions of mainstream economists. The literature on gendered rights over resources thus draws upon the framework developed in this literature on common pool resource management even if most of that latter literature does not itself enter within the walls of the household (Doss and Meinzen-Dick 2015).

Schlager and Ostrom (1992) identify rights over resources as extending from (i) entry or access (physically accessing the resource, for example: stepping onto the land), (ii) withdrawal (the ability to use the output from the resource), (iii) management rights or decision-making about the use of the resource (including crop choice and choice of agricultural technologies), (iv) exclusion rights, and (v) rights of alienation (decision-making about the sale, lease, transfer, or bequeathing of the resource).

They point out that in most cases entry rights are bundled together with withdrawal rights to comprise operational rights that help allocate current benefits from resource use. However, the remaining three rights they classify as collective choice rights that allow holders of such rights to determine future operational rights. From the mainstream efficiency perspective, the latter may be decisive in shaping incentives to improve and maintain the resource, as opposed to allowing it to degrade. From an equity perspective, the latter also more strongly shape the ability to accumulate wealth and thus the degree of wealth inequality, which is a key consequence of differential rights to assets and resources.

We follow this literature in grouping together entry and withdrawal rights as “use or access” rights and rights to make decisions about management, exclusion, and alienation as “control” rights. In the case of physical resources such as land and livestock, data on patterns

of labor allocation can help us obtain a sense of a person's "entry" rights of access to such resources. Withdrawal rights, on the other hand, require not only the ability to access output from the resources (for example, harvest the crop) but also the ability to exercise some measure of influence over how the output is used (whether to sell or eat the harvest, for example).[3] In this paper, we therefore propose using indicators of labor use to track some patterns of access to/use of land and livestock while also proposing indicators of control over the resource output to capture withdrawal rights.

Thus, "control rights" capture the degree to which women and men are able to exercise management, exclusion, and alienation rights over the resource itself, and we propose some indicators of control rights across different resources. Throughout the paper, we treat these "control rights" as more decisively linked to gender equity and potential long-term changes in the gender wealth gap.

The term "ownership" in the Schlager and Ostrom formulation refers to the existence of all five kinds of rights bundled together. Thus, a woman may be said to own land if she, individually or jointly, holds all these five rights to land. However, as Doss et al (2013) point out, in different contexts, women and men may use the word ownership to address varying subsets of these rights. In particular, the right to alienate may not exist in regions where markets for resources are thin or nonexistent, so "ownership" may refer only to use, management, and exclusion rights. The term ownership is often used in such contexts to mean formally recognized use and control rights (usually including some rights to exclude others), that may or may not be accompanied by the right to alienate the land without the agreement of others.

In thinking about indicators that both build upon existing data sets but are also conceptually clear, we thus face something of a conundrum. Although we conceptualize ownership as the "super set" of these five rights, this more specific definition prevents us from using many existing data sets that are building questions about ownership into their surveys without specifying which of the rights the term refers to. In some contexts, such surveys may be the only information available about the intra-household distribution of rights over productive resources. Furthermore, these indicators, while varying in meaning, do capture what anthropologists would call "local knowledge" about ownership and thus perhaps describe the de facto situation on the ground.

One recommendation that emerges from this is the need for indicators of use and control that do not use the word ownership per se. However, we do want to make use of available data on ownership, even while urging greater attention to these conceptual issues on the part of those developing such data sets. Thus, where indicators of "ownership" are available, we do

[3] This means that slave and wage laborers engaged in harvesting would not have withdrawal rights by this definition.

recommend using them, with the caveat that such indicators may not be easy to aggregate across contexts, since they may incorporate very different bundles of rights in different contexts.

2. Does the gender gap indicator measure for de facto as against de jure rights?

In developing countries, weak states and the co-existence of traditional and modern constitutional legal systems often mean that there can be considerable divergence between documented claims that can hold up in formal courts of law and what the community accepts as a legitimate claim or right. A "legally pluralistic" approach that does not rely only on documented formal claims of ownership is thus necessary to understand ownership as it exists on the ground (Doss et al 2014a). Although the evidence suggests that women have fewer ownership rights than men to most kinds of productive assets across the world, it is not clear which system, customary or statutory constitutional, is more biased against women. In some contexts, such as traditionally matrilineal communities, custom may provide women with more ownership rights than formal legal systems, while in others the situation may be reversed.[4]

On the other hand, de facto access to resources may not match the patterns of ownership. Thus, a woman who owns land in her natal village may have little ability to use it after moving to her husband's village, while women without de jure rights to land may be able to use land owned by their husband's family (Hare et al 2007, Lin and Lixin 2006). De jure and de facto rights thus overlap but are not synonymous with each other.

From the perspective of understanding the gendered impact of agricultural interventions, it is useful to consider de facto rather than de jure claims. The recommended indicators are based on self-reported "subjective" survey responses rather than on "objective" evidence of documentation. This is not just a matter of pragmatics, but rather is grounded in the understanding that marginalized groups are unlikely to have official claims to resources and that efforts to work with such groups require us to acknowledge and validate the strength of their "informal" claims to resources (Doss et al 2014a. Johnson et al 2015).

3. Does the gender gap indicator capture sole as well as joint rights?

As discussed above, there is a literature on "collective rights" over common pool resources. Such "collective rights" exist where rights of use and control are vested in a community or a collective body such as a water user group, both existing as aggregates of member households (Meinzen Dick and Knox 1999, Ostrom 2003). Although collective rights imply some degree of jointness in the exercise of rights, rights are jointly claimed and exercised

[4] In both China and Rwanda, state-led allocation of land and regularization of land tenure appear to have been more favorable to women than custom may have been (Hare et al 2007, Ali et al 2011).

within the household as well. Most household assets are used and accessed by multiple members of a household, with patterns of use by each individual varying seasonally and/or with changes in the demographic composition of the household. This sharing of rights among individuals is what we mean here by "jointness" in rights.

Since women's access to assets is often mediated through their families, they are more likely to be joint rather than sole owners of assets (Johnson et al 2015). They are also more likely to participate in decision-making together with other family members rather than alone. In certain countries, the marital regime – whether there is community property or separation of property within the marriage – results in spouses owning property jointly even in de jure terms (Deere et al 2013).

As discussed below, we do not privilege individual or sole use and control of assets over joint use and control, given that the ultimate goal is one where women and men can participate as equals in the common project of ensuring the well-being of a household or community (Deere and Twyman 2012). We do emphasize, however, that jointness does not mean equality. To a greater degree than joint rights, sole rights may improve exit options in ways that enhance intra-household bargaining power (Agarwal 1997). Nevertheless, indicators that do not measure joint rights to assets fail to capture the lived reality of gendered patterns of access to resources. In the resource-scarce agricultural contexts of the developing world, joint and collective rights may also be the only feasible way to ensure broader access to assets for marginalized populations (Rao 2006, Agarwal 2010b). We recommend that data be collected on sole as well as joint use and control of resources so that researchers can combine them when appropriate but also be able to analyze any differences between the two.

4. Does the gender gap indicator disaggregate rights and decision-making by sex of the respondent rather than the household head?

As the social construction of biological difference, gender is a relational concept that cannot be understood by studying either men or women in isolation from each other. The extensive focus on female-headed households in prior research on agricultural contexts is thus problematic in that it does not help us grasp the nature of gendered rights within the dual-headed households within which a majority of women live (Deere et al 2012). We use the language of comparing dual-headed and single-headed households (rather than female- and male-headed) and urge the development of indicators that look within both. In this review, we largely exclude studies that simply compare female-headed households with male-headed households.

The definition of rights we use is measured on the ground by a respondent's ability to influence decision-making about the use of the resource and/or the output from the resource.

Almost all the indicators we recommend thus require data on decision-making by women and men separately. The Demographic and Health Surveys (DHS) module on decision-making about expenditure on daily goods and major goods, mobility, and health is an important example of an ongoing attempt to collect data on decision-making (Subaiya and Kishor 2008). The recent WEAI index also collects data on decision-making about agricultural production.

In the case of the DHS, however, questions on decision-making are answered only by female members of the household. We argue here that surveys on decision-making should comprise male and female respondents within both dual- and single-headed households. Gender gaps in the exercise of rights over resources require data on decision-making from both men and women. Extending surveys on decision-making to male and female respondents is thus a key recommendation we make here.

In the interests of logistical feasibility, we do not recommend the more resource-intensive process of asking men and women within the same household to answer these decision-making questions. We acknowledge that this would produce a much richer picture of intra-household dynamics, but our goal here is to develop feasible indicators of gender gaps in control over resources rather than to fully probe the intra-household dynamics of cooperation and conflict. The Gallup/World Bank Findex survey provides a good example of the kind of sampling methodology we consider practical. The survey collects data via telephone and face-to-face interviews on the financial usage of one respondent from each household surveyed. This sampling strategy therefore ensures the inclusion of women respondents.

We should note that, as Deere and Twyman (2012) point out, an implicit assumption in many studies of decision-making is that, when a woman has the sole or final say in an aspect of decision-making, this represents a greater degree of female empowerment. On the other hand, depending on the local gender division of labor, women having the final say in certain zones of decision-making can simply be a sign that the household follows gender norms that may be quite regressive for women overall. The desired goal may instead be joint decision-making in which the members of the household participate as equals. Consistent with the rest of the paper, therefore, we consider jointness in decision-making to be a legitimate indicator of female voice.

One approach is to provide response options to decision-making questions that include not just “alone,” “jointly with someone else,” and “entirely by someone else” but an additional category of “not an area of decision-making because we are following norms”. This option may capture the areas of decision-making that default to men and women due to custom, rather than representing enhanced bargaining power Holvoet (2005).[5] It is not clear yet how logistically

[5] Holvoet (2005, 79) reports that “the category of ‘norm-following’ was less obvious as none of the interviewees literally used the notion of ‘norm-following.’ Rather, they responded in such terms as ‘nobody’; ‘it is natural, we do not need to take a decision on that’; ‘we do not really decide on that, we just do like we always have done’; ‘this is what we always do, we do not need to take a decision on this’; ‘it is normal, everybody/nobody does.’”

feasible such an option would be across locations, so we mark it as a possibility for consideration in the future.

5. Does the gender gap indicator measure the value of resources as well as (or instead of) the quantity of resources?

Technology-based innovations are likely to change the relative returns to different productive assets and thus their value. In the case of land, without substantial land reform policy from the government, patterns of control over land are deeply rooted in inheritance regimes and are unlikely to change easily. Allocations of labor are also often the result of long-standing norms that govern the gender division of labor. Although the prices of resources are also influenced by deep-rooted forces of tradition and/or discrimination, the introduction of new technologies may more easily change the value of resources and thus gender *value* gaps in resources, for better or for worse. From a tracking perspective, shifts in value may thus be more sensitive indicators of technological impacts.

As we discuss below, such changes in resource value are difficult to measure, particularly in contexts in which markets are thin. As a result, indicators of such changes may not always be feasible. Nevertheless, we urge greater consideration of such indicators by data collection agencies given their relative sensitivity to changes in the wider socioeconomic context.

6. Is the gender gap indicator based on quantitative data, with qualitative validation?

The need to measure change over time favors the creation of a quantitative indicator. All our recommended indicators are quantitative for this reason. However, since these are quantitative measures based on household survey instruments, they require prior qualitative work both to verify the relevance of the indicator in that particular context and to validate the results of the quantitative measures. Qualitative work is also required to understand exactly what it means that the indicator has changed and to disentangle alternative interpretations of some of these changes.

7. Is the gender gap indicator based on data that can be readily collected at several different points in time?

Most of the current empirical studies on gender gaps are small-scale studies that do not claim to be nationally representative. Although an understanding of the specificities of the local is extremely important, there is value in having some indicators that are produced at the national level to allow for comparisons between countries. This is particularly true when agricultural technologies are introduced on a large scale and benchmarks to track progress are also required at that scale. In this paper, we focus on indicators that can be “scaled up” even as we

acknowledge the limitations of such indicators and recommend local-level qualitative work to tease out what changes in these indicators truly mean on the ground.

As discussed earlier, it is very important for an indicator to facilitate tracking gender gaps over time. Simple, robust national-level data that can be integrated into existing surveys can help accomplish that goal.

8. Is the gender gap indicator designed to minimize data requirements?

One of our goals was to suggest indicators in forms that minimize the resource intensity of the data-gathering process. For example, we do not recommend indicators that require sampling men and women within the same household despite the richness of the data generated. We also discuss relatively simple forms of time-use surveys below.

We are especially interested in minimizing the need for additional primary data collection. Thus, one criterion in evaluating possible indicators is the potential for integration with existing forms of national and international data. Table 2 lists large household surveys that have this potential. In particular, we looked for indicators that used data that is or could be collected in the following existing international surveys: the DHS (Demographic and Health Surveys), the LSMS (the Living Standards Measurement Surveys), the WEAI (Women's Empowerment in Agriculture Index), and the Global Findex survey.

Table 2: List of national multi-year household surveys referred to in the paper

Name of survey	Agency administering the survey	Website
LSMS and LSMS-ISA	World Bank	http://go.worldbank.org/BCLXW38HY0
Demographic and Health Surveys (DHS)	The DHS Program	www.dhsprogram.com/
Women's Empowerment in Agriculture Index (WEAI)	IFPRI, USAID, and the OHPI	www.ifpri.org/topic/weai-resource-center
Global Findex Survey	World Bank	www.worldbank.org/en/programs/globalfindex

9. Is the gender gap indicator based on data that are easily replicable across sites, countries, or regions?

Replicability, or a degree of universality that would allow the indicator to be meaningful across contexts and across time, is also an important criterion. Although inter-country and intra-country regional differences are always important, we attempted to select indicators that minimize such differences. In some instances, this has meant choosing less specific versions of indicators. In other cases, such as the example of land ownership data above, we recognize

that replicability remains a challenge. In Appendix Table 2, we flag some possible problems with replicability that we anticipate in the indicators we have selected.

10. Is the gender gap indicator sensitive to short- and medium-term change?

In order for the indicators to help assess the impact of technological changes, a subset needs to be especially sensitive to early signs of setbacks or progress in the achievement of women's control over assets and decision-making. Since such evaluations occur within a few years, our goal was to identify a range of indicators, some of which could track short-term changes (3-5 years) and some medium- and long-term changes (more than 5 years). Developing such a range of indicators would also allow us to see whether any changes, for better or for worse, were limited only to the short run and reversed themselves in the long run.

Given that studies that measure changes across time do not yet exist in the case of most indicators we recommend, our analysis of the time sensitivity of indicators is based on our conceptual framework. This suggests that indicators related to use and to the value of resources are somewhat more likely to change in the short term than indicators of control and of the quantity of resources controlled. Most fundamentally, the more control over a particular resource is shaped by deep-rooted norms about gender, the less likely it is to change in the short run.

During the course of our literature review, we were struck by the paucity of studies that do indeed track indicators over time. Some efforts in this direction, such as the Findex and WEAI, are extremely promising, but many more are needed to generate a body of evidence on the relative time sensitivity of these indicators.

INDICATORS OF GENDER GAPS IN RESOURCE USE, CONTROL, AND OWNERSHIP

In this section, we recommend indicators for tracking gender gaps in the use or control of the following types of resources: land and livestock, water and forest common property resources, financial assets, labor, and "participation in collective action." The recommended indicators are summarized in Boxes 1–7 at the beginning of each section, followed by discussion of the rationale for each. All of these indicators are based upon population (rather than group) sampling methods.

All of these indicators were identified from an extensive literature review of small- and large-scale empirical studies, narrowed down by the application of key conceptual and measurement criteria as listed in Box 1. All the indicators satisfy the following three conceptual criteria from Box 1: they are based on the distinction between use and control rights developed above, they incorporate de facto joint as well as individual rights, and they are disaggregated by sex of the respondent rather than of the household head. In addition, all the indicators satisfy two measurement criteria from Box 1: they are all quantitative measures that are capable of being collected at multiple points of time. Table 1 in Appendix 2 presents the complete list of recommended indicators that meet all five criteria, along with quantitative formulae for calculating them from raw data. These formulae also incorporate the above-mentioned criteria.

Table 1, Appendix 2 also provides a summary of two important findings from the literature review discussed in detail below. First, the table notes any concerns expressed in the literature about the empirical validity of the link between the indicator and gender equality. For example, indicators based on group membership raise questions about the extent to which membership translates into influence that has a bearing on gender equality. Second, the table notes whether the recommended indicator has been used in a large-scale study and has therefore been tested. Although all of these indicators have been used in published research, most are found in small-scale studies that test the indicator in local contexts. Few indicators have been tested in large-scale national or regional studies.

Our indicators do vary in the degree to which they satisfy the remaining five criteria listed in Box 1. Only a few are based on measured value, rather than quantity, of resources. These are self-evident from the description and formulae provided. The indicators also vary in their degree of resource intensity, replicability, and time sensitivity. Table 2 in Appendix 2 evaluates the indicators on each of these three additional measurement criteria. We hope that this evaluation will help researchers develop their own subgroups of indicators based on the goals of their study/project.

Dashboard of indicators

Our target audience for recommendations is composed of researchers and development practitioners involved in designing or validating agricultural innovations who need to monitor the effect of specific changes they are introducing into an agricultural production process. These indicators are relevant primarily for users whose main objective is not the study of gender relations but who need evaluations of the effect of specific innovations on gender equality. With this application in mind, the paper proposes a “dashboard” of indicators that can provide feedback in the short term to ensure that innovators are alerted if gender gaps seem to worsen.

The dashboard of indicators presented in Table 5 is a subset selected from the full menu in Tables 3 and 4 on the basis of (a) sensitivity to change in the short run and (b) data already in existence or, if not, that can be collected by adding questions to existing surveys. The dashboard is intended to make it easy for innovators to re-evaluate the design and implementation of an intervention in an agricultural production process that is in progress and while there is still time to self-correct before final impacts can be measured or even achieved.

This classification shows that, even when we aim to provide a subset of indicators that can be easily used for monitoring changes in gender gaps, there is no quick way to go about this. Table 5 highlights that no data are already available in existing large-scale studies for time-sensitive indicators related to crucial gender gaps in land and livestock. There are ongoing efforts to add these to existing international surveys, but at this point they require primary data collection.

Table 5. Dashboard of time-sensitive indicators for which there is an existing data collection instrument

	Data already available	Data can be constructed using existing data collection instrument	Data provide short-term time sensitivity
Land			
The average sale value of the land owned by women compared with that owned by men,	No	GAGP	Yes
Proportions of women and men participating in decisions about the agricultural use of land	No	FAO, GAGP, WEAI	Yes
Livestock			
Proportions of women and men who own livestock (preferably by livestock type, for example: poultry, sheep and goats, cattle)	No	WEAI, GAGP	Yes
Livestock: proportions of women and men participating in decisions about sale or slaughter of livestock	No	WEAI	Yes
Water and forest			
Proportions of women and men able to access water/firewood/fodder/fish to the desired degree	No	WWAP is developing indicators for water	Yes
Number of hours (per week, per person) for women and for men in the household, spent on collecting water/firewood/fodder/fish (not disaggregated)	Yes	National time-use studies, UN Statistics Division	Yes
Finance			
Proportions of women and men who saved money in the last 12 months through a formal or informal institution (i.e., not "under the pillow")	FINDEX	FINDEX	Yes
Proportions of women and men who received a loan in the last 12 months from a formal or informal institution	FINDEX	FINDEX	Yes
Labor			
Female labor force participation rate and male rate in agriculture (denominator, size of agricultural labor force)	World Development Indicators	Yes	Yes
Female paid labor force participation rate and male rate in agriculture (denominator, size of agricultural labor force)	World Development Indicators	YES	Yes
Average hours of leisure for women and for men or proportions of women and men who report inadequate leisure time	National time-use surveys		
Income			
Proportions of women and men who participate in decisions to purchase daily goods	DHS	Yes	Yes

Literature Review and Discussion of Recommended Indicators

Resource type: land and livestock

As the most significant immovable asset that households in agricultural regions own, land has both material and symbolic importance, connecting landholders to a source of livelihood as well as to their lineage and culture. There is now a small but significant body of literature that addresses gendered patterns in ownership and, to a lesser extent, control over land. The relatively extensive literature on ownership of land in particular means that we include a separate section on indicators of ownership in the case of this resource.

Little work exists on what we term “use rights” (entry and withdrawal rights) in land. However, indicators of labor use, including those based on time-use studies, can give us a good sense of the extent to which women and men are physically accessing land and livestock and withdrawing output. We turn to these indicators of labor use later in the paper. Here, we add some indicators of decision-making about the output from the resource, an important aspect of withdrawal rights not revealed by patterns of labor use.

Access to land may be a requirement for participation in agricultural technology interventions. Such interventions have a direct impact on the value of land, which is often the most valuable asset rural households own. There is thus a very high likelihood that a gender-blind implementation of agricultural programs may serve to further widen intra-household wealth inequalities between men and women. The collection of data on the intra-household distribution of land must therefore be a part of any effort to track the gendered impact of an agricultural intervention.

In areas of water and land scarcity and/or inequality, livestock take on special importance as household assets that generate income, enhance food security, and serve as insurance in case of an income shock (Peterman et al 2014). Women are often responsible for the maintenance of livestock, particularly those housed close to the homestead such as poultry and vulnerable animals (such as those that are sick or injured), along with the processing of dairy products (FAO 2010). However, women are less likely than men to own livestock, particularly larger, more valuable livestock.

Agricultural R&D agencies are extensively involved in livestock breeding innovations in part because ownership of livestock is a way to raise income and improve nutritional outcomes for poor, landless households in arid regions (Njuki and Sanginga 2013). Indeed, given the entrenched patterns of land inheritance, livestock may actually prove to be easier for women to own and control than land (FAO 2010).

Box 2. Recommended indicators for gender gaps related to ownership, use, and control over land and livestock

Indicators of ownership:

Land:

- The proportion of women and the proportion of men who own land (solely or jointly, self-reported)
- The average area of land owned by women, same indicator for men
- The average potential sale value of the land owned by women, same indicator for men

Livestock:

- The proportion of women who own livestock, same indicator for men
- The average Total Livestock Units owned by women, same indicator for men
- The average potential sale value of livestock owned by women, same indicator for men

Indicators of use rights:

Land:

- The proportion of women who participate (solely or jointly) in decisions about the use of crops (sale versus own consumption), same indicator for men

Livestock

- The proportion of women who participate (solely or jointly) in decisions about the use of daily livestock produce (such as milk, eggs), same indicator for men
- The proportion of women who participate (solely or jointly) in decisions about the use of meat (when livestock are slaughtered), same indicator for men

Indicators of control rights:

Land:

- The proportion of women participating (solely or jointly) in decisions about the "agricultural use of land", same indicator for men
- The proportion of women participating (solely or jointly) in decisions about
  - crop choice
  - choice of inputs
  - timing of cropping
  - sale or transfer of land

  (for at least one crop or plot if there are multiple crops or plots).

  Same indicator for men

Livestock:

- The proportion of women participating (solely or jointly) in decisions about sale, transfer, or slaughter of livestock, same indicator for men

Indicators of ownership of land

Across the world, a growing body of literature shows that women are less likely than male members of their households to own land and even less likely to own high-quality land (Deere and Doss 2006). The feminist literature on gender and land rights, pioneered by the

work of Agarwal (1994) and Deere (Deere and León 2001), suggested that women's ability to own land may improve their bargaining power within the household while also expanding their livelihood opportunities more generally. A number of recent studies have attempted to test this hypothesis using small data samples.

Doss et al (2015) lay out some of the widely used indicators of gender asset gaps in land ownership for Africa. The most common measure reported in their review of studies on women and land ownership in Africa is the proportion of women/men who self-report owning land jointly or individually. Reviews of studies of gender and land rights for Asia and Latin America also show that this is the most common indicator used (Kieran et al 2015, Deere et al 2012).

These reviews all note the paucity of nationally representative data on even this "incidence" indicator. Although the DHS does ask about the incidence of land ownership, it does so for only one woman of reproductive age per household. The LSMS provides a more complete listing of both whether and how much land is owned by each household member.

Doss et al (2015) also point out that, in most of the studies they reviewed, the term ownership was used when the survey actually asked about the landholder/manager. As discussed below, we treat land management as an aspect of control rights and urge greater attention to the difference between these terms. Deere et al (2012) point out other discrepancies in the country-level surveys in Latin America that make generalization across countries difficult. For example, in some countries, questions were asked only about the ownership of titled land, which is a subset of all owned land. Furthermore, only in two countries were respondents asked about joint ownership of land, which is often the most common form of land ownership for women.

Some recent studies do pay careful attention to these issues. Deere et al (2013) use incidence measures to describe the extent of the gender asset gap in Ecuador, Ghana, and Karnataka (India), as do the ICRW GLAS studies in South Africa (Jacobs et al 2011) and Uganda (Kes et al 2011). The ICRW studies find that women are more likely to state that they own land jointly rather than solely and furthermore that gender asset gaps are greater *within* dual-headed households than between female-headed and male-headed households. Another significant finding is that the woman's familial situation is extremely important, with age and relationship to the head affecting the likelihood of owning land. For example, in the South African sample, women who were married to the household head were better off in terms of land ownership than wives or partners of other men in the household. The authors thus call for more gender-disaggregated data collection on land ownership within dual-headed households.

Overall, whether a woman owns land (solely as well as jointly) appears to affect the well-being of the women and their households. Savath et al (2014) find that higher proportions of female ownership of land are associated with more food-secure livelihood combinations being pursued by households in Odisha, India. Panda and Agarwal (2005) find that female ownership

of land or a home significantly reduces the likelihood that the woman experiences domestic violence. In a study based on primary data from the Philippines, Estudillo et al (2001) show that the mother's ownership of land has a positive effect on the amount of schooling daughters (as compared with sons) receive as well as on the amount of land bequeathed to daughters (as compared with sons). Allendorf (2007) uses DHS data on whether a woman owns land solely or jointly to show that women's ownership of land has a positive statistically significant effect on their ability to participate in joint decision-making about their own mobility and healthcare as well as household expenditure.[6] Menon et al (2013) show for Vietnam that women's sole ownership of land has beneficial effects on household poverty, household expenditure, and the self-employment of women, while women's joint ownership has a statistically significant impact only on the former. The ability to differentiate between sole and joint ownership can thus be insightful.

Another body of literature tests the impact of female land ownership on farm productivity. Female land ownership is found to decrease productivity in the aggregate (Dimova and Gang 2013) but studies that control for lower female access to complementary labor and capital inputs find that this productivity gap is eliminated or shrinks substantially (Udry et al 1995, Peterman et al 2014, de Brauw 2015, Kilic et al 2015, Aguilar et al 2014, Oseni et al 2015).

We therefore recommend the more widespread collection of the basic land ownership incidence measure described above, with the caveat that ownership may mean different things in different contexts. The proportion of men and women who own land meets our conceptual and logistical criteria and has been empirically tested in multiple contexts.

We also recommend the collection of data on the value of land owned by women and by men. This indicator has limitations in that it is conditional upon land ownership as well as upon the existence of a robust measure of monetary value. Nevertheless, the likelihood that such an indicator may be more sensitive to changes in technology in the short to medium run makes it a potentially useful indicator.

Doss at al (2015) note that data on the value or even the area of land owned were rarely collected in the studies they reviewed, although the LSMS-ISA does collect some such data. At present, the research that is emerging from the Gender Asset Gap Project (GAGP) for Ecuador, Ghana, and Karnataka appears to be the most systematic attempt to construct and analyze a sex-disaggregated measure of land value (Deere et al 2013, Swaminathan et al 2012, Doss et al 2013). The surveys administered as part of the GAGP collected information on the size of land owned by each member of the principal couple as well as two different valuation measures: rental value and current sale value. Valuation questions raised issues of the inaccuracies of

[6] She also finds that women's land ownership increased child nutrition outcomes, most likely as a result of what she assumes to be the "larger income and resources that women's land rights provide" (Allendorf 2007, 10). Notably, this last assumption is not necessarily borne out in the literature below on productivity.

respondents, of disagreements among respondents, and missing values where rental or sale markets did not exist. Nevertheless, the authors conclude that valuation data play a significant role in any study of gender and asset inequality since asset wealth gaps may not always correspond to asset incidence gaps. The authors also show that the current sale value of land may be the most generalizable measure of land value given the complexity and variation in rental contract structures in different regions and countries. As noted earlier, agricultural interventions are much more likely to directly affect wealth gaps than incidence gaps in the short to medium term and thus such data, although resource intensive to collect, are likely to be much more useful than incidence data alone.

Indicators of ownership of livestock

Significant gender gaps exist in livestock ownership, with women less likely to own larger livestock, in part because of a lack of capital (Taj et al 2012, Ayoade et al 2009, Oladele and Monkhei 2008). Poultry appear to be the most common form of livestock owned by women, with goats and sheep less frequently reported as being owned by women (Njuki and Mburu 2013, Kabeer and Tran 2000). There is some evidence that the increased involvement of rural men in nonagricultural activities has increased the role women play in small-scale livestock production (Farinde and Ajayi 2005). On the other hand, as with other assets, increases in the value of livestock or livestock products and shifts toward large-scale production often mean that women lose control over the asset (FAO 2010). Agricultural interventions can more easily shift the incidence of livestock ownership than of land ownership Quisumbing and Kumar 2011) so incidence indicators of livestock ownership are likely to be more sensitive than indicators of land ownership.

The simplest indicator we recommend is thus the gendered incidence of livestock ownership (sole and joint), without specifying the kind of livestock owned. This is the approach taken by the WEAI. However, although more resource intensive, data by type of livestock can be more revealing of gender gaps. We thus recommend a second indicator that aggregates across ownership of various kinds of livestock using the FAO's system of Total Livestock Units (TLU) (Njuki et al 2013).

In terms of how the data are collected, Njuki and Mburu (2013) ask both members of the principal couple in dual-headed household to list the type and quantity of livestock that they own solely or jointly. Since we recommend interviewing one member of a household, we follow the GAGP in suggesting that the interviewee be asked to construct a household-level inventory of all assets, including all livestock, and then be asked the identity of the owner or owners of each (Doss et al 2013).

The current market value of livestock could be used to generate wealth gaps in livestock (Quisumbing and Kumar 2011). Njuki and Mburu (2013) use this approach and find that, although a small proportion of women own cattle, the high value of cattle means that cattle ownership comprises the most significant proportion of the value of women's livestock.

Indicators of use rights over land and livestock

As discussed earlier, the female (or male) labor force participation rate in agriculture, an indicator of labor use, could be a useful indicator of access to over land and livestock. We elaborate further on this as a possible indicator later in the paper. Insofar as withdrawal rights are an important aspect of use rights, the key question is whether women and men have decision-making rights over the output withdrawn from land and livestock. Although this is a question that the literature often folds into the discussion of control rights, we separate out entry and withdrawal indicators for the sake of conceptual clarity.

Thus, our list of recommended indicators includes the proportion of women who report sole or joint participation in decision-making about the use of land for crops (sale or own-use). In the case of livestock, we distinguish between daily output from livestock (milk, eggs), which women do appear to have more say in, as opposed to meat from the slaughter of livestock, which women appear to have less control over (FAO 2010).

Indicators of control rights over land and livestock

In this paper, control over land and livestock is understood to refer to participation in the management of the asset and decision-making about the use and distribution of output. In a somewhat unusual situation, gender-disaggregated data for at least one measure of land management – the principal landholder or agricultural decision-maker – are more likely to be available at the nationally representative level than a measure of land ownership. The FAO gender and land rights database has aggregated data on the share of landholders who are women from national agricultural censuses for 84 countries.

The FAO notes that this measure is flawed in that multiple plots are aggregated under a single holding, thus masking the gendered distribution of farming responsibilities at the plot level. Furthermore, the censuses report a single farm holder, often corresponding to the male household head, although women may be involved in many significant aspects of farm management. The World program for the Census of Agriculture (WCA) has recognized this problem and, as of 2010, has modified its definition to include a "joint holder" (FAO 2005). It is not clear to what extent these new guidelines are being followed by member countries.

While the WCA thus provides some limited and imperfect data, to be consistent with our conceptual criteria, we recommend a related but slightly different indicator: the share of women who report being the primary decision-maker (solely as well as jointly) with respect to agricultural use of land. Thus, while using a similar definition of landholder, our measure has a different denominator (all women) from that of the WCA database (denominator, all landholders).

De Brauw et al (2008) create an indicator of managerial control for land in China, which also includes a more specific question on control over the income generated by the farm and/or over processes such as marketing that generate most of the income. Here, we distinguish between control over land and control over income, thus separating these two categories. Understanding decision-making about land, as separate from control over income, will aid the design of more effective and gender-equitable agricultural interventions.

Of course, the WCA definition is quite broad, as "management control" over the agricultural holding can incorporate several different issues. The LSMS creates three categories of agricultural decision-making: decisions about (a) crop choice, (b) input use, and (c) the timing of cropping. Although some LSMS ask questions about decision-making for each crop and each subactivity within these three categories, this broader three-part frame may be one that is reasonably concise but could nevertheless capture some more subtle changes in female and male management rights. We thus recommend a second, more nuanced, indicator of control over land that is disaggregated into these three categories, as well as a fourth important category of decisions about the sale/transfer of land.

Dimova and Gang (2013) use crop-disaggregated LSMS data for Malawi and find that female land ownership increases the likelihood that women participate in decisions about cash-cropping, which is associated with larger streams of income in Malawi. de Brauw (2015) uses simply the ability to choose the crop (solely or jointly) as a measure of female management rights over agricultural land. He uses plot- and crop-level data based on a small sample household survey in northern Mozambique to show that women make these decisions in only 70% of the cases in which they own the land and that the primary determinant of women's ability to make these decisions is an indicator that the man was involved in off-farm work. Thus, effective management of land by women, he argues, is enhanced but not guaranteed by female ownership of land. Although his results differ from those of Dimova and Gang (2013), in both cases sex-disaggregated data on decision-making in agricultural production turn out to be useful.

We follow a similar format for livestock, asking about participation in decision-making about the sale, transfer, or slaughter of the livestock as an indicator of "control" over the resource (Njuki and Mburu 2013).

Resource type: water and forest common pool resources

Common pool resources (CPRs) are a vital source of food, fodder, fuel, firewood, and water for agricultural households, particularly for poorer and landless ones (Beck and Nesmith 2001). Understanding the full income impacts of any policy or technology change in rural communities thus requires an understanding of its impacts on the use and control of common pool resources. A growing body of research is calling attention to the gendering of CPR use and arguing that increasing women's ability to access and control the use of CPRs is not only central to ensuring gender equality in these communities, but can also improve the conservation and management of such resources (Agarwal 2010a, Khosla and Pearl 2003).

To the extent that these are common pool resources, an understanding of who controls the use of these resources requires identifying the institutions of CPR management at the community level in each context and developing indicators that appropriately address the extent to which women and men are able to influence those decisions. The increased advocacy and prevalence of user groups to manage common pool resources means that recent studies of gendered access to common property resources investigate the extent to which the "descriptive representation of women in (user) groups can lead to substantive representation" (Meinzen-Dick and Zwarteveen 2001). This raises methodological issues for us, as our primary goal is to recommend indicators that can be developed using population sampling methods such as those employed by national household surveys, the LSMS, the WEAI, and so on. As we see in Appendix 1, the indicators of control that are used in the CPR literature are based on the sampling of groups. We instead propose versions of these indicators based on population samples.

This section focuses in particular on access to forest and water resources. Forest resources provide firewood and fodder as well as access to fruits, herbs, and vegetables that grow in the wild, whose collection is the responsibility of women and girls in most societies. These forest products serve as key inputs into the production of food, again the responsibility of women worldwide. Any degradation in the quantity or quality of these resources thus affects women's time and income poverty.

Access to water is equally central to a host of tasks that are defined as the responsibility of women, within and outside the household (Zwarteveen 1997, Khosla and Pearl 2003). Here, too, water-use technologies developed primarily for agriculture (for example, large-scale irrigation projects that involve the diversion and consolidation of water bodies or tube wells that reduce the groundwater available for drinking wells) can negatively affect women's ability to access and use water for their needs (Crow and Sultana 2002). Sex-disaggregated indicators that capture changes in women's/men's ability to access water are thus crucial to evaluating the full impact of such projects on well-being.

The impact of technological innovations on common pool resources is likely to be significant. Changes in seed type and increases in the value of crops, for example, can change patterns of land and water use and thus claims upon water and forest lands. As agricultural land has expanded, land once defined as common use has become increasingly privatized or controlled by the state, thus affecting women's ability to gather firewood and water and thus their time and income poverty (Beck and Nesmith 2001).

Given the extent to which poor households depend on common pool resources for fuel, food, and water needs and the extent to which women use these CPRs, any analysis of the impact of agricultural interventions must include their impact on common property resources.

In seeking to identify such indicators, our work overlaps with that of the World Water Assessment Program (WWAP), which is in the process of developing a set of international indicators for gendered access to water (WWAP 2014). To enable coordination between these efforts, we suggest employing some of those indicators for other common property resources as well.

Box 3. Recommended indicators for gender gaps related to use and control over water and forest common pool resources

Indicators of use

- The proportion of women able to access water/firewood/fodder to the desired degree, same indicator for men
- Average number of hours (per week, per woman, per man in the household) spent in collecting water, firewood and fodder

Indicators of control over decision-making

- The proportion of women and men who are members of a water or forest user group
- The proportion of women and men who report attending water or forest user group meetings (conditional upon group membership)
- The proportion of women and men who report speaking at meetings of the forest/water user group (conditional upon group membership)

Indicators of use rights over forests and water

Forest resources

Women's use of forest resources differs from men's use in terms of the kinds of forest products they are likely to access. Women are more likely to access berries, fruits, fodder, and firewood and men are more likely to access timber (Agarwal 1997, Mwangi and Mai 2011). This difference also means a difference in the timing of use. Women's needs, while causing less large-scale damage to the forest, are ongoing throughout the year. Male logging of timber, on the other hand, can be concentrated in time, occurring a few times in a year. Attempts to manage forest resources by restricting use to certain periods of time can thus have disparate impacts on men and women, making it harder for women to use forest resources than for men.

The most comprehensive work on gender and forest use and conservation is Bina Agarwal's study of 135 forest user groups in India and Nepal, compiled in the book *Gender and Green Governance* (2010a). As part of the study, Agarwal asks respondents whether they experience a shortage of firewood, fodder, timber, fish, and wild fruits and vegetables.

A modified indicator, which we recommend, would be the proportion of women/men who are able to access forest resources to the extent necessary. If asked of both men and women, this would be a subjective indicator of gendered gaps in access to these resources. Answers to these questions would of course vary by class, caste, and race within the same geographic/ecological region, so surveyors would have to be careful about their sampling frame.

A more objective but also more resource-intensive indicator would be the average amount of time spent per week per woman in the household to collect the desired amount of each resource versus the average amount of time spent per week per man in the household. We recommend this indicator despite its resource intensity because, as discussed later, time-use studies are essential to understanding time poverty. Furthermore, the collection of time-use data by the WEAI and some national survey agencies may imply that such an indicator will become easier to construct in the future.

Water resources

In order to capture actual use, the WWAP review also suggests an indicator on "the ability to access water to the desired degree." This would be an extremely important question to ask women and men in households to evaluate the "full income" impact of agricultural interventions. As in the case of forest resources, a time-use module would provide a more objective answer to this question by helping understand gendered differences in the average hours spent to access water and fuel.

Indicators of control rights over forests and water

As we shall see, the few studies that attempt to look at gendered control over forests and water rely on sampling and observation of user groups (Mwangi and Mai 2011). Our goal, on the other hand, is to find indicators that can be based on national household surveys that sample individuals. What we recommend is therefore a question asking women and men if they are members of forest or water user groups. The weakness of this indicator is that mere membership in the user group does not translate into effective control over resource management outcomes (Nightingale 2002). To attempt to get at more substantive participation,

we also recommend indicators based on asking women and men if they attend forest and user group meetings, as well as if they have spoken at forest and user group meetings.[7]

Indicators based on membership, attendance, and voice in user groups are clearly limited in terms of their replicability across context given that forested areas are likely to have more forest user groups than the plains, and that the prevalence of user groups of any kind is likely to vary significantly depending upon the local political economy. These indicators are merely a first step toward measuring gendered gaps in common pool resources and we urge further research into these issues.

Resource type: financial assets

A very important consequence of women's lack of property rights and limited participation in paid work is an inability to acquire and accumulate financial assets, including checking and savings accounts in banks and other financial institutions as well as access to credit and insurance instruments that depend on proof of repayment via income streams or collateral, both of which women lack.

Although women's exclusion from large, formal financial institutions is well documented, so is the existence of women-only "chit funds," ROSCAs, or savings groups across the world, some of which are now regulated by the government and thus "formalized" (Collins et al 2009). The existence of such institutions globally suggests a less visible women's history of engagement and comfort with financial transactions and an understanding of the importance of access to savings and credit. Indeed, in some countries, women's involvement in informal financial institutions is greater than men's (Johnson and Nino-Zarazua 2011, Demigurc-Kunt and Klapper 2013). However, although being more flexible and clearly more inclusive of the poor, smaller microfinance institutions often provide relatively more expensive credit/lower returns on savings, thus limiting members' ability to use financial instruments to increase savings, investment, and household income (Claessens 2006). Dupas and Robinson (2009) find that women small entrepreneurs in Kenya extensively used non-interest-bearing savings accounts even though they had high withdrawal fees (provided to them in a randomized control trial), indicating negative rates of return on their informal savings instruments and high latent demand for access to formal bank accounts.

Despite an expansion of microfinance agencies targeting women, women's access to savings and credit remains extremely limited in rural, developing-world contexts (Mayoux and Hartl 2009). Microfinance groups have not been able to build the long-lasting linkages to larger financial institutions necessary to scale up their access to funds and grow independently of

[7] These mirror questions asked of group members by Agarwal in her 2010 study, as well as questions that the WWAP is hoping to collect data on for water user group members.

nongovernment and aid organizations (Cull et al 2009). Meanwhile, commercial financial institutions (FIs), both public and private, seem to act in ways that further reinforce legal and social biases against women rather than undermining them (Demigurc-Kunt et al 2013).

The long-term success of agricultural interventions rests on sustainable access to credit, which, if gendered, inevitably results in gendered patterns of participation in the agricultural interventions. This can generate a vicious circle in which participation in innovation programs increases assets and income in a gender unequal way, thus further reducing the likelihood of female participation in future programs. One important early indicator of gendered impact is thus likely to show up in women's and men's patterns of savings and credit.

The recent publication of the 2011 and 2014 Findex surveys means that sex-disaggregated data on the use of financial assets are now available across a three-year period nationally for 148 countries. When possible, we therefore recommend indicators that the Findex collects to minimize the resource intensity of data collection. Indeed, in comparison to the paucity of gendered data on other kinds of resources, this survey provides us with a wealth of internationally comparable sex-disaggregated data on basic measures of financial use. We hope that funding for the Findex survey will remain robust and that the survey will continue to serve as an example of the kind of gendered data collection that we seek. It should be noted that the Findex survey assumes that registered microfinance organizations are formal financial institutions. In some countries, however, a significant proportion of microfinance organizations may not be formal in this sense (Grown et al 2015).

Box 4. Recommended indicators for gender gaps related to use and control over financial assets

Use

- The proportion of women banked (individually or jointly) at a formal sector institution, same indicator for men
- The proportion of women who are members of a microfinance/ROSCA group, same indicator for men
- The average duration for which women have participated in a group-based formal/informal financial institution, same indicator for men
- The proportion of women who have saved money in the last 12 months through a formal or informal financial institution, same indicator for men
- The proportion of women who have received a loan in the last 12 months from a formal or informal financial institution, same indicator for men

Control

- The proportion of women who (solely or jointly) decided how to use the loan amounts, same indicator for men
- Conditional upon asset use of the loan, the proportion of women who acquired an ownership (solely or jointly) stake in the asset, same indicator for men
- The proportion of women responsible for repayment of the loan (conditional upon loan receipt), same indicator for men

Indicators of use rights over financial assets

Access to large, commercial financial institutions (FIs) remains the goal of most projects that seek to expand financial inclusion. Ultimately, commercial FIs provide most savers and borrowers with larger and cheaper loans and offer them a wide variety of vehicles for savings that are safer and have higher returns (Vonderlack and Schreiner 2002). As Johnson (2004) points out, although the lack of participation in commercial FIs could be voluntary, given the clear cost advantages of FI financial products and the extent to which the poor participate in informal institutions (Collins et al 2009), it is widely accepted that the financial exclusion of women and the poor in developing countries is more likely involuntary. Given that the use of commercial FIs begins with the opening of a checking or savings account at a bank or credit union, the proportion of women and men who are banked (i.e., hold a bank account in a post office, bank, or credit union) is widely used as an indicator of financial use (Claessens 2006).

The Findex survey asks respondents whether they hold accounts solely and jointly in a bank or other type of financial institution. This is the same indicator we recommend, with the additional recommendation that sole and joint data be collected separately so that a disaggregated analysis can be performed if useful. According to Findex data, the gender gap in the proportion of women banked is considerably higher in developing countries, and in rural areas. The gender gap in the proportion of men and women banked ranges from 6 to 9 percentage points across the sample. Although the “lack of money to open an account” was the most common reason for being unbanked in the sample as a whole, the second most common reason that women provided was that a “family member already has an account” (Demigurc-Kunt and Klapper 2013).

As far as access to credit goes, the Findex asks whether the respondent has borrowed money “from any source in the past year” and then disaggregates by kind of source (bank, informal lender, family, etc.) and purpose of the loan. Here, we recommend the question on borrowing in the last year from formal and informal institutions (as opposed to family) as a first look at gendered access to credit. The Findex includes a similarly structured measure of savings: whether the respondent saved any money in the last 12 months and the savings vehicle used. We recommend a savings measure that focuses on savings through formal and informal institutions (as opposed to money saved “under the pillow”).

The Gender Asset Gap Project recently published an analysis of its data on borrowing (Grown et al 2015). This is a richer data set in that information on both members of the principal couple in a household is available and this includes information on the purpose of the loan. The authors find that women have less debt for asset accumulation than men, and that the mean value of asset debt held by women is lower. They also find that ownership of assets is positively

correlated with taking out asset loans, for both men and women. Thus, inequalities in asset ownership tend to perpetuate themselves.

The receipt of a loan on its own is, however, an ambiguous measure of well-being as it could indicate the existence of debt spiral and so may require information on the purpose and source of the loan (Mayoux and Hartl 2009). Grown et al (2015) find, for example, that wealthier households are more likely to hold asset debt, which leads to greater wealth in the future, while poorer households hold expense debt, more likely a sign of a debt spiral. Since Findex data on the purpose of the loan are available, researchers may be able to investigate the gendered use of different kinds of credit.

The size of savings accumulated by women and men and the size of loans received by each are also possible indicators of use. These last two indicators are somewhat more difficult to collect and, as with all wealth data, more prone to errors and/or disagreements among the members of the household. Within the Findex, questions on the amount of money saved or in checking accounts are conspicuous by their absence because of the sensitivity of such questions. However, Grown et al (2015) do collect and analyze these data. Some national household surveys such as the Indian NSS do collect data on quantity and source of loans at the household level and perhaps need to be urged to ask in whose name the loan was taken out. We mark this as a possibility for the future given our belief that wealth indicators can be more sensitive than incidence indicators.

We also flag, without recommending, another indicator used in the U.S. Survey of Consumer Finance (SCF) but not in the Findex: the proportion of women or men who report being denied a loan in the last five years. This may be helpful in understanding the extent to which women are being denied credit at a higher rate. However, those who are likely to be denied are also less likely to ask for a loan, making us hesitant to recommend this indicator.

There is a much larger literature on gendered access to group-based financial institutions. Particularly among rural women, participation in a microfinance group/organization is used as an indicator of access to credit in several studies (Johnson 2004, Johnson and Nino-Zarazua 2011). Other studies use the gender of a microloan recipient (as opposed to just membership in a microfinance group) as an indicator of an increase in financial access (Pitt and Khandker 1998, Hashemi et al 1996, Holvoet 2005). Although the Findex does not ask this question, we recommend a survey question asking women and men whether they are members of a ROSCA (rotating savings and credit association)/microcredit group.

Merely holding an account or being a member of a chit fund does not, however, necessarily translate into higher savings and credit activity. An alternative indicator on the duration of membership in a microfinance/informal financial institution has been used to add more nuance to an indicator of use. Garikipati (2008) uses a categorical variable with 0 = not a member, 1 = member for three years or less, 2 = member for between 3 and 6 years, and 4 =

member for more than 6 years. Pitt et al (2006) find that such a duration indicator is highly correlated with loan size. Where group participation is of interest, we suggest that this may thus be a richer indicator of use for membership-based financial institutions.

Indicators of control rights over financial assets

Although participation in financial institutions can increase women's ability to use credit and savings vehicles, the question of whether they effectively control the allocation of these funds within the household and thus the distribution of benefits remains in doubt. Some studies suggest that group membership can be especially important in translating participation in microfinance into effective control by women (Bali Swain and Wallentin 2007, Holvoet 2005). The literature also suggests that, when female access to financial assets does not result in increased female ownership of productive assets and increased female streams of income, female-male empowerment gaps can actually worsen (Mayoux and Hartl 2009, Garikipati 2008).

The ongoing debate over this issue has, however, brought about several possible ways of measuring the extent of control over credit. In one of the earliest systematic studies of this issue, Goetz and Sengupta (1996) use a dual indicator that combines knowledge about the use of the loan with involvement (through the contribution of labor) in the activities that the loan was used to finance. They combine these two variables to develop a five-point index of "managerial control" over the loan. Kabeer (2001), however, points out that this conflates the decision about how to use the loan with the actual implementation of that decision. Given the possible differences between male and female financial priorities, she argues for clearly separating out the former.

Several studies ask respondents who decided how to use the loan, with answers classified along a range from only or mostly the respondent to only or mostly another family member. In the case of most studies, this other member is the spouse. Thus, a question about "who decides how to use the loan/savings amount" as well as "who was responsible for repayment of any loan" would appear to be reasonably easy to integrate into a household survey while also fitting the conceptual need for a sex-disaggregated measure that can be tracked over time. When a loan is taken out to purchase an asset, we recommend asking who owns this asset (Mayoux and Hartl 2009, Garikipati 2008).

An extensive body of literature attempts to examine the gendered impact of financial assets on outcome variables, including decision-making. Studies measure a range of outcome variables such as the proportion of household income generated by the woman versus her spouse (Garikipati 2008), the number of hours of employment of the woman versus her spouse, and questions about the extent to which the woman participates in decision-making about aspects of household expenditures (Holvoet 2005, Garikipati 2008, Ashraf et al 2010, Banerjee et al 2015). Studies also look at non-sex-disaggregated household metrics such as expenditure

on certain durable goods believed to be female-preferred (Ashraf et al 2010) and medical expenditure or the years of education of children (Pitt et al 2006, Pitt and Khandker 1998) or nutritional outcomes for children (Hazarika and Guha-Khasnobis 2008), based on the assumption that these outcome variables correlate with women's increased decision-making. Even if in almost all these cases the data are not nationally representative, this body of literature suggests that sex-disaggregated data on use and control of financial assets can be a useful signal of gender gaps in well-being more generally.

Resource type: labor

Labor is an extremely critical input into agricultural production, a vital source of livelihood for asset-poor households, and an important determinant of intra-household bargaining power. This section analyzes key indicators of the impact of agricultural interventions on gender gaps with respect to labor. Here, too, we use the framework of use and control to distinguish between the actual allocation of women's time and the extent to which women believe they have a say in that allocation.

Indicators of use of labor

The traditional metric of labor force participation continues to be extensively used and widely published in UN, World Bank, and other international studies of gender and the economy. Several studies link female labor force participation rates to greater participation in household decision-making as well as improved education and health outcomes for women and children. In addition, the UN and World Bank continue to treat higher female labor force participation as a metric of increased female empowerment (World Bank 2012, UN Women 2010).

It is important to note that the UN System of National Accounts (SNA) definition of labor includes self-employment and paid and unpaid work in family enterprises in both informal and formal settings, but excludes unpaid domestic work. Activities are within the economic production boundary defined by the SNA if they comprise (a) production of goods or services supplied, or intended to be supplied, to units other than their producers, including the production of goods and services used up in the process of producing such goods or services (intermediate consumption); (b) production of all goods retained by their producers for their own final use (own-account production of goods); (c) production of housing services by owner-occupiers; and (d) production of domestic and personal services produced by paid domestic staff (UN 2008). National data on labor force participation currently cover only SNA work. Here, we therefore distinguish between these two kinds of work by using the terms SNA and non-SNA work.

The debate over the U-shape in the relationship between female labor force participation (SNA work) and GDP/capita suggests that increases in female labor force participation do not

always correspond to improvements in household income such as those that might be expected from agricultural innovations (Cagatay and Ozler 1995, Klasen 1999). Increased participation in heavy farm work is not in itself desirable, as shown by more localized studies that find that women report greater satisfaction when they withdraw from the labor force – particularly when the work itself is arduous labor in inadequate working conditions (Agarwal 1994, Johnson et al 2015). The International Labour Organization (ILO) is currently developing a global indicator of decent work to address these limitations of the current definition of the labor force participation rate. Consequently, we recommend time-use studies of leisure hours to understand whether increased labor force participation merely intensifies a "double burden" for women and men (Floro and Mieurs 2009). We return to the issue of time-use data below.

With respect to labor force participation in agriculture, the World Development Indicators database reports the female/male proportion of the agricultural labor force (SNA work).[8] We recommend use of the same indicator in order to make use of the World Development Indicators database and others since this indicator is also available from most country censuses or household surveys at the level of local administrative units. An important caveat, however, is that these surveys are undercounting women's economic activity by treating at least some own-farm agricultural work as domestic or non-SNA work (Antonopoulos and Hirway 2010).

An indicator of a gender gap in the use of labor resources based on the female proportion of the wage labor force in agriculture is desirable for several reasons. First, although a relatively low proportion of men's and women's agricultural work is likely to be paid a wage in smallholder agriculture, for asset-poor households, paid work may provide a vital source of cash in a commercializing economy. Thus, participation in the agricultural wage labor force can be interpreted as an indicator of access to a scarce resource – cash. Second, there is reason to expect that female participation in wage labor will be correlated with increased decision-making over other farm household resources based on some evidence that paid work increases women's participation in decision-making in some contexts (Jejeebhoy 2002, Anderson and Eswaran 2009, Deere and Twyman 2012, Twyman et al 2015). Finally, sex-disaggregated data on individual participation are easily available in international databases.

In many countries, the relative stagnation of agriculture and the profound urban bias of the state have resulted in a very deep problem of under-unemployment for men and women in rural areas (Jackson and Rao 2009). One important indicator of the success or failure of agricultural interventions would thus be a decline in the degree of under-/unemployment for men as well as women. To the extent that domestic non-SNA work can be a residual category for women, measures of unemployment are notoriously poor at picking up female unemployment in

[8] An important difference is that the denominator for the proportion of the agricultural labor force is the total size of the agricultural labor force, whereas, for labor force participation, the denominator is the female working-age population.

developing countries. Thus, a direct question on self-reported under-employment may be a useful indicator.

However, indicators of SNA-based work have their limitations. Apart from failing to value women's domestic work, they mask possible negative effects on leisure time. Interventions that increase labor force participation may also decrease leisure time, thus intensifying women's work burdens and doing so differently for women based on ethnicity and class status (Doss 2001, Deshpande 2011, Johnson et al 2015). Time-use studies have thus emerged as among the most significant methodological additions to the development data toolkit in the last decade (Antonopoulos and Hirway 2010). Time-use studies are currently our best tool to measure non-SNA work. The expansion of time-use studies has come about largely as a result of pressure from feminists arguing that women's "double burden" makes them uniquely starved of leisure time and that both the long-standing devaluation of women's work and the extent of multi-tasking involved in much of women's intra-household labor make conventional methods of measuring work inadequate (Esquivel et al 2008).

Eighty-five countries have now implemented at least one national-level time-use survey since 1990 although this list is dominated by developed countries (Antonopoulos and Hirway 2010, ICATUS 2012). Their experience suggests that these surveys do require well-trained enumerators and are likely to be time and resource intensive. Time-use studies can vary by the time frame tracked as well as the method used to document activities: diaries versus recall interviews. Although 24-hour time diaries maintained by respondents are recommended by ICATUS guidelines, several recent surveys, including the WEAI, have chosen to ask respondents to recall their use of time over the previous 24 hours. Based on recall data, the WEAI computes the number of hours of leisure reported by the respondents and creates an indicator of insufficient leisure hours if they fall below 10.5 hours (per 24-hour period).

For tracking a gender gap in labor use, we recommend including an indicator based on differences in leisure time between men and women. When possible, data for this indicator should be obtained from a respondent survey based on recall to compute the average number of leisure hours for the male and female members of the principal couple in a household. Tracking increases or decreases in average leisure hours is likely to be more sensitive to short- or medium-term change than an indicator that simply asks women and men if they have adequate leisure time or if they are satisfied with their hours of leisure. Although subject to all of the problems with self-reported subjective assessments, this indicator will remind planners and program managers to pay attention to the risk that an agricultural innovation can inadvertently exacerbate problems of women's "double-burden."

Box 5. Recommended indicators for gender gaps related to use and control over labor:

Use:

- Female labor force participation rate in agriculture (denominator, number of people in the agricultural labor force), same indicator for men
- Female paid labor force participation rate in agriculture (denominator, number of people in the agricultural labor force), same indicator for men
- The proportion of women who report that they are underemployed. That is, employed **((**self-employed or engaged in wage work) for fewer hours than they want to be), same indicator for men
- Average hours of leisure for women or the proportion of women with inadequate leisure time, same indicator for men

Control:

- Currently, no recommended indicators.

Indicators of control over labor

Indicators of control over labor are very uncommon. Some small-scale studies of the impact of access to financial assets on decision-making by women and men do incorporate questions on women's control over labor, as does the Gender Asset Gap Project. However, although women's control over their own and others' labor is a crucial aspect of gender inequality in agriculture, the existing evidence and sources of data are too scarce for a recommendation for any specific indicators of control over labor use following the criteria used in this analysis. We do, however, discuss some possibilities below.

One indicator with potential is an umbrella question about whether a woman can decide how to use her time. For example, the GAGP uses the question "Do (or did) you make the decision on whether or not to work" (Deere and Twyman 2012). Although the authors appear to be referring to extra-household work, this could be broadened to all SNA work and framed to ask whether the man or woman can decide solely or jointly to take up or leave work (whether domestic, waged, salaried, or self-employment) or whether someone else decides. A query about whether engaging in a particular type of work is "not a decision, based on norms" might be especially useful in contexts in which a strict gender division of labor restricts women to particular forms of household work (Holvoet 2005). Changes in the proportion of women or men who perceive engaging in a particular type of work as a choice proportion could signal a shift in the gender division of labor. Garikipati (2008) uses a version of this question, asking women whether or not they wanted to change how they used their work time. At least two other studies include a version of this question, asking if the "spouse has banned you from working outside the home" (Pitt et al 2006, Menon et al 2013). However, when this question refers to all or any type of work and is not agriculture-specific, the data will be "blunt" in the sense that they may not be sensitive to changes caused by agricultural interventions.

A different approach to measuring gender differences in control over labor would be to ask individual women and men whether they decide solely, jointly, or not at all about how they use their time on a task-by-task basis within the agricultural production cycle. This is resource and time intensive. A compromise is to categorize work into agricultural own-farm work, wage work, and (non-SNA) domestic labor and ask women and men whether they are able to decide how to use their time among different tasks. For example, instead of administering a time-use survey, Garikipati (2008) asks a question on whether the woman is able to share a variety of domestic chores. This is a less resource intensive way to capture the extent of the "double burden." Another version of this question, used by the WEAI, is more specific to wage or salaried work, which, as discussed earlier, is potentially more directly connected to greater bargaining power and may also involve challenging gender norms.

Resource type: income

Women involved in agriculture have little "own" income under their sole control. However, women almost always directly contribute to household income in an agricultural setting whether it is through paid work or unpaid farming and livestock maintenance.[9] To capture a gender gap in control over income, it is therefore preferable to address the ways men and women use (or decide about the use of) household income rather than focusing narrowly on each individual's "own" income.

Box 6. Recommended indicators for gender gaps in use and control over income

- The proportion of women who participate (solely or jointly) in decisions to purchase daily goods, same indicator for men
- The proportion of women who participate (solely or jointly) in decisions to purchase major goods, same indicator for men
- The proportion of women who participate (solely or jointly) in decision-making about income from a specific farm enterprise or off-farm employment, same indicator for men

Use and control rights over income

It is difficult to distinguish between indicators of use and indicators of control over income by sex. This is primarily because differences between female and male uses of income are highly dependent on context. For example, food is commonly treated as a female expenditure and goods such as alcohol and tobacco as male expenditure (Hoddinott and Haddad 1995, Pitt and Khandker 1998), but these are poorly verified generalizations. The use of expenditure proportions on food or alcohol as evidence of female or male "use" of income

[9] The proportion of women who farm independently of male partners is quite low in Asia and Latin America. The proportion of women engaged in paid work in agriculture also varies significantly by region.

should be avoided. Indicators based on sole or joint participation in decision-making about different aspects of the use of income are preferable.

One way of measuring gender differences in control over income is to compare men's and women's physical access to earnings. For example, several studies begin with questions about physically holding onto or retaining money. Pankaj and Tankha (2010) ask whether the woman retains any of her earnings as well as the proportion of wage earnings she hands over to someone else in the household. Kabeer and Tran (2000) show that, in Vietnam, in 98% of surveyed households, male earners handed over a majority of their earnings to their wives to manage. Another way to assess control over income is to ask whether the woman or man receives the earnings of other members to manage. Garikipati (2008) asks whether the woman retains money from the sale of crops and the sale of livestock; Kabeer et al (2011) ask whether the woman retains some income for own use while Jejeebhoy (2000) asks whether she receives cash to spend as she chooses. Since this is an important aspect of control over income, we recommend an indicator of physical control over household income that is created by asking women and men whether they retain any part of their own earnings and/or receive any part of the earnings of any others in the household.

However, questions about participation in decision-making about the use of household income are more commonly used than questions about retaining own income or receiving income from others in the household. The widely used DHS ask women whether they participate in decision-making about daily and major household purchases (Kishor and Subaiya 2008). Other studies ask more narrowly focused questions: for example, the GAGP asks respondents who earn money whether they make the decision on how to spend it (Deere and Twyman 2012). This measures only the decision-making of women who report earning their own income. Other studies use decisions about specific kinds of purchases, including food, jewelry, consumer durables, and various items of expenditure for children (Ashraf et al 2010, Kabeer et al 2011). The WEAI is unusual in asking about participation in decision-making based upon the source of the income. Respondents are asked about their participation in decision-making about income generated from (a) food crops, (b) cash crops, (c) livestock production, (d) nonfarm activities, and (e) wage and salary work. This specificity is important for detecting how changing cropping and livelihood patterns affect gendered control over income but these data are not readily available through large international surveys and collection is resource intensive.

In conclusion, for easy measurement of gender gaps in control over income, we recommend the use of an indicator of participation in household expenditure decisions based on the Demographic Household Surveys that ask women whether they participate in decision-making about daily and major household purchases. This provides a field-tested indicator of female control over the use of household income, which is more specific than a question about

household spending in general, and it allows researchers to use the growing database of DHS globally.

Resource type: social capital derived from collective action

Participation in collective action that provides access to and influence over social capital is treated as a resource for the purposes of this paper because gender gaps in this type of social capital affect several outcomes sought by agricultural innovations. For example, access to training and information provided through organized groups is a critical input to technology choice and to optimal use of new technologies as well as opportunities for credit, marketing, and small enterprise development. In addition, group participation can channel access to other resources, including water, grazing, and forest as well as inputs such as seed and fertilizer. Group participation can also change many of the patterns of decision-making, control, and use within the household discussed throughout this paper. Given women's historic confinement to private spaces, participation in public, collective decision-making has symbolic significance but is also extremely important for women's practical and strategic needs (Molyneux 1985). As seen earlier, women's participation in water or forest user groups can shape their ability to secure food and affect their time burdens (Agarwal 2010a). Participation in microfinance groups can help increase access to credit and thus to assets (Mayoux and Hartl 2009). Technologies disseminated through women's groups can have a more significant impact on livelihood and nutrition outcomes than those disseminated through individual male heads of households (Kumar and Quisumbing 2011).

In the following analysis of indicators, "use" corresponds to participation in collective action, defined minimally as being a member of one or more organized groups. Peterman et al (2014) distinguish between group membership and political participation, and we address both below. The notion of "control" in this context corresponds to influence over group decision-making. In view of our focus on gender gaps affected by agricultural innovation, we include indicators that apply to local-, village-, or district-level collective bodies in preference to national-level ones. Although data for national-level political participation is readily available, it is unlikely to be sensitive to change in gender gaps affected by agricultural innovations. However, to meet our criteria that indicators be easily replicable and, to the extent possible, make use of existing data, we recommend only indicators that are based on population sampling, rather than indicators that require the sampling or observation of groups.

Box 7. Recommended indicators of gender gaps in participation in collective action

- Average number of community organizations and/or groups that women are members of, same indicator for men
- Average number of agricultural producer/farmer groups that women are members of, same indicator for men
- The proportion of women who voted (conditional on existence of elections), same indicator for men
- The proportion of women who independently decided how to vote (conditional on voting), same indicator for men
- The proportion of women who attended village council meetings, same indicator for men

Influence related to control:

- The proportion of women who spoke up at community group/village council meetings, same indicator for men
- The proportion of female leaders and representatives in the village council (publicly available data)

Indicators of participation in collective/community bodies

Membership in groups is commonly used as an indicator of participation in collective action, although the literature makes it clear that mere membership in a group is not the same as active participation. Various approaches are in use: for example, the WEAI simply asks respondents whether they are members of any village-level group while the World Bank/IFPRI (2010) study on gender and governance asked sampled heads of households in India, Ghana, and Ethiopia how many village-level groups/collective bodies they took part in. The World Bank/IFPRI study found mixed results in terms of gender differences in the number of groups that male and female heads belonged to, but it did appear that female heads were less likely to be involved in production and farmer-based groups, including agricultural cooperatives. This finding is echoed in a number of other studies, suggesting that it is not just the number but the kinds of groups that men and women belong to that might be an indicator of greater (or reduced) female access to information and social networks that enable agricultural production (Davis and Negash 2007, Godquin and Quisumbing 2008). We are especially interested in tracking women's participation in such producer groups. We therefore recommend both an aggregate indicator on the number of village-level community organizations that the individual belongs to and a sub-indicator that measures the number of agricultural/farmer-based organizations that the individual belongs to.

As Peterman et al (2014) point out, political participation may not involve group membership but is nevertheless an extremely important form of participation in collective decision-making. Clearly, not all countries have democratic systems, but, where there are established systems of universal franchise at the local level, respondents have been asked

whether they voted and whether they made the decision of whom to vote for independently (Pitt et al 2006, Bali Swain and Wallentin 2007, Menon et al 2013).

One could also examine the degree to which women participate in the activities of local political bodies. As a minimal measure of this, at least three studies include in their measures of female empowerment a question on whether respondents had attended a village-level council meeting (Pankaj and Tankha 2010, World Bank/IFPRI 2010, Kabeer et al 2011).

Indicators of influence or control within collective bodies

Female membership in collective decision-making bodies does not necessarily translate into influence or even voice when their participation is passive. Typically, the opinions of marginalized groups such as women are disregarded by ruling elites. Some studies therefore probe beyond mere membership in groups: for example, the WEAI asks respondents whether they feel comfortable speaking up in public; other studies ask whether women and men have actually spoken up in the course of meetings of community groups or local political bodies such as village councils (Kabeer et al 2011). Two studies find that, when women occupy leadership positions as a result of quotas, the groups make infrastructure investments in public goods that more directly serve women (Chattopadhyay and Duflo 2004, Iyer et al 2012).

Concrete benefits for closing gender gaps can be expected from having more women actually serving in positions of power. An indicator based on publically available data that does not require a household survey and that meets our other criteria is the proportion of leaders or representatives within a local political body who are women. We can expect an increase in women serving as leaders in local government to be correlated with improvement in gender gaps in agricultural credit, training, and extension.

CONCLUSIONS

The learning and transparency goals of agricultural research agencies would both be served by greater attention to the collection of sex-disaggregated data that can be used to track changes in key indicators of gendered use and control of assets and decision-making. Based on a review of the literature, this paper suggests criteria for the evaluation of such indicators and then recommends a key set of indicators that fit many of these criteria. These indicators are chosen to be replicable across international contexts and are sensitive to the impact of agricultural R&D interventions without being excessively resource intensive to collect.

In the last two decades, a few international sources of sex-disaggregated data have emerged, but they tend to cover only a few of the recommended indicators and/or a limited set of countries. As the review found, most studies of gender in agricultural contexts continue to rely on small data samples collected at a single point in time, so that changes cannot be tracked over time. Too many studies continue to analyze gender at the level of the sex of the household head (most such studies were not reviewed in this document). There is thus a pressing need to expand the available sources of sex-disaggregated data on assets using projects such as the Gender Asset Gap Project and the WEAI as models.

The majority of the indicators recommended in this paper do call for an expanded household survey that samples individuals, rather than households, and includes (abbreviated) time-use surveys. Such a survey is unlikely to be short. We also argue that wealth gaps are likely to be more sensitive and thus useful indicators to track, even while acknowledging that they are more complicated to measure than incidence gaps. Finally, the expectation is that data will be collected at multiple points in time so that changes in the indicators can be captured.

The creation of such indicators will therefore require some investment in well-designed survey instruments and well-trained enumerators. To the extent that agencies wish to address gender inequality, however, we also believe that such an investment is vitally important. In supporting such efforts, these agencies would be aiding their own ability to do effective, gender-aware agricultural research, while also serving the larger community of development professionals interested in reducing gender inequality.

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Appendix 1: Indicators of gendered control over common property resources that are based on group sampling

The existing literature on gendered control over common property forest resources is primarily based on an analysis of the proportion of women and men within forest user groups and requires appropriate sampling of the groups themselves. The primary indicator used in this literature is the proportion of women in forest and water user groups.

Mwangi et al (2011) and Sun et al (2011) used International Forestry Resources and Institutions (IFRI) data on the proportion of women in forest user groups across Uganda, Kenya, Bolivia, and Mexico to investigate the question of the impact of female participation on common property management. In part because of prior gender inequalities in mobility, asset ownership, and use and time-use, Mwangi et al (2011) found that female-dominated groups actually engaged in less monitoring and were less likely to adopt forest-improving technologies than men's and mixed groups. Sun at al (2011) used the same indicator and found that female-dominated groups tended to participate in district-level forest decision-making to a smaller degree. However, Sun et al (2011) also found that female-dominated groups were less exclusionary and sanctioned members less for breaking rules.

Westermann et al (2005) divided groups into male, female, and mixed on the basis of the proportion of female membership of groups and found that the female groups demonstrated increased cooperation and solidarity within the group due to greater collaboration both within and outside the group (what they call greater relational social capital), thus increasing the capacity for self-sustaining collective action. Although the short-run impacts of women's groups on conventional measures of forest quality may not always be positive, there is some evidence that the inclusion of women facilitates more rational rule-making by groups and more equal sharing of the costs of forest conservation, possibly resulting in more effective and sustainable groups in the long run.

The primary weakness of all these indicators is the fact that mere membership in the user group does not translate into effective control over resource management outcomes. The forest user groups Agarwal (2010a) studied had an executive council that drove rule-making and enforcement. Agarwal found that a higher percentage of women in the executive councils (ECs) of forest management groups has a statistically significant positive correlation with various measures of forest quality, although in some cases these results are obtained only if women's membership within the council meets a certain threshold of between 20% and 40% of the members. She also found that women's effective participation could result in more rational forest closure rules and thus more ability on the part of women to comply with those rules. In her qualitative work, she found evidence that, when women participated more, they also helped police the forest by providing information on violators and forming informal forest patrols.

Agarwal (2010a) thus proposes indicators of substantive female involvement in decision-making about forest use, including (i) the percentage of EC meetings with no women present, (ii) the female attendance rate, (iii) whether women speak up at EC meetings, and (iv) the proportion of female office bearers. She finds that each of these measures of substantive participation increases when the proportion of women in the EC increases (particularly beyond a threshold of 33% membership). These indicators of substantive control over decision-making of course require the careful maintenance and analysis of minutes of meetings. They are thus more resource intensive and less easily replicable.

Water resources

As in the case of forest resources, there is a gender division in the use of water that emerges from the gender division of labor in the household. As Zwarteveen and Meinzen-Dick (2001) point out, the policy focus on water for agricultural use, which is usually the purview of men, has led to the marginalization of women's water needs. Furthermore, women's lack of rights to land means that even women from landed households are systematically excluded from irrigation water user groups, in which the criterion for membership is ownership of irrigated land. Fee-based water services can also exclude women who have less access to cash. Meanwhile, the rapid privatization of water sources for irrigation as well as for household use has further increased the importance of class disparities among women, with women in households that own irrigated land more easily able to access water for household as well as extra-household uses.

The growing literature on gender and water raises these concerns about the neglect of women's water needs and the consequent differential impacts on their time and income poverty, as well as the negative health outcomes that result from the use of unsanitary water for drinking, cooking, and cleaning. Unfortunately, there appear to be few quantitative empirical studies of the effects of women's control over water along the lines of those discussed for forests earlier, although some studies document (rather than analyze) the gender division of labor in water-related tasks and even the extent of participation by women in water user groups (UN 2006, Crow and Sultana 2002, Faisal and Kabir 2015).

As part of an effort to highlight these issues, the WWAP is developing five baskets of indicators, of which two (relating to governance and income generation from water) are pertinent to our discussion (WWAP 2014) . One relevant indicator the WWAP recommends is the proportion of women to men in water user groups. For forests, these are data that the IFRI is already collecting; for water, these are data that the WWAP intends to collect. It is conceivable then that a coordinated effort on this particular piece of data may be able to cover a fairly large number of countries.

The WWAP also suggests indicators that address substantive participation by women in such groups. In particular, it proposes an indicator that measures the "ratio of contributions in

decision-making meetings by women and men, and the percentage of decisions adopted from women's contributions in meetings." Although extremely valuable information, this is likely to require close monitoring of group meetings and to be quite expensive to collect. As discussed in the case of forest resources, a simpler but more subjective piece of information would be to track the proportion of women (versus men) who reported speaking in meetings of the group (conditional upon participation in user groups). Of course, as with participation in forest groups, participation by women in water user groups does not always result in decisions that fully consider women's needs and interests (Khosla and Pearl 2003, Cleaver and Hamada 2010).

Appendix 2: Tables

Table 1: List of indicators with formulae and findings from the literature review

Indicator	Formula	Caveats in the literature about the link to gender equality	Existence of large-scale empirical studies using the indicator (as well as small-scale studies)
Land			
Ownership			
Proportion of women and proportion of men who own land	# of women who own land/ # of women in the sample population; # of men who own land/ # of men in the sample population	None	Yes
The average area of land owned by women and by men	Total land area owned by women/ # of land-owning women; total land area owned by men/ # of land-owning men	None	
The average sale value of the land owned by women and by men	Total land value owned by women/# of land-owning women; total land value owned by men/# of land-owning men	None	
Use			
Proportion of women and of men who participate in decision-making whether to sell or consume crops	# of women who participate/# of women in sample population; # of men who participate/# of men in sample population	None	
Control			
Proportion of women and of men participating in decisions about the agricultural use of land:	For each decision:		
(a) crop choice, (b) choice of inputs, (c) timing of cropping, (d) sale/transfer of land	# of women who participate/# of women in sample population; # of men who participate/# of men in sample population	None	Yes

Table 1 contd: List of indicators with formulae and findings from the literature review

Indicator	Formula	Caveats in the literature about the link to gender equality	Existence of large-scale empirical studies using the indicator (as well as small-scale studies)
Livestock			
Ownership			
The proportion of women and the proportion of men who own livestock (preferably by livestock type, for example: poultry, sheep and goats, cattle)	# of women who own livestock/# of women in sample population; # of men who own livestock/# of men in sample population	None	Yes
The average TLU owned by women and by men	TLU owned by women/# of livestock-owning women; TLU owned by men /# of livestock-owning men	None	
Use			
The proportion of women and the proportion of men who participate in decisions about the use of dairy products from livestock (eggs, milk, etc.)	For each decision:	None	
The proportion of women and the proportion of men who participate in decisions about the use of meat (when livestock are slaughtered)	# of women who participate/# of livestock owning women; # of men who participate/# of livestock owning men		
Control			
Livestock: Proportion of women and the proportion of men participating in decisions about the sale or slaughter of livestock	# of women who participate/# of women in sample population; # of men who participate/# of men in sample population		

Table 1 contd: List of indicators with formulae and findings from the literature review

Indicator	Formula	Caveats in the literature about the link to gender equality	Existence of large-scale empirical studies using the indicator (as well as small-scale studies)
Water and Forest Resources			
Use			
Proportion of women and the proportion of men able to access water, firewood and fodder to the desired degree	# of women who participate/# of women in sample population; # of men who participate/# of men in sample population	Answers may be strongly determined by socioeconomic status	
Number of hours (per week, per person) for women and for men in the household spent on collecting water,firewood and fodder	Sum of # of hours spent by each woman; sum of # of hours spent by each man	None	Yes
Control			
The proportion of women and the proportion of men who are members of a water or forest user group	# of women who report membership/# of women in sample population; # of men who report membership/# of men in sample population	Membership may not mean influence	Yes
The proportion of women and the proportion of men who have ever attended user group meetings (conditional upon membership)	# of women who report attendance/# of women who report membership; # of men who report attendance/# of men who report membership	Attendance may not mean influence	
The proportion of women and the proportion of men who report ever having spoken at user group meetings (conditional upon membership)	# of women who report speaking/# of women who report membership; # of men who report speaking/# of men who report membership	None	

Table 1 contd: List of indicators with formulae and findings from the literature review

Indicator	Formula	Caveats in the literature about the link to gender equality	Existence of large-scale empirical studies using the indicator (as well as small-scale studies)
Financial Assets			
Use	-		
Proportion of women and the proportion of men banked (individually or jointly) in a formal sector institution	# of women banked/# of women in sample population; # of men banked/# of men in sample population	Having an account may not have the same impact as actively using it	Yes
The average duration for women and the average for men of participation in a micro-/informal financial institution	Average of numbers of years of member ship for women per woman member; Average of number of years of membership per male members	Increases income generation, but mixed evidence on other aspects of gender equity	Yes
Proportion of women and the proportion of men who have saved money in the last 12 months through a formal or informal institution (i.e., not "under the pillow")	# of women who report saving money/ # of women in sample population; # of men who report saving money/ # of men in sample population	Savings may take away from needed consumption	Yes
Proportion of women and the proportion of men who received a loan in the last 12 months from a formal or informal institution	# of women who report a loan/# of women in sample population; # of men who report a loan/# of men in sample population	The impact of the loan may be different depending on whether it is asset debt or expense debt	Yes
Control	-		
Proportion of women and the proportion of men who decided how to use the loan/savings amounts (conditional upon saving, access to loan)	# of women who participated in decision/ # of women; # of men who participated in decision/ # of men	None	Yes
Proportion of women who acquired ownership stake in the asset, conditional upon asset use of loan	# of women who acquired stake/ # of women who received loan; # of men who acquired stake / # of men who received loan		Yes

Proportion of women and proportion of men responsible for repayment of the loan (conditional upon loan receipt)	# of women who are responsible/ # of women who received loan; # of men who are responsible/ # of men who received loan	Such responsibility may be onerous in the case of a debt cycle	

Table 1 contd: List of indicators with formulae and findings from the literature review

Indicator	Formula	Caveats in the literature about the link to gender equality	Existence of large-scale empirical studies using the indicator (as well as small-scale studies)
Labor[10]			
Use			
Female labor force participation rate and male rate in agriculture (denominator, size of agricultural labor force)	# of women performing agricultural SNA work/ # of individuals performing or seeking agricultural SNA work; # of men performing agricultural SNA work/ # of individuals performing or seeking agricultural SNA work;	Participation in agriculture may imply exclusion from nonagricultural activities	Yes
Female paid labor force participation rate and male rate in agriculture (denominator, size of agricultural labor force)	# of women performing or seeking agricultural SNA work for wages/ # of individuals performing or seeking agricultural SNA work; # of men performing or seeking agricultural SNA work for wages/ # of individuals performing or seeking agricultural SNA work	Participation in agriculture may imply exclusion from nonagricultural activities	Yes
Proportion of women and proportion of men who report that they are underemployed (employed for fewer hours than they want to be)	# of women who report underemployment/# of women performing agricultural SNA work; # of men who report underemployment/# of men performing agricultural SNA work;		Yes
Average hours of leisure for women and average hours for men or proportion of women and proportion of men who report inadequate leisure time	# of hours of leisure reported by women/# of women in sample population; # of hours of leisure reported by men/# of men in sample population		Yes
Control			
No recommended indicators; see text for suggestions			

[10] SNA: UN System of National Accounts

Table 1 contd: List of indicators with formulae and findings from the literature review

Indicator	Formula	Caveats in the literature about the link to gender equality	Existence of large-scale empirical studies using the indicator (apart from small-scale studies)
Income			
Proportion of women and proportion of men who retain any part of their own earnings and/or receive any part of the earnings of any others in the household	# of women who answer yes/# of women in sample population; # of men who answer yes/# of men in sample population		
Proportion of women and proportion of men who participate in decisions to purchase daily goods	For each: # of women who participate/# of women in sample population; # of men who participate/# of men in sample population		Yes
Proportion of women and proportion of men who participate in decisions to purchase major goods			Yes
Proportion of women and proportion of men who participate in decision-making about income generated from (a) food crops, (b) cash crops, (c) livestock production, (d) nonfarm activities, and (e) wage and salary work	# of women who participate/# of women in sample population; # of men who participate/# of men in sample population		

Table 1 contd: List of indicators with formulae and findings from the literature review

Community Groups			
Participation			
Average number of community organizations/groups that women are members of and average number that men are members of	Sum of # reported by each woman/ # of women in sample population; sum of # reported by each man/# of men in sample population	Membership does not equate to influence	
Average number of agricultural producer/farmer groups women are members of and average number that men are members of	Sum of # reported by each woman /# of women in sample population; sum of # reported by each man/ # of men in sample population	Membership does not equate to influence	
Proportion of women and proportion of men who attended village council meetings	# of women who report attendance/# of women who report membership; # of men who report attendance/ # of men who report membership	Membership does not equate to influence	Yes
Indicators of influence/control			
Proportion of women and proportion of men who spoke up at community group/village council meetings	# of women who report speaking/# of women who report membership; # of men who report speaking/ # of men who report membership		
Proportion of female leaders and proportion of male leaders who are representatives in the village council (publicly available data)			Yes

Table 2: Evaluation of indicators: resource intensity, replicability, and time sensitivity

Note: Ownership and decision-making here refer to sole and joint combined. However, data should be collected separately on sole and joint ownership and participation in decision-making.

Indicator	Resource intensity of data collection			Replicability	Time sensitivity	
	Required indicator already available	**Builds upon existing data instrument**	**No basis in existing international surveys**	**Contexts where inapplicable**	**Short to medium term**	**Long term**
Land						
Ownership						
Proportion of women/men who own land		GAGP, LSMS-ISA		Where land is state controlled or collectively controlled; meaning of ownership varies		Yes
The average area of land owned by women and the average owned by men		GAGP, some LSMS-ISA		Where land is state controlled or collectively controlled; meaning of ownership varies		Yes
The average sale value of the land owned by women and the average sale value of land owned by men		GAGP		If no effective land markets	Yes	
Use						
Proportion of women and proportion of men who participate in decision-making about the use of crops (sale versus own-consumption)						Yes
Control						
Proportion of women and proportion of men participating in decisions about the agricultural use of land: (a) crop choice, (b) choice of inputs, (c) timing of cropping, (d) sale/transfer of land		FAO gender and land rights database, but not disaggregated by decision type; WEAI, GAGP		Preferably collected by plot/crop, but that depends on the nature of the gender division of labor (crop-based versus crop- and plot-based)		Yes

Table 2 contd: Evaluation of indicators: resource intensity, replicability, and time sensitivity

Indicator	Resource intensity of data collection			Replicability	Time sensitivity	
Livestock						
Ownership						
The proportion of women and the proportion of men who own livestock (preferably by livestock type, for example: poultry, sheep and goats, cattle)		WEAI (does not ask about kinds of livestock), GAGP (categorized by livestock type)		Livestock categories must be broad enough to cover local variations	Yes	
The average TLU owned by women and the average TLU owned by men			Yes		Yes	
Average sale value of livestock owned by women and the average sale value of livestock owned by men			Yes		Yes	
Use						
The proportion of women and the proportion of men who participate in decisions about the use of dairy products from livestock (eggs, milk, etc.)			Yes (may also be inferred from time-use surveys)			Yes
The proportion of women and the proportion of men who participate in decisions about the use of meat (when livestock are slaughtered)			Yes (may also be inferred from time-use surveys)			Yes
Control						
Livestock: the proportion of women and the proportion of men participating in decisions about the sale or slaughter of livestock		WEAI				Yes

Table 2 contd: Evaluation of indicators: resource intensity, replicability, and time sensitivity

Indicator	Resource intensity of data collection			Replicability	Time sensitivity	
Water and Forest Resources						
Use						
Proportion of women and the proportion of men able to access water,firewood and fodder to the desired degree		WWAP is developing indicators for water.		Better-off households/regions may not perceive shortages	Yes	
Number of hours (per week, per person) for women and for men in the household, spent on collecting water,firewood and fodder		National time-use studies (UN Statistics Division), but disaggregated indicators are not easily available.			Yes	
Control						
The proportion of women and the proportion of men who are members of a water or forest user group		WEAI has a general question about membership in village-level groups.		Groups may not exist in particular regions	Yes	
The proportion of women and the proportion of men who have ever attended user group meetings (conditional upon membership)				Groups may not exist in particular regions; may not hold regular meetings	Yes	
The proportion of women and the proportion of men who report ever having spoken at user group meetings (conditional upon membership).		WEAI has a question about being comfortable speaking in groups.		Groups may not exist in particular regions; may not hold regular meetings		Yes

Table 2 contd: Evaluation of indicators: resource intensity, replicability, and time sensitivity

Indicator	Resource intensity of data collection			Replicability	Time sensitivity	
Financial Assets						
Use						
Proportion of women and the proportion of men banked (individually or jointly) in a formal sector institution	Findex			Depends on network of formal sector financial institutions	Yes	
The average length of time (duration) for women and the average for men of participation in a micro- or informal financial institution			Yes			Yes
Proportion of women and the proportion of men who saved money in the last 12 months through a formal or informal institution (i.e., not "under the pillow")	Findex				Yes	
Proportion of women and the proportion of men who received a loan in the last 12 months from a formal or informal institution	Findex				Yes	

Table 2 contd: Evaluation of indicators: resource intensity, replicability, and time sensitivity

Indicator	Resource intensity of data collection			Replicability	Time sensitivity	
Water and Forest Resources						
Use						
Proportion of women and the proportion of men able to access water/firewood/fodder/fish to the desired degree		WWAP is developing indicators for water.		Better-off households/regions may not perceive shortages	Yes	
Number of hours (per week, per person) for women and for men in the household, spent on collecting water/firewood/fodder/fish		National time-use studies (UN Statistics Division), but disaggregated indicators are not easily available.			Yes	
Control						
The proportion of women and the proportion of men who are members of a water or forest user group		WEAI has a general question about membership in village-level groups.		Groups may not exist in particular regions	Yes	
The proportion of women and the proportion of men who have ever attended user group meetings (conditional upon membership)				Groups may not exist in particular regions; may not hold regular meetings	Yes	
The proportion of women and the proportion of men who report ever having spoken at user group meetings (conditional upon membership).		WEAI has a question about being comfortable speaking in groups.		Groups may not exist in particular regions; may not hold regular meetings		Yes

Table 2 contd: Evaluation of indicators: resource intensity, replicability, and time sensitivity

Indicator	Resource intensity of data collection				Replicability	Time sensitivity
Financial Assets						
Use						
Proportion of women and the proportion of men banked (individually or jointly) in a formal sector institution	Findex			Depends on network of formal sector financial institutions	Yes	
The average length of time (duration) for women and the average for men of participation in a micro- or informal financial institution			Yes			Yes
Proportion of women and the proportion of men who saved money in the last 12 months through a formal or informal institution (i.e., not "under the pillow")	Findex				Yes	
Proportion of women and the proportion of men who received a loan in the last 12 months from a formal or informal institution	Findex				Yes	
Control						
Proportion of women and the proportion of men who decided how to use the loan/savings amounts (conditional upon saving, access to loan)			Yes			Yes
Conditional upon asset use of loan; proportion of women who acquire ownership stake in the asset		GAGP				Yes

Proportion of women and the proportion of men responsible for repayment of the loan (conditional upon loan receipt)		GAGP			Yes	

Table 2 contd: Evaluation of indicators: resource intensity, replicability, and time sensitivity

Indicator	Resource intensity of data collection				Replicability	Time sensitivity
Labor						
Use						
Female labor force participation rate and the male rate in agriculture (denominator, size of agricultural labor force)	World Development Indicators			Depends on gender division of labor		Yes
Female paid labor force participation rate and the male rate in agriculture (denominator, size of agricultural labor force)	World Development Indicators, national household surveys			Depends on gender division of labor		Yes
Proportion of women and the proportion of men who report that they are underemployed (employed for fewer hours than they want to be)			Yes		Yes	
Average hours of leisure for women and the average for men; or the proportion of women and the proportion of men who report inadequate leisure time		WEAI, national time-use surveys				Yes
Control						
No recommended indicators; see text for suggestions						

Table 2 contd: Evaluation of indicators: resource intensity, replicability, and time sensitivity

Indicator	Resource intensity of data collection				Replicability	Time sensitivity
Control						
No recommended indicators; see text for suggestions						
Income						
Proportion of women and the proportion of men who retain any part of their own earnings and/or receive any part of the earnings of any others in the household			Yes			Yes
Proportion of women and the proportion of men who participate in decisions to purchase daily goods	DHS					YES
Proportion of women and the proportion of men who participate in decisions to purchase major goods	DHS					YES
Proportion of women and the proportion of men who participate in decision-making about income generated from (a) food crops, (b) cash crops, (c) livestock production, (d) nonfarm activities, and (e) wage and salary work		WEAI				YES

Table 2 contd: Evaluation of indicators: resource intensity, replicability, and time sensitivity

Indicator	Resource intensity of data collection				Replicability	Time sensitivity
Community Groups						
Participation						
Average number of community organizations/groups that women are members of, average that men are members of		WEAI has a general question about membership in village-level groups		Conditional upon existence of local-level community bodies	Yes	
Average number of agricultural producer/farmer groups that women are members of, that men are members of			Yes	Conditional upon existence of local-level community bodies	Yes	
Proportion of women and proportion of men who attended village council meetings			Yes	Conditional upon existence of elections	Yes	
Indicators of influence/control						
Proportion of women and proportion of men who spoke up at community group/village council meetings		WEAI has a general question about membership in village-level groups	Yes	Conditional upon existence of local-level community bodies		Yes
Proportion of female leaders and proportion of male leaders who are representatives in the village council (publicly available data)				Conditional upon existence of local-level community bodies		Yes