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Agriculture, Gendered Time Use, and Nutritional Outcomes

A Systematic Review

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ABSTRACT

Existing reviews on agriculture and nutrition consider limited evidence and focus on impact size, rather than impact pathway. This review overcomes the limitations of previous studies by considering a larger evidence base and exploring time as one of the agriculture-nutrition pathways. Agricultural development plays a role in improving nutrition. However, agricultural practices and interventions determine the amount of time dedicated to agricultural and domestic work. Time spent in agriculture—especially by women—competes with time needed for resting, childcare, and food preparation and can have unintended negative consequences for nutrition.

The findings of this systematic review confirm previous conclusions about the gendered nature and impact of agricultural practices and interventions. However, the results contradict the assumption that rural residents in low- and middle-income countries have surplus labor time. In particular, the evidence shows that

- women play a key role in agriculture, and this is reflected in their time commitments to these activities, whether as farmers or as farmworkers;
- women are important actors in the uptake and response to agricultural interventions; and
- agricultural interventions tend to increase women's, men's, and children's time burdens.

However, the studies included in this review do not provide clear-cut evidence on the nutritional implications of agricultural practices and interventions, even when these result in increased time spent on agricultural activities.

Nutritional impacts are varied because households and household members respond to increased time burden and workload in different ways. Why are responses different? It depends on a number of important differentiating factors that include income and the possibility of purchasing food, household socioeconomic status more generally, household type and composition (in particular the presence of members who can take up domestic work), and the type of indicator used to assess food consumption, security, or nutrition. Therefore different sets of policies are needed to address specific forms of burden management, shouldered by households, individual household members, or both.

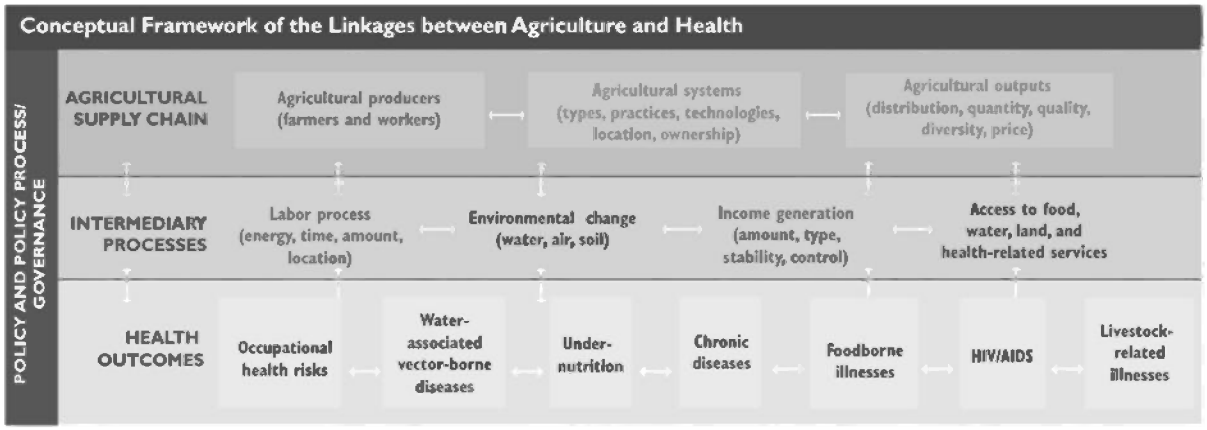
Keywords: agricultural interventions, nutrition, time use, gender

1. THE CONTEXT FOR THIS REVIEW

The Impact of Agriculture on Nutritional Outcomes

During the past ten years, the impact of agriculture on health has received renewed interest. There is a wide set of complex interactions between agriculture, food, nutrition, and health, which provides both challenges and opportunities for researchers and policymakers (Lang 2010). These challenges are encapsulated in the diagram designed by Hawkes and Ruel (2006) (Figure 1.1).

Figure 1.1 Conceptual framework of the linkages between agriculture and health



Source: Hawkes and Ruel (2006).

This systematic review focuses on the central link between agricultural interventions and nutrition,[1] a key concern for all interested in development outcomes. Nutritional status greatly influences an individual's growth, educational attainment, productivity, reproductive success, and susceptibility to disease.

Nutrition's contribution to disease burden differs by age, gender, social group, and region (Global Burden of Disease 2010). Globally, the health risks of a high body mass index and low consumption of fruit and whole grains have risen in importance. However, undernutrition remains significant in many areas. Malnutrition and suboptimal breast-feeding were the number one global health risk factor for children ages four and under. There is an important reverse linkage from poor health to poor nutrition, which operates through changes in metabolism, malabsorption, appetite loss, and maternal feeding practices (Girard et al. 2012). Women and children are particularly vulnerable to poor nutrition, with the key period being the first 1,000 days from conception (PMNCH 2012). There are strong gendered patterns to nutritional risks, with women and girls experiencing far higher rates in some settings.[2] There may be important inequities in nutritional outcomes between social groups, and in several countries the gaps between the rich and poor have widened (World Bank 2013). Overall, the health and financial costs to low- and middle-income countries from malnutrition—both undernutrition and, increasingly, overnutrition—are extremely high.

The proposed Sustainable Development Goals assign great importance to nutrition and health and, at the same time, acknowledge some of the interconnections between agriculture, food security, and nutrition. The second Sustainable Development Goal is aimed at ending hunger, achieving food security and improved nutrition, and promoting sustainable agriculture. The third goal is about ensuring healthy lives and promoting well-being for everyone at all ages.

[1] However, other interactions include the creation of occupational health risks for farmworkers, the propagation of food-borne disease, and the health effects of the environmental change caused by operation of the agricultural and food sectors.

[2] http://www.fao.org/gender/gender-home/gender-programme/gender-food/en/.

Cross-sectoral approaches linking agriculture, food, nutrition, and health promise to be far more effective, efficient, and sustainable than single-sector strategies (World Bank 2013). Cross-sectoral actions can strengthen health outcomes in three ways: accelerating and improving the sustainability of interventions by changing the underlying economic and social determinants of poor nutrition, increasing the scale of operations as nutrition considerations are integrated into programs in other sectors, and attending to the unintended consequences for nutrition resulting from other policies and programs. Interventions can be thought of as nutrition specific (that is, activities directly providing nutritional inputs) or nutrition sensitive (that is, interventions that provide other kinds of input and that may have a wide range of sectoral goals but that also affect nutrition).

A number of nutrition-sensitive agriculture interventions were identified in a review by Hawkes et al. (2012), by the existence of nutrition-improvement goals as part of an agricultural development project. All projects that had a stated objective of improving nutrition, even if nutritional status was not explicitly measured, and which included an agricultural component, were deemed relevant. Only current and planned research projects were included, thereby excluding most published research. The review at the time (April–August 2012) identified 151 projects, with a strong geographic focus on Africa south of the Sahara and, to a lesser extent, Asia. Many projects were focused on female and child outcomes.

Time is a crucial link in the pathways between agriculture and health. Time is needed for farming, for waged work, to buy food, and for domestic activities of food preparation and childcare. Time must be divided between these activities, so trade-offs exist between them. For instance, if women increase their time spent in food production, they may have less time to prepare nutritious foods for themselves and their children. Trade-offs can be complex and unpredictable and depend on a range of factors, some of which are highlighted in recent discussion of agriculture and health linkages (Kadiyala et al. 2014). These authors show that the increased income obtained through women's waged work does not necessarily improve nutrition because women have less time to spend on child health. However, they also point out that women's employment in agriculture may not always reduce time for childcare, especially when there are other people in the home who take on this responsibility (Kadiyala et al. 2014, 50). They also highlight issues of seasonality and work intensity, both of which dovetail with time use to produce contradictory outcomes (Kadiyala et al. 2014, 51). The current project is motivated by a need to better understand these complexities and the various ways in which different patterns of time use may redirect or even reverse taken-for-granted pathways between agriculture and health.

The Research Landscape

Policymakers increasingly call for evidence on effectiveness of policy, and in the area of nutrition, this has led to several exercises to determine the effects of agricultural interventions on nutrition in the past decade (Webb and Kennedy 2014). This systematic review attempts to clearly situate itself in the light of existing research and reviews of the interaction between agricultural interventions and nutritional outcomes.

Two characteristics are relevant:

1. Existing studies have had limited evidence to consider.
2. Existing studies have tended to focus on impact size and have not always looked at impact pathway.

Why do we argue this? Taking first the issue of limited evidence, there is wide agreement that the evidence on nutrition-sensitive agricultural and food interventions is weak due to the absence of sufficient good-quality research and evaluation (Girard et al. 2012; Ruel and Alderman 2013; Webb and Kennedy 2014). To give one example, in their systematic review of the effects of agricultural interventions on children's nutrition, Masset et al. (2011) found that their criteria in terms of study indicators and study quality meant that their original pool of more than 7,000 studies was reduced to 23 in the final analysis. Of these, no study reported participation rates or coverage or presented information by socioeconomic

status (to determine how the most vulnerable were affected). Anthropometric data were collected in only 13 of the 23 studies, and of these, few reported rates of stunting or wasting (Masset et al. 2011, 25).

Overall, evaluations have often been forced to focus on studies that are able to provide evidence on the entire theory of change (Webb and Kennedy 2014). In effect, this has meant that they have focused on those participating in home gardens and on homestead food production (Ruel and Alderman 2013). There is often limited coverage of the areas covered by studies, focusing often on rural areas. In the Masset et al. (2011) study, of the 23 studies included, 8 focused on a country in Africa south of the Sahara, 8 on a South Asian country, 5 on East Asia, and 2 on countries from more than one region. Few studies look at impact of interventions on nonparticipants or at the impact of wider policies or programs (Turner et al 2013; Webb and Kennedy 2014, 131). With these caveats in mind, it is clear that home gardens and food production interventions are able to improve dietary patterns and improve vitamin A intakes of women and children in the participating households. However, there is mixed evidence that nutritional outcomes can be improved, with the only strong evidence base presently for orange sweet potatoes (Girard et al. 2012; Ruel and Alderman 2013).

There are several problems created by this lack of evidence. As Webb and Kennedy (2014, 126) remind us, "absence of evidence should not be equated with evidence of no impact." However, it is also true that the patchy evidence itself has had three further weaknesses. First, studies have generally failed to investigate the outcomes for nonparticipants and the indirect effects of interventions (Turner et al. 2013). Second, systematic reviews have often been unable to unpack the broad domains of "agriculture" on the one hand, and "nutritional status" on the other. Third, Webb and Kennedy (2014, 130) argue that there is a need for more research on the pathways to impact. This is because many of the existing studies have focused on determining the size and direction of impacts, rather than the channels by which impact occurs. Webb and Kennedy (2014, 130) summarize the findings that suggest that interventions may be particularly powerful where behavior change communication is integrated; income, output, and consumption are integrated; women's empowerment is enhanced; and there is attention to overall health (for example, the impact of greater zoonotic disease through increased animal husbandry).

Many studies and reviews identify women's role as key. Ruel and Alderman (2013, 68–69) argue that all researchers in this field agree that women are central mediators of the pathway from agriculture to nutritional outcomes. Girard et al. (2012) remind us of the reasons increased homestead food production may not benefit the women and children in the household. Household production strategies may not always be aimed at the production of high-quality food, and if they are, households may sell the high-quality foods they grow, and the income earned may not be used on high-quality food. Any high-quality food that is purchased or retained by the household may not be eaten by women and children—or if received by them, this food may not be consumed in sufficient quantities to effect nutritional change, in light of the existing disease burden. However, Ruel and Alderman (2013, 70) remind us that few studies measure the impact of agricultural interventions on women's time, knowledge, resources, or nutritional status.

The Neglect of Time Use

A focus on time use has the potential to expose invisible social and economic inequalities. This is because time is an important indication of the frequently unequal distributions of labor at both intra- and interhousehold levels. Gender is a crucial category through which time use is unevenly distributed, but age, marital status, and other social rankings many also be significant, depending on the context. This research project is aimed at exploring the linkages between agricultural interventions (policies and projects) and practices, time use patterns, and nutritional outcomes through the lens of gender and other power relations. Why is an investigation of time use relevant as a pathway to impact? *Although agriculture is considered important to improve nutritional outcomes, agricultural interventions and practices can have unintended negative consequences on nutritional status via time use outcomes because time is a critical factor for nutrition.* In this section, the evidence for this assertion is laid out. However, it should be noted that the need for a review of the knowledge base on the impact of agriculture on gendered

time use was identified in a workshop held in March 2013 by The Leverhulme Centre for Integrative Research on Agriculture and Health: Limits to Gender Empowerment? Gender Perspectives on Agriculture and Health. The 25 participants included specialists from a range of disciplines working in the area of gender, agriculture, and health. The aim of the workshop was to assess existing scholarship on gendered approaches to agriculture and health, with a view to identifying gaps and opportunities for further research. The need for a review of the evidence on time use was identified at that workshop but is further supported by the secondary material below.

The most recent evidence from internationally comparable databases shows that women are heavily involved in agriculture. In the current policy context, women are seen as heavily responsible for food production—it is estimated that women make up 40 percent of the agricultural labor force in low-income countries (Food and Agriculture Organization of the United Nations [FAO] 2011). Surely, there are regional differences due to variation in farming systems and gendered division of labor—for instance, in Africa south of the Sahara women appear to be disproportionately in charge of agricultural food production (50 percent of labor force in agriculture) relative to other regions of the world (for example, Latin America has on average 20 percent of women working in agriculture) (FAO 2011). Yet it remains true that women play a significant role in shaping agricultural and food practices due to their involvement in food production and, important to note, in other stages of food provision such as food purchase, preparation, and processing. This recognition has shaped policy debates for rural development since the 1970s, from Women in Development onward (Kandiyoti 1990) and led scholars and policymakers to consider the implications of work on the well-being of women themselves and their children (if any), families, and communities.

The concern for well-being is exacerbated by the fact that although many women are economically active in the agricultural and other sectors, they tend to maintain unequal reproductive responsibilities relative to men. Studies conducted in Africa and Asia demonstrated that women work as much as 13 hours more per week than do men (FAO 2009). In addition, some of the activities that are female dominated have been proven to be most time consuming; for instance, one of the most laborious activities is food preparation (for example, see Barrett and Browne 1994; Hyder et al. 2005). From here originated the debate on time-saving technologies (for example, see Carr 1978; Cecelski 2000), which would help women decrease their time burden and drudgery and, eventually, make women more productive. Time use studies have corroborated the notion on women's time poverty (Hirway 2010) and provided evidence of an unequal time burden for women, thus making women's unpaid work visible (Jackson and Palmer-Jones 1998). It is also important to take into consideration the household's developmental cycle and how it may shape women's use of time over time.

Men are affected by time constraints too, but they are seen as being more able to perform their activities sequentially, whereas women may have to pursue their paid and unpaid work simultaneously (Blackden and Wodon 2006), thus facing more severe trade-offs between reproductive and productive activities, or between productive activities of different kinds. Yet it is important to take men's time use into consideration to have a more comprehensive picture of household allocation of labor and its implications on food consumption and nutrition. In fact, intrahousehold time use as well as intrahousehold distribution of food is another factor that shapes the nutritional status of women, children, and men.

Time use patterns shape food consumption practices and nutritional outcomes (for example, Hull 2013). Exploring the mechanisms through which this occurs is especially relevant in light of the growing numbers of nutrition-related noncommunicable diseases (Popkin 2006), increased availability of processed foods in low-income countries and centrality of women in development and poverty-reduction agendas. In this context, if agriculture is a primary source of employment and income for many women and men, then consideration for the time use outcomes of agricultural practices is to be an essential component of the study of nutritional outcomes.

Quoting from the research base discussed in the previous subsection, we can see both a concern about the role of time constraints and agreement that there is a lack of information. Thus, we see increasing recognition that effective programs need to consider the gendered impact on workloads and time constraints (Berti et al. 2004, 604–605; Arimond et al. 2011, 49). World Bank (2007) notes that women are usually principal agents in terms of nutrition and agriculture but that they tend to be exceptionally constrained in terms of time and resources. As a result, it is essential that programs do not impose additional constraints on women's time. This is formalized in the reviews by Masset et al. (2011, Table A1.1), Leroy and Frongillo (2007, 2312), and Arimond et al. (2011, 55), which include the impact on women's (or caregivers') time in the theory of change linking agriculture to nutritional outcomes.

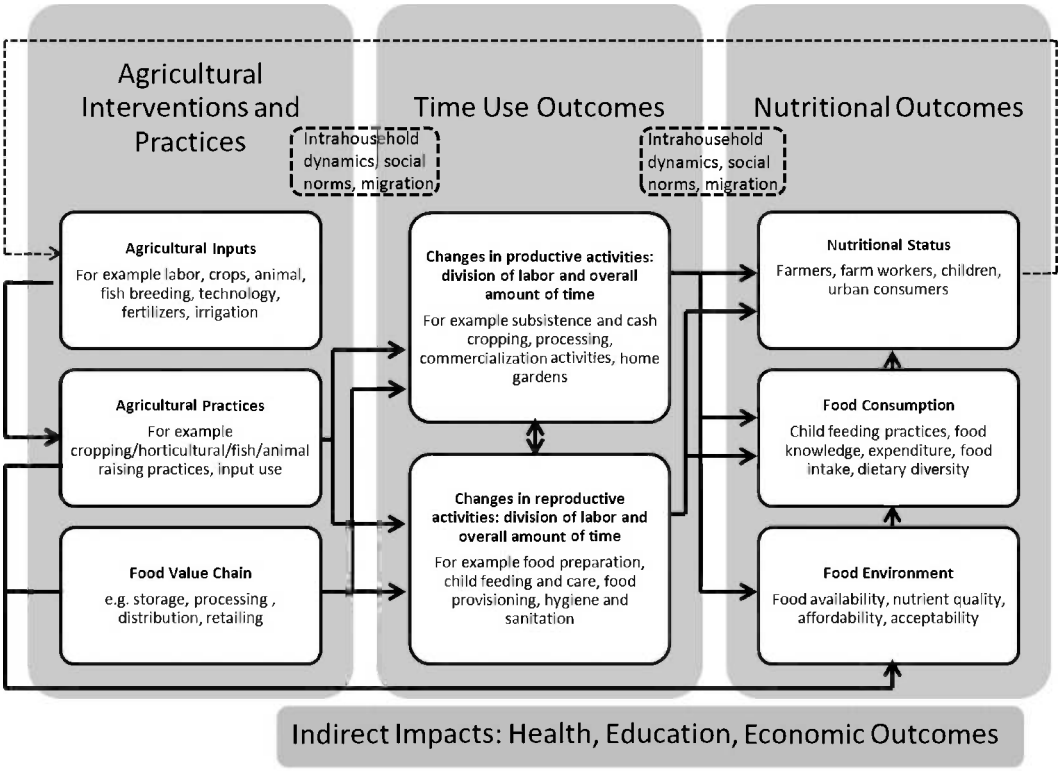
However, the evidence to understand how agriculture affects women's or men's time is quite limited in practice. The systematic review of aquaculture interventions by Kawarazuka (2010, 29) found limited evidence of aquaculture activities on gendered workloads or time allocation. Further, in the systematic review by Leroy and Frongillo (2007, 2313) of animal husbandry and aquaculture, only 4 of the 14 included studies have even a limited assessment of the impact on caregiver time and workload, and these show mixed impacts. Leroy and Frongillo conclude that given this lack of knowledge, it is possible that the potential benefits from any successful intervention to increase the output of animal-sourced protein may be offset by a reduction in the time available for childcare (2007, 2315).

2. THEORY OF CHANGE FOR THE IMPACT OF AGRICULTURE ON NUTRITION VIA TIME USE

This review assesses the evidence on the size and causes of impact along the pathway set out in Figure 1.1. How do agricultural interventions and practices (including those aimed at women) affect time use—are they well designed (thereby conserving women's and men's time spent on agricultural tasks), or do they put added pressure on other productive and reproductive activities carried out by women and men? In particular, does increased time on agricultural tasks mean that (1) time for childcare is reduced, (2) time for rest (particularly for women) is reduced, and (3) time for food provisioning and preparation is reduced? Each one of these three routes (set out in our theory of change diagram below) has the potential for negative nutritional outcomes.

In Figure 2.1, it can be seen that changes in time allocation are an output of varied agricultural practices. Time then becomes an input into care activities and other activities associated with nutritional outcomes.

Figure 2.1 Theory of change



Source: Compiled by authors.

Do time use outcomes differ due to differences in farming systems or agrarian structures? Do time use outcomes differ due to differences in employment status within farming systems (own-account farmer, unpaid family worker, casual or seasonal wage worker, formally employed worker)?

In this work, time is of interest in its own right (as part of the set of constraints faced by women and men) but also as a proxy for work burden. Here it must be recognized that time is an imperfect proxy for burden or energy expenditure (Jackson and Palmer-Jones 1998). Is the change in time use changing work intensity and with it energy intensity? With this in mind, one hypothesis is that agricultural interventions may raise the energy intensity of women's activities, with negative effects on their nutritional and wider health outcomes.

3. METHODS FOR THIS REVIEW

The Systematic Review Approach and Structure

This research project is aimed at exploring the linkages between agricultural interventions (policies and projects) and practices, time use patterns, and nutritional outcomes through the lens of gender and other power relations. The study will be based on the review of existing literature and the exploration of new sources of data to then draw overall policy conclusions.

Given the review of the research landscape set out in the Research Landscape section, this review has identified three key approaches that are intended to solve the problems experienced by previous reviews:

1. It aims to improve our evidence base by using an approach intended to capture a wider set of data than previous reviews. As such, the review will analyze three sets of studies: those that look at the impact of agricultural interventions and practices on time use, those that look at the impact of time use on nutritional outcomes, and those that look at the full pathway from agricultural interventions and practices to nutritional outcomes via time use. The intention is to widen the pool of relevant data that can be analyzed while still allowing us to consider the link between agricultural interventions and outcomes.
2. It aims to unpack and map the available evidence. This gap map in itself is a useful contribution to the debate about the impact of agricultural interventions, as it highlights the range of geographic, thematic, and methodological weaknesses in the existing literature.
3. It aims to understand not only the size of impact but also the impact pathway. It does this in two senses: by maintaining a focus on a particular pathway, in this case time use, and by providing a narrative synthesis of the quantitative and qualitative studies on this issue to outline why impacts have occurred. In the field of development research and practice, systematic reviews are often used to synthesize evidence on impact evaluations. In other words, they restrict the focus on studies assessing the impact of intervention X on outcome Y. As described in earlier sections, this review is concerned with a wider understanding of the role time plays as a mediating factor in the relationship between agriculture and nutrition. So on the one hand, there is an interest in understanding the impact of agricultural interventions but with a strong consideration for the mechanisms and the circumstances under which they take place. On the other hand, the review is aimed at testing and, possibly, expanding the theoretical framework on agriculture, time use, and nutrition.

This review will include information from studies on both agricultural interventions (policies and projects) and practices:

- By agricultural interventions, we refer to policies, programs, and projects implemented at a specific point in time. For instance, this includes programs to introduce particular agricultural technologies or crops while it excludes processes of agricultural commercialization, which take place more gradually and describe wider processes of change. Agricultural interventions are time-bound activities undertaken by groups or agencies, such as state bodies or nongovernmental organizations. Masset et al. (2011) provide a detailed definition of agricultural intervention activities.
- By *agricultural practices,* we broadly refer to various forms of agricultural activity. Small-scale agriculture, commercial agricultural production, homestead gardens, animal husbandry, fishery, and so forth are examples of what constitutes an agricultural practice in this review. The studies that mentioned one or more forms of agricultural practices in relation to time allocation were included in the review.

To fulfill these objectives, the research will be structured as a two-part study:

- Part A—Mixed studies review, consisting of a systematic review that makes use of qualitative, quantitative, and mixed-methods studies. The methodology to conduct the review is presented below.
- Part B—Audit of (new) sources of data.

The Objectives of This Systematic Review

The key objectives can be summarized as follows:

- To map the literature and highlight the knowledge gaps
- To develop a theoretical framework to study the association between agricultural interventions and practices, time use patterns, and nutritional outcomes through a renewed understanding of the underlying mechanisms
- To indicate how new datasets and sources can be used to shed light on the association between agriculture, time use, and nutrition
- To inform future research and policy interventions in agrihealth with a focus on time use, gender, and nutrition

Study Selection Criteria

Table 3.1 sets out the inclusion/exclusion criteria that guided the search.

Table 3.1 Inclusion/exclusion criteria

Parameters	Inclusion criteria	Exclusion criteria
Location	• Low- and middle-income countries	• High-income countries
Language	• Only English (due to time and budget constraints)	• Any language that is not English
Time frame	• No time frame specified	
Population	• Women and men, senior and junior members of households, adults and children • Rural residents	• Urban residents
Outcomes	• Studies that are concerned with the nutritional outcomes of agricultural interventions/practices via time use • Studies that are concerned with the time use changes as a result of changes in patterns of agricultural interventions/practices • Studies that are concerned with the nutritional outcomes of changes in time use patterns	• Studies that are concerned with the agricultural outcomes of nutritional interventions/statuses (reverse causality) • Studies that do not look at time use
Study type	• Primary research that uses qualitative, quantitative, and mixed methods	• Book reviews, literature reviews, policy documents

Source: Compiled by authors.

Tables 3.2 and 3.3 show the reasons results were excluded at each screening stage.

Table 3.2 Reasons for exclusion in the first round of screening on title and abstract[a]

Exclusion criteria[a]	Number of results
High-income country	200
Language	63
Urban focus	160
Reverse causality	42
Study type	51
No time use	2,854
No nutrition or no agriculture	681
Nonhuman[b]	1,380

Source: Compiled by authors.
Notes: [a]. Remembering that studies can be excluded for more than one reason, numbers do not round to the number of cases excluded. [b]. Nonhuman includes studies that are concerned only with animals, chemicals, or other nonhuman substances.

Table 3.3 Reasons for exclusion in the second round of screening on full text

Exclusion criteria[a]	Number of results
High-income country	4
Urban focus	17
Reverse causality	2
Study type	5
No time use	283
No nutrition or no agriculture	32
Nonhuman[b]	1
No full text	169
Duplication	49

Source: Compiled by authors.
Notes: [a] Remembering that studies can be excluded for more than one reason, numbers do not round to the number of cases excluded. [b] Nonhuman includes studies that are concerned only with animals, chemicals, or other nonhuman substances.

Search Strategy

The search strategy used in this review was informed by Waddington et al. (2012). A number of comprehensive databases, which include articles, books, and book chapters, were searched. The databases are CAB Abstract, Scopus, Web of Science, Econlit, and Proquest. A search of three relevant websites of development and research agencies was also conducted to capture grey literature. These organizations are the International Food Policy Research Institute, FAO, and World Health Organization.

Several trials were conducted as part of a pilot search strategy aimed at uncovering the most effective ways to capture the studies of interest. As a result, the search strategy used multiple key words and a number of filters, where possible. For example, a filter for low- and middle-income countries was used to minimize the presence of studies on high-income countries. Combinations of key words contributed to reduce the number of studies where the term "time" appeared in titles, abstracts, or both but had nothing to do with time use or time allocation.

The peculiarity of the search strategy in this systematic review is that it was constructed on a pairwise approach. Based on the results obtained through the pilot search, it was considered necessary to split the search strategy into two pairs to capture a range of studies that can shed light on the relationship

between agriculture and nutrition via time use. The pairs used are the following: agriculture and time use, expected to yield studies on the linkages between agricultural practices or interventions and time use, and time use and nutrition, aimed at capturing the studies focused on the food- and nutrition-related impacts of time use patterns. This search also encompasses the studies that include all of the elements of interest: agriculture, time use, and nutrition.

Using pairwise search leads to having a wide array of studies, presumably wider than that obtained in other mixed-methods reviews in social science research. The additional layer of complexity arises from the presence not only of qualitative, quantitative, and mixed-methods studies but also studies with different focuses. In the next section, it will be explained how the constant presence of time use in all included studies helped inform the strategy for quality assessment.

The search returned 8,205 studies, of which 5,263 were yielded by the agriculture–time use search and 2,942 by the time use–nutrition pair. All of the citations were uploaded on Eppi Reviewer, and then the duplicates, at least those identified by the software, were eliminated, which brought down the number to 5,938.

An example of the search strategy applied can be found in Appendix A, together with a summary of the databases and websites searched and the number of results obtained.

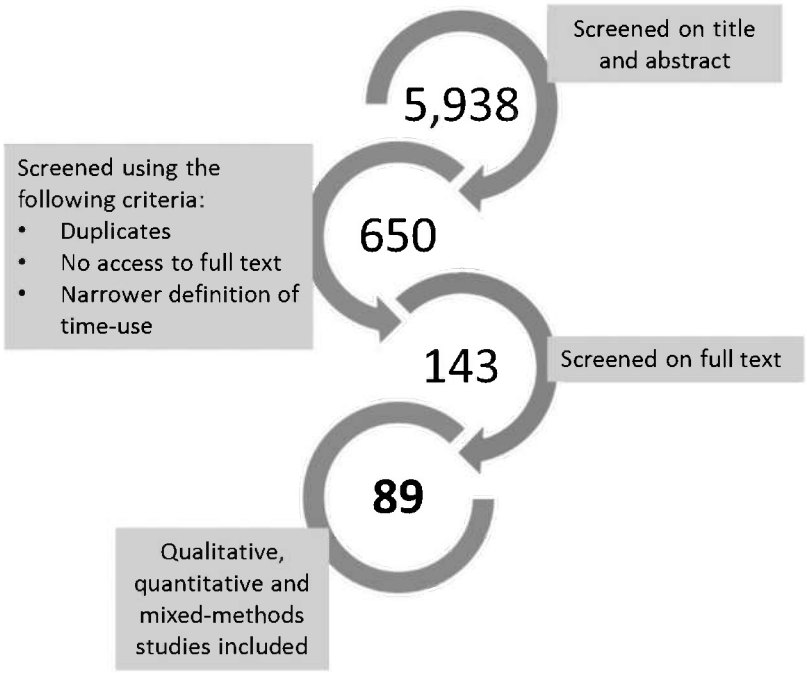
Data Collection and Analysis

Screening

The studies were initially screened on title and abstract, applying the set of inclusion and exclusion criteria listed in the Study Selection Criteria section. Following recommendation and practice (for example, Masset et al. 2011; Waddington et al. 2012), two reviewers screened the studies independently. Double-coding was then replaced by single-coding after reaching a level of disagreement less than 10 percent between the two reviewers. The original family of 5,938 results contained a vast majority of irrelevant studies. Many were studies on animals or chemicals. Others were excluded on the basis of not having a focus on time use or time allocation, agriculture, or nutrition. A relatively effective filter was used to rule out studies focused on high-income countries. Sophisticated search strategies and combinations of key words increase the chances of capturing relevant studies but are much less effective in leaving out irrelevant studies. Arguably, a reduction in the time spent on screening titles and abstracts of thousands of irrelevant studies would be an improvement in the systematic review process.

After the first round of screening, 650 studies were included. These studies were then screened in more detail (although not necessarily by reading the full text) to identify duplicates that had not previously been captured by Eppi Reviewer and to find out which studies could be fully accessed. In addition, a decision was made to narrow down the notion of time use/allocation to include only the studies that contained a comprehensive and/or detailed investigation of time use. For example, studies looking at agricultural technology or innovation that mentioned the potential for time savings without going into greater detail were excluded at this stage.

Figure 3.1 Screening process



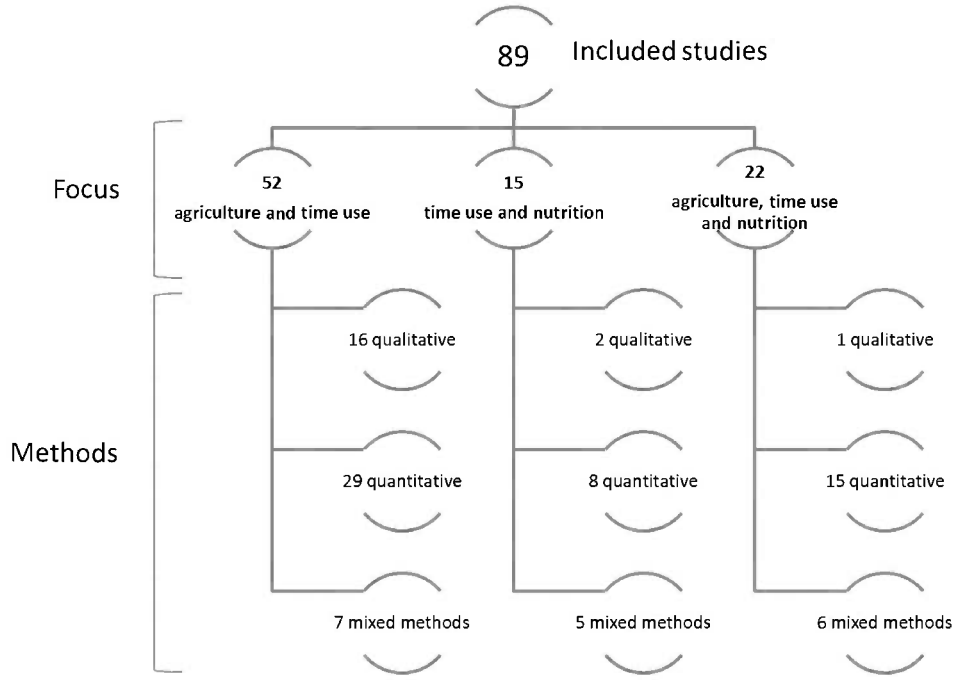
Source: Compiled by authors.

Data Extraction

The remaining 143 studies were read in full. As in the first phase of screening, two reviewers began the process independently and compared coding regularly until an agreement greater than 90 percent was reached. The codes (categories) used to extract data are based on a variety of elements of interest, including characteristics of the study at hand and factors considered important to understand how time may mediate the relationship between agriculture and nutrition.

Information was extracted on geographic area of focus and type of agricultural or food system described. Particular attention was given to data on work, paid and unpaid; consideration and measurement of socioeconomic status; and seasonality. In this phase, studies were also categorized on the basis of their focus—agriculture and time use, time use and nutrition, and agriculture, time use, and nutrition—and of the method(s) used—qualitative, quantitative, mixed methods (Figure 3.2). The full list of codes is provided in Table B.1 in Appendix B.

Figure 3.2 Included studies, by focus and method



Source: Compiled by authors.

Critical Appraisal

The critical appraisal used in this review is constituted by three components: one assessing the quality of time use data, one for qualitative evidence, and one for quantitative evidence. The first component was filled out for all included studies, and the last two were completed according to the research method(s) used in the study at hand.

The quality assessment of time use data is an element of originality introduced by this systematic review. The choice was based on the fact that a focus on time use or time allocation is the crosscutting feature of all of the included studies. A time use data quality checklist was elaborated following the format of the Critical Appraisal Skills Programme[3] (CASP) checklist for qualitative evidence. This means a set of questions whose answers can be broadly classified as "yes," "no," and "unclear." The checklist was informed by literature on time use methodology, with a specific focus on low- and middle-income countries (United Nations Statistics Division [UNSD] 2005; Esquivel et al. 2008; Esquivel 2010; Hirway 2010). Time use data are considered useful to provide a more realistic picture not only of unpaid work but also of employment in paid work, especially in areas characterized by high levels of economic informality (Hirway 2010).

In general, the appropriateness of the method used to collect time use data is to be evaluated in relation to the objectives pursued. The aim could be a comprehensive investigation of time use or a study of time spent on particular activities, such as childcare and food preparation. If data are collected through interviews, then full-time diaries, which record all activities performed in a day, are considered to be a better tool for comprehensive investigations of time use than short task lists and stylized diaries (UNSD 2005). Stylized activity diaries do not consider simultaneous activities and the definition of the activity needs to be explicit in the question to make sure respondent and interviewer are referring to the same type of activity.

[3] More information on the Critical Appraisal Skills Programme can be found at http://www.casp-uk.net/#!casp-tools-checklists/c18f8.

Interview-based methods can record time use using fixed or open time intervals. The former refers to the use of fixed time slots (of 15 or 30 minutes, for instance) during 24 hours normally as a guiding principle to record the respondent's time use. The latter indicates the documentation of different activities according to their (variable) time duration (UNSD 2005; Esquivel 2010). Open intervals tend to generate larger variations in data quality and are more difficult to process; therefore, standard practice in time use surveys is to use fixed time intervals (UNSD 2005).

Time use surveys and interviews are not the only available techniques to collect time allocation data. Qualitative investigations of time use often employ direct observation. Without going into the details of the different ways in which observation can be used, the point that is important in this context is that direct observation may be useful, even necessary, in settings where life is not organized by the clock (Esquivel et al. 2008). In these contexts, asking respondents to provide a coherent account of the amount of time spent on different activities may not yield reliable information. Linked to this, consideration for literacy levels is important for the choice of time-collection method.

Although the time use checklist includes fairly basic questions, it was difficult to ascertain accurate answers to all questions for some studies. In other words, the studies reviewed at times failed to report the methods for collection of time use data in detail, which resulted in the need to mark as "unclear" many of the fields of interest. In an attempt to minimize this uncertainty, we tried to contact the authors of a random sample of studies to obtain more precise answers. However, the response rate was low (4 responses from a random sample of 17 requests), and therefore we do not report on it because the exercise was inconclusive.

As for the more conventional components of time use to assess the quality of qualitative and quantitative evidence, the approaches followed were of two types. Although there is a high degree of consensus on how to evaluate quantitative studies, the same cannot be said for qualitative evidence. Nonetheless, there are increasing numbers of systematic reviews that include qualitative and mixed-methods studies, and unsurprisingly, there is also a corresponding body of literature that reflects on the methodological implications of assessing, selecting, and extracting data from qualitative studies (Jones 2004; Dixon-Woods et al. 2007; Thomas and Harden 2008; Snilstveit et al. 2012). Various methods have been proposed, including the CASP checklist mentioned above.

Based on reflection of different available methods and on consideration that a CASP-like approach is used for time use data, a decision was taken to limit the assessment of qualitative evidence to verification that a study is peer reviewed or not peer reviewed. This seems to be an effective and quicker tool to conduct this type of assessment.

With regard to quantitative evidence, the studies were divided in randomized and nonrandomized. For the former, the 3ie (International Initiative for Impact Evaluation) risk of bias assessment tool (Hombrados and Waddington 2012) was used. For the latter, it is less straightforward because traditional systematic reviews include only a narrow set of quantitative studies, those based on randomized experiments. To assess nonrandomized quantitative studies, the approach used by Cirera et al. (2011) and Dorward et al. (2014) was adopted. This consists of three questions to evaluate the model specification used, the methods of inference, and whether the study was peer reviewed. The model specification was assessed on the basis of

- correction of endogeneity (for instance, using instrumental variables)
- use of nonunitary models of the household
- reliance on realistic assumptions (for example, non–perfectly competitive markets)

As for the methods of inference, these were judged according to the indictors or proxies used. Given the variety of studies included, it was difficult to establish a priori a comprehensive list of indicators considered adequate or inadequate, so the assessment was made in relation to specific studies. For example, the operationalization of women's work as a dummy variable was considered an inappropriate indicator.

The studies were not included or excluded on the basis of quality. All of the studies remained included and were ranked as low-, medium-, or high-quality for each component—time use and qualitative and/or quantitative evidence. The categories were defined by distributing even weights to all questions and then establishing a set of cut-off points. The tools used for the critical appraisal are reported in Table B.2 in Appendix B.

Methods of Synthesis

The results are synthesized using a narrative-based thematic approach. The main objective of the review is to shed light on the underlying mechanisms that link agriculture, time use, and nutrition. Therefore, identifying the thematic aspects that emerged as important in the reviewed studies is the most useful way to fulfill this aim.

According to Harden (2010), there are three ways of conducting mixed-methods systematic reviews:

1. Studies included are mixed, and therefore the results are too.
2. Methods of synthesis are mixed (meta-analysis combined with another form of narrative-based synthesis for qualitative evidence).
3. Types of analysis are mixed—theory building combined with theory testing.

This review is best described by ways 1 and 3, above. In the initial phase of the review, we considered combining narrative synthesis and meta-analysis; however, this approach had to be ruled out because only one randomized study is included. Nevertheless, narrative syntheses are considered appropriate to elaborate both qualitative and quantitative evidence (Snilstveit et al. 2012).

The synthesis will be developed in the next three sections. The studies are divided into three groups to reflect the results yielded by the pairwise search strategy. Section 4 looks at the studies (52) on agricultural interventions/practices and time use. Section 5 presents the studies (15) on time use and nutrition. Section 6 considers the studies (22) that look at the entire chain—agricultural interventions/practices, time use, and nutrition. We analyze the studies in subgroups to identify the key themes and findings emerging from each group.

4. AGRICULTURAL INTERVENTIONS AND PRACTICES AND TIME USE

Agricultural Interventions and Practices

Given the objectives of the review (see The Objectives of This Systematic Review section), it was considered necessary to include studies on agricultural practices and time use (and nutrition), in addition to agricultural interventions, to deepen the conceptual understanding of the underlying mechanisms in the interactions between agriculture, time use, and nutrition. In hindsight, this also makes sense in relation to the results obtained, of which the studies on agricultural interventions and time use (and nutrition) are a very small group relative to those on agricultural practices. Table 4.1 shows that 52 out of 89 studies are on agriculture and time use, and 22 out of 89 are on agriculture, time use, and nutrition. Only 5 and 4 of these studies, respectively, are on agricultural interventions. The rest of this chapter is focused on the subgroup of studies on agriculture and time use (52), whereas those on agriculture, time use and nutrition (22) will be analyzed in section 6.

Table 4.1 Agricultural practices and interventions

Focus of study	Total	Agricultural practices	Agricultural interventions
Agriculture and time use	52	47	5
Agriculture, time use, and nutrition	22	18	4

Source: Compiled by authors.

Mapping Studies on Agriculture and Time Use

A Surprising Result

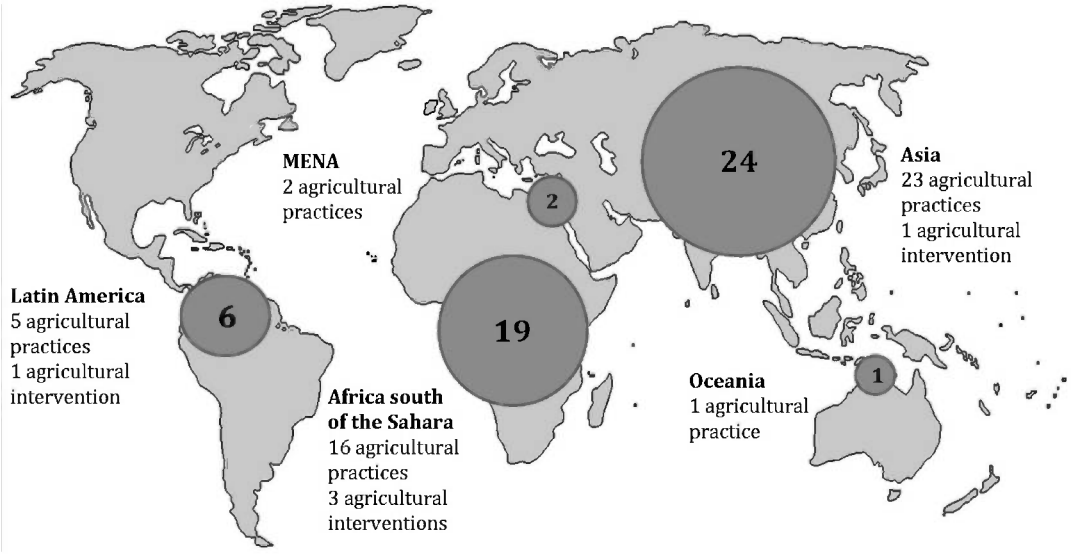
The subgroup of studies on agricultural interventions/practices and time use is the largest in this systematic review. This was a somewhat surprising result because the importance given to maternal time allocation in the nutrition literature led us to expect there would be more studies on the relationship between time use and nutrition relative to that on agriculture and time use. What emerged instead is that there is evidence on the linkages between agriculture and time, on the time allocation of farmers and farmworkers, and on rural residents' use of time in specific agricultural activities.

In this section, some descriptive characteristics of the studies on agriculture and time use are highlighted.

Geographic Area

Looking at the studies by geographic area, it can be seen that coverage is quite extensive, especially in relation to previous systematic reviews on agriculture and nutrition (see section 1). As illustrated in Figure 4.1, with regard to the geographic regions where low- and middle-income countries are dominant, the included studies focus mostly on Asia and Africa south of the Sahara. In Asia, the country that stands out for a number of studies is India. The other countries are Bangladesh, Nepal, the Philippines, Pakistan, Sri Lanka, and Indonesia. In Africa south of the Sahara, the studies are more evenly distributed across different countries, including Nigeria, Ethiopia, Zambia, Sudan, and Burkina Faso. A smaller group of the included studies are on Latin America (Peru, Ecuador, and Caribbean islands), the Middle East and North Africa (MENA) region (Turkey and Iran), and Papua New Guinea in Oceania.

Figure 4.1 Studies on agriculture and time use by geographic area



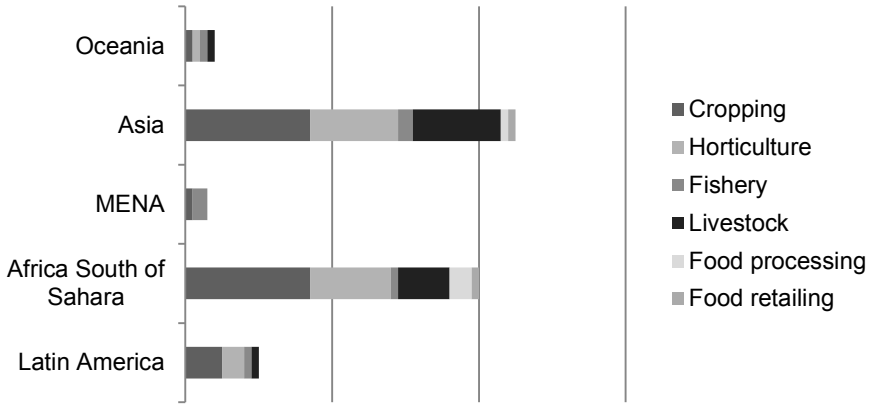
Source: Compiled by authors.
Note: MENA = Middle East and North Africa.

Agriculture and Food Systems, by Geographic Region

For each study, we coded the type(s) of agriculture, food systems, or both that were described. The different categories refer to various types of agricultural systems and segments along the food value chain. These categories are not mutually exclusive, which explains why the overall numbers are bigger than the group of studies examined.

As can be seen in Figure 4.2, the most frequent agricultural systems are cropping, horticulture, and livestock. Few studies looked at fishery, and very few studies addressed food distribution or retailing as components of the food value chain. We note therefore that a gap in research on agriculture and time use may be identified in the area of food value chains. How is time organized in employment and activities around food processing, distribution, and retailing?

Figure 4.2 Agriculture and food systems



Source: Compiled by authors.
Note: MENA = Middle East and North Africa.

Time Use

In this subgroup of studies, 33 conduct a comprehensive investigation of time use patterns, and 19 are concerned with detailed analysis of time spent on particular activities. Studies classified as using a comprehensive approach to time allocation look not only at time spent in agricultural activities but are concerned more broadly with allocation of time to nonagricultural activities, housework, or both. Clearly, there are differences among these studies, but the common denominator is a holistic or broad study of time use. For example, Gunewardena (2010) uses time use survey data in combination with in-depth qualitative analysis to describe gender division of labor and community roles in Sri Lanka in relation to commercial sugarcane production. Mishra and Mishra (2012) study the relationship between deforestation, agricultural activities, and housework, with a specific focus on women's burden, in India.

On the other hand, the studies looking in detail at time spent on specific agricultural activities are perhaps of a narrower type. Beyond a couple of studies on child farm labor and children's time use (Agbonlahor et al. 2007; Dammert 2008), the others are mostly aimed at showing the extent of women's participation in particular agricultural activities, such as small-scale farming in Pakistan (Luqman et al. 2012); commercialized potato production in Punjab, India (Jethi 2008); livestock production in Kenya (Roberts 1996); and mixed farming, cropping, and livestock in Iran (Fami 2006).

The methods used to collect time use data were interview based in 39 studies and observation based in 11. In 5 of these studies, in fact, interview and direct observation techniques were combined. In 7 studies the method used for collection of time allocation data was unclear.

Methods

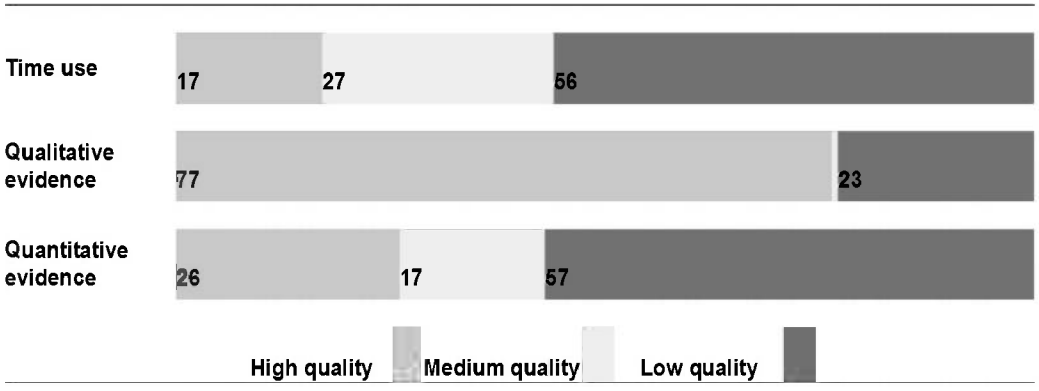
The majority of the studies on agriculture and time use are quantitative (29). These include a range of studies, including some using only descriptive statistics and others using more or less sophisticated household models and regression analysis. This group of studies features the only randomized experiment included in the review, Newman (2002).

There are 16 qualitative studies and 7 mixed-methods studies. Qualitative (12 out of 16) and mixed-methods studies (7 out of 7) are overrepresented in the group of studies that carry out a comprehensive investigation of time use.

Assessment of Study Quality

The quality assessment of the subgroup of studies on agriculture and time use is presented in Figure 4.3. Each component is analyzed in turn.

Figure 4.3 Quality assessment (in percentages)



Source: Compiled by authors.

More than half of the studies use low-quality time use data. This may be due to unavailability of good-quality time use data or failure to report essential information of the methods of data collection or datasets used in the study. In general, we note that time use research would benefit from an improvement in methods for primary collection of time allocation data. In particular, consideration for simultaneous activities and for literacy levels, the latter being especially relevant in low- and middle-income countries, emerges as an area for improvement of time use data.

As for qualitative evidence, assessed for 24 studies in this group, the criterion used looks at whether the study is peer reviewed or not. Arguably, this technique may produce *generous* outcomes in terms of quality. In other words, a high number of studies are classified in the top-quality category because they were peer reviewed. In future systematic reviews or research, it would be useful to compare the results obtained with different assessment tools for qualitative evidence. The conclusions would need to be drawn in relation to the potential trade-off between using a quicker tool and a more time-consuming one.

Finally, the results for quantitative evidence, contained in 38 studies in this group, are more mixed. A high proportion was categorized as low quality on the basis of inappropriate model specification, poor inference methods, or uncertainty about peer review. This suggests that quantitative and mixed-methods studies on agriculture and time use need to pay more attention to the models used. For example, unitary and two-person household models need to be replaced by more sophisticated, and realistic, conceptualizations of the household. Improvements are needed also in the methods of inference; for instance, more refined indicators of employment that overcome the distinction of "primary" versus "secondary" activities are much needed.

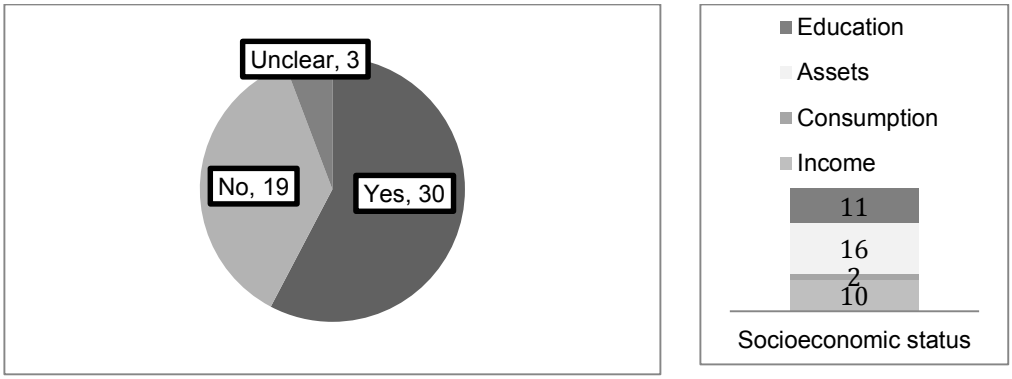
As the criteria used to assess the quality of quantitative and qualitative evidence are different, we conducted a sensitivity test. The test disaggregated the peer-review component of the assessment of quantitative evidence to compare how quantitative evidence scores if it is assessed with the same criterion used for qualitative evidence. The test shows that the assessment of quantitative studies improves, which confirms a bias in favor of qualitative evidence, as mentioned above. The results of the test are reported in Figure B.1 in Appendix B.

Socioeconomic Status

An additional aspect that can be taken into consideration when looking at quality is measurement of socioeconomic status. This is important to avoid treating households or individual respondents as homogeneous whereas there may be significant differences in terms of wealth or education.

Figure 4.4 shows that 30 studies out of 54 used measurements or indicators of socioeconomic status. Of these, the majority reported a measure of landholdings, given the focus of the studies on agriculture. However, 19 studies did not include any indicator of socioeconomic status.

Figure 4.4 Socioeconomic status



Source: Compiled by authors.

Agricultural Interventions and Time Use

There are only five studies that looked at the relationship between agricultural interventions and time use. The main characteristics of the studies are reported in Table 4.2.

Table 4.2 Agricultural interventions and time use

Study	Intervention	Country/provider	Outcome	Impact
Admassie and Bedi (2003)	Introduction of agricultural technology—extension program (agricultural machinery, chemicals, fertilizers, improved seeds)	Ethiopia/government of Ethiopia	Use of child labor (hours of work)	Reduction of child labor in the short run and increase in work burden in the long run
Dammert (2008)	Anticoca policies	Peru/government of Peru	Child labor	Increase in hours spent in wage and domestic work for girls and boys
Riley and Krogman (1993)	Irrigation projects to promote commercial vegetable production	Lesotho/unclear	Women's work (men are migrant workers in South Africa); irrigators and dryland farmers	Irrigators spend considerably more time in agriculture than dryland farmers and less time on childcare and other types of housework.
Rubin (1990)	Sugarcane out-growers scheme	Kenya/unclear	Women's time use in cane-growing and nongrowing households	Women in cane households spent more time in domestic tasks and in craftwork, which was carried out in the home while supervising children. They also had more leisure time. Women in households not growing sugar spent slightly more time not only in agricultural work on food crops but also in marketing and transport as well as in hired agricultural labor.
Shirajee et al. (2010)	Mymensingh Aquaculture Extension Project	Bangladesh/Danish International Development Assistance	Extent of women's participation in aquaculture activities	Women's average daily involvement in fish cultivation ranged from two to six hours. The women were engaged in aquaculture activities for an average of 27 percent of their total daily working hours.

Source: Compiled by authors.

Note: The type of intervention and outcome summarized in this table do not necessarily reflect the overall scope of the study at hand but were selected due to their relevance to the review's questions.

Type of Intervention

Different types of intervention are analyzed in each study; however, all of the interventions tackle particular aspects of agricultural activities that contribute to processes of agricultural commercialization. These range from agricultural extension schemes to intensification of livestock production and fishery. Only one study stands out for the type of intervention considered, Dammert (2008), which looks at the anticoca policies in Peru.

Most of the studies then compare households in the treatment group with households in the control group, although none of these studies is a randomized experiment. For instance, Riley and Krogman (1993) compare women farming irrigated fields and women practicing dryland agriculture in Lesotho.

Although parts of scholarship are becoming increasingly skeptical of nonrandomized studies in impact evaluation, we find that the studies included in this review are useful to shed some light on the underlying mechanisms in the relationship between agricultural interventions and time use patterns.

Type of Employment

All of the studies focused on employment in agriculture, with variations in terms of own-account farming, wage labor, and family labor. Distinction between different types of agricultural work is clear in some studies, such as Riley and Krogman (1993), and much less so in others.

Only two studies took housework into account, whereas the other three looked only at agricultural work. Consideration for housework can be represented by recording time spent on particular activities such as child feeding practices or, more broadly, by reporting time spent on a range of reproductive activities.

Little attention is paid to nonagricultural work. Although the focus is evidently on agriculture, households and individuals may be engaged in multiple occupations and combine agricultural and nonagricultural activities. In most of these studies, it is not clear whether the respondents, other household members, or both are involved in nonagricultural forms of employment alongside agricultural work.

Household Members and Life Cycle

The majority of these studies are concerned with women's agricultural work and time allocation. It is important to underline that the focus is precisely on women and not more specifically on mothers in this case. Some studies also collected data on children and men.

Two studies, Admassie and Bedi (2003) and Dammert (2008), focus specifically on children's participation in agricultural work. The others look at time spent by women on a range of agricultural and housework activities.

Three out of five studies report information about respondents' and/or household's life cycle. This means that they take age into account in relation to the organization of productive and reproductive activities.

Seasonality

Interesting to note, none of these studies considers seasonality. This is surprising because agricultural activities vary seasonally, and therefore the time use patterns associated with agriculture are likely to vary across different seasons.

Outcome and Impact

In some studies, time use represented only one of the outcomes explored among others. For instance, Admassie and Bedi (2003) look at child schooling in addition to hours spent on farm work. Other studies in this subgroup instead focus mostly on women's participation in agricultural activities and time allocation outcomes. Shirajee et al. (2010) look at women's roles and workload in aquaculture activities in Bangladesh. Riley and Krogman (1993) study women's time allocation in irrigation-based and dryland farming in Lesotho.

In general, all of the studies suggest that the examined intervention or participation in the agricultural project at hand is associated with longer hours spent in agricultural activities.

Summary tables on the direction of impact are reported in Tables B.3 and B.4 in Appendix B.

Agricultural Practices and Time Use

In this section, we look in more detail at the 47 studies on agricultural practices and time use. Given the large number of studies, a summary table will not be provided. Arguably, this subgroup of studies is more diverse than that on agricultural interventions. The objectives of the included studies are broader; the relevant characteristics will be described in turn.

Type of Agricultural Practice

The studies in this subgroup can be divided broadly into three categories:

- Studies on time allocation or on the determinants of time allocation in a given setting, which include a more or less detailed description of the prevailing agricultural systems, practices, or both
- Studies on the gendered division of labor in a given setting and/or in relation to particular agricultural systems, practices, or both
- Studies on participation—especially women's participation—in specific agricultural activities

Examples of the first category are Evenson (1978) on time allocation in rural Philippines, Ikpi (1992) on time use and agricultural technology in Nigeria, Mueller (1984) on time use in rural Botswana, and Tripp (1982) on collecting data on time use in northern Ghana.

In the second category, we find studies such as Newman (2002) and Korovkin (2003) on gendered work in the cut-flower industry in Ecuador, Whitehead (1999) revising previous accounts on the gendered division of labor in rural Zambia, and Mishra and Mishra (2012) on deforestation, reorganization of agricultural activities, and women's work burden in India.

Finally, in the last category, there are a number of studies on children's or, more frequently, women's participation in specific forms of agriculture. For instance, Grossman (2000) analyses women's participation in export agriculture (banana production) in St. Vincent, Eastern Caribbean; Kanwar et al. (2003) look at time spent in agriculture by hill farm women in India; and Admassie (2002) investigates children's participation in farm work in Ethiopia.

Type of Employment

In terms of employment, all of the studies look at agricultural work, and as for the studies on agricultural interventions and time use, there is variation in terms of own-account farming, wage agricultural work, and family labor. Some studies spell out these distinctions clearly, whereas others do not distinguish between different types of agricultural work.

A smaller but nonetheless significant number of studies, 17, look at employment in nonagricultural sectors. The level of detail varies, but it is important that some of these studies mention the presence of nonagricultural employment.

Finally, ten of these studies consider housework. Per the above, housework is category that includes time spent on specific reproductive activities or a broader range of household maintenance activities.

Household Members and Life Cycle

Almost all of these studies, 41 out of 47, focus on women. In 32 cases, data are collected on both women and men. But not a single study is on men only. A few studies, 9, collect data on children or are specifically focused on children. One study, Panter-Brick (1989), is on mothers.

In terms of considering life cycle, the studies are essentially split in the middle, with 24 studies that do consider life cycle and 23 that do not consider it.

Seasonality

Seasonality and seasonal variations were taken into consideration in 19 studies. In certain studies, seasonality is central. For example, Wodon and Beegle (2006) look at seasonal labor shortages in Malawi and study time use and agricultural work patterns in different seasons; Zaman (1995) looks at time use and seasonal variation in rural Bangladesh. In other cases, the focus on seasonality is not central, but seasonality is accounted for through data collection at different times of the year.

Outcome

The studies that investigate general patterns of time allocation or gendered division of labor in rural societies tend to conduct a comprehensive investigation of time use. Studies concerned with participation in specific agricultural activities tend to develop detailed investigations of time use spent on particular activities.

One finding that emerges as crosscutting is the widespread participation of women in both productive and reproductive activities, commercialized agriculture, and housework.

5. TIME USE AND NUTRITION

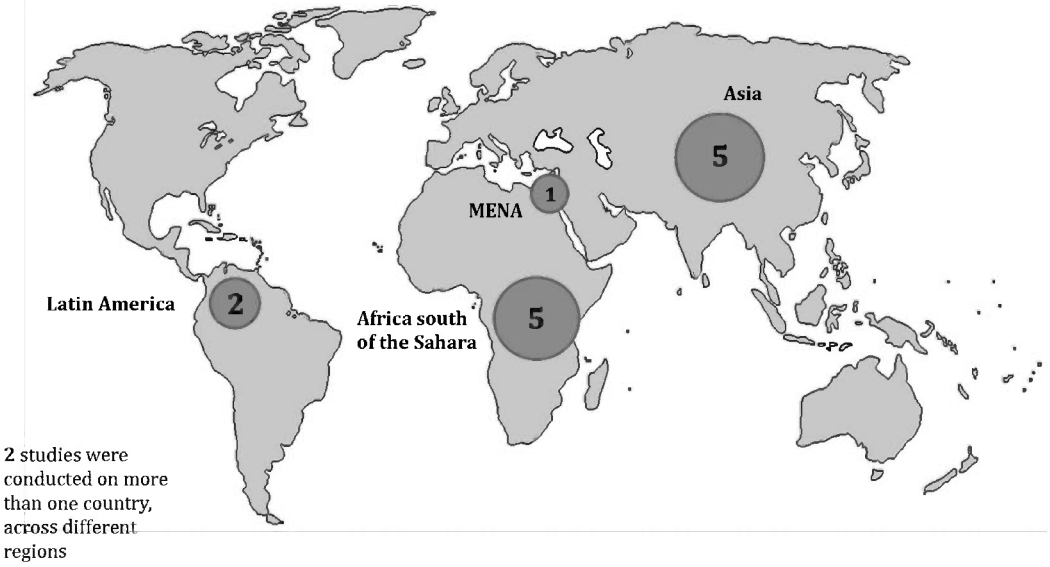
Mapping Studies on Time Use and Nutrition

In this section, some descriptive characteristics of the studies on agriculture and time use are highlighted.

Geographic Area

Looking at the studies by geographic area (Figure 5.1), it can be seen that coverage is similar to that of the studies included in section 4. The majority of the studies are for countries in Africa south of the Sahara (specifically the Gambia, Ghana, Tanzania, and Zimbabwe) and Asia (specifically India, Indonesia, the Philippines, and Taiwan). There are two studies situated in Latin America (specifically Bolivia and Dominica) and one in the MENA region (Egypt). Two studies covered more than one region (one covered Haiti and Rwanda, and another China, Mexico, and Tanzania).

Figure 5.1 Studies on time use and nutrition by geographic area



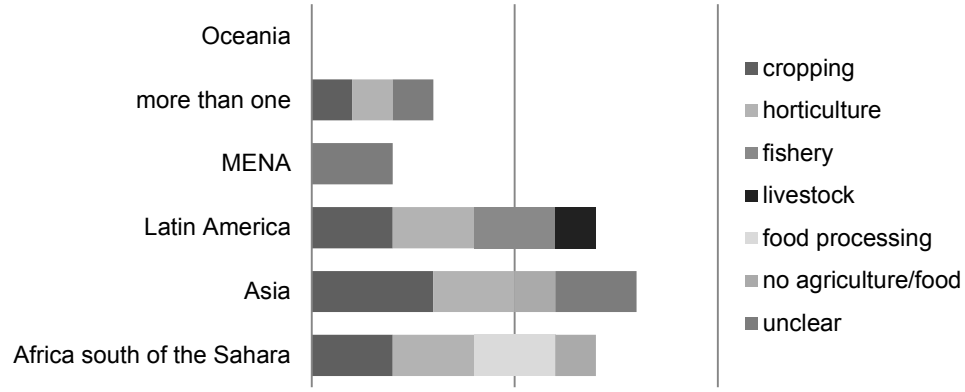
Source: Compiled by authors.
Note: MENA = Middle East and North Africa.

Time Use Studies and the Relationship to Agriculture/Food Systems, by Geographic Region

As in the previous chapter, we coded the type(s) of agriculture, food systems, or both that were described. These categories are not mutually exclusive, which explains why the overall numbers are bigger than the group of studies examined.

As can be seen in Figure 5.2, the most frequent agricultural systems are cropping and horticulture. Surprisingly few studies looked at food processing, and many were unclear in terms of their focus. This lack of attention to food preparation and processing was unexpected (given the time-consuming nature of much food processing and the burden for women).

Figure 5.2 Agriculture and food systems



Source: Compiled by authors.
Note: MENA = Middle East and North Africa.

Time Use

This subgroup of studies is almost evenly split between those conducting a comprehensive investigation of time use patterns (seven) and those concerned with detailed analysis of time spent on particular activities (eight).

An example of the comprehensive approach is given by Desai and Jain (1994), who investigated the relationship between maternal employment and child welfare in rural South India. In doing so, they asked closed questions about a range of activities, intending to encompass all activities for the index mother and her husband in the household. In the same category of studies, Bamji and Thimayamma (2000) investigate the time use of the index mother based on 24-hour recall in their South India study.

In contrast, Barrett and Browne (1994) focus on the change to time allocation following the introduction of village cereal mills, specifically asking women how they used the time that was saved as a result. Similarly, the study by Keng and Lin (2005) of the relationship between wives' value of time and food consumption in Taiwan focused on the relationship to food consumed away from home.

Methods

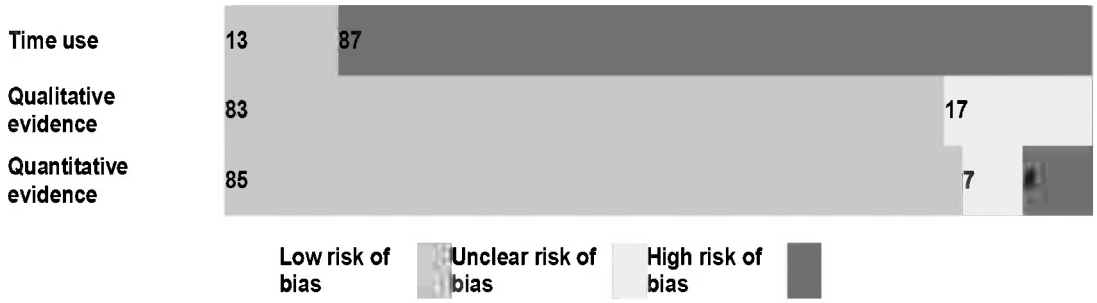
As with the previous subgroup (discussed in section 4), the majority of the studies on time use and nutrition are quantitative (eight). These include a wide degree of approaches, including studies that set up complex econometric models of time use (for example, Keng and Lin 2005; Blau et al. 1996) and those that rely on simpler descriptive statistics (for example Nti et al. 1999).

Interesting to note, there were few qualitative-only studies (two), and there were five mixed-methods studies. For example, Quinlan et al. (2005) use a combination of interviewing (to gain maternal history and household information) and observation (to understand time use in productive activities).

Assessment of Study Quality

The quality assessment of the subgroup of studies on time use and nutrition is presented in Figure 5.3. Each component is analyzed in turn.

Figure 5.3 Quality assessment (in percentages)



Source: Compiled by authors.

A very high proportion of studies use low-quality time use data. This is mostly due to the failure to attempt a comprehensive approach to activities (that is, the predisposition to focus on only one activity) and to use methods that are observational or that use a fixed-interval approach. Other key areas of improvement are consideration for simultaneous activities and for literacy levels.

As for qualitative evidence, a high proportion is assessed as high quality. Similar to findings in section 4, this may be an artifact of the approach used to determine quality (that is, the existence of peer review).

Finally, the quality of the quantitative evidence was much higher than for the previous group of studies (that is, in section 4). A high proportion appeared to use more appropriate models, eschewing simplistic household models of time allocation, and utilized stronger inference methods, such as comparison groups.

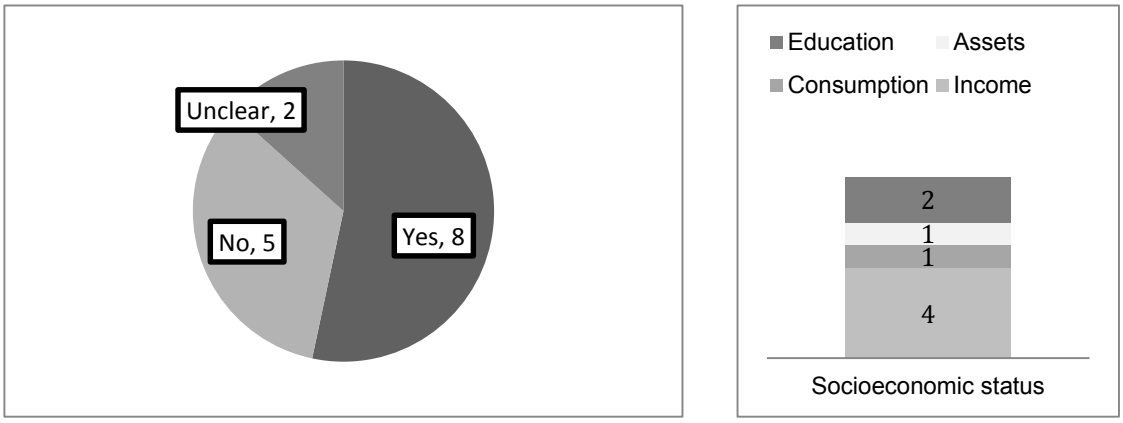
However, as we shall see below, although these studies scored better in terms of qualitative and quantitative quality, they often lacked the necessary analytical sophistication to differentiate between different kinds of time use and different household structures, for example.

Socioeconomic Status

As we argued in section 4, socioeconomic status is a crucial indicator for inclusion in any study to avoid treating individuals or households as homogeneous.

Figure 5.4 show that eight studies out of 15 used of socioeconomic status. Of these, the majority reported a measure of income. This contrasts with the studies included in the previous section that were more likely to use a measure of landholding.

Figure 5.4 Socioeconomic status



Source: Compiled by authors.

Time Use and Nutrition

In this section, we look in more detail at the 15 studies on time use and nutrition. Overall, they suggest a complex relationship between demands on women's time and nutritional outcomes. Indeed in this, the findings of this review are similar to other reviews of the relationship between women's employment and child health (Coreil 1991, 222; Blau et al. 1996, 91). Bamji and Thimayamma (2000, 28–29) go so far as to argue that there are other more important causes of child nutritional status than women's occupation.

There may be methodological reasons for the difficulty in finding an association between measures of time use and nutrition/health outcomes. Peterman et al. (2013) carried out large dataset investigation into the relationship between pregnancy and work in China, Mexico, and Tanzania. They suggest the lack of relationship between pregnancy and physically demanding activities may be due to the fact that many activities in rural areas may be carried out simultaneously—and that this is a challenge to the interpretation of time use studies. They also note that many time use data are of poor quality (Peterman et al. 2013, 422).

However, some studies suggest that there are underlying reasons why there may not be a relationship. Some contrasts are worth identifying. Blau et al. (1996) study the impact of labor supply decisions by mothers in a rural area of the Philippines and conclude that mothers with higher wage offers are more likely to work, to use infant formula, and to have healthier children. They argue that the income effect dominates—and indeed, mothers who have lower wage offers are less likely to work. Bamji and Thimayamma's (2000) study in rural South India found no statistically significant difference in women's work on child nutritional outcomes. In contrast, Hawkes et al. (1997) study Tanzanian Hadza women's time allocation and offspring provisioning. They find that the time mothers allocate for foraging for food is clearly linked to child weight. However, this relationship is relaxed when there is a grandmother present who also forages to provide for the children.

Similar findings on the importance of nonmaternal caregivers are found in a range of other studies. For example, Gryboski's (1996) study in rural Java reminds us that a wide range of nonmaternal caretakers can be involved in infant care. In her study, one or more nonmaternal caretakers participated in infant care on 90 percent of sample days, including infant feeding. These were particularly the grandmothers, sisters, and fathers of the infants. However, this does not entirely negate the way that caring for infants restricts female movement and work activity—and Gryboski (1996) reminds us that these limitations are not only practical (that is, related to the extent to which an activity can be combined with childcare) but also involve social norms about appropriate practices (that is, the extent to which such an activity is seen as harmful or undesirable). In a similar vein, Quinlan et al. (2005) argue that breast-

feeding patterns in a rural Caribbean community can be explained by a wide range of factors: women's work demands, the presence of multiple adult female kin in the household, and greater household wealth all led to shorter breast-feeding, whereas the presence of a partner led to longer breast-feeding. Keng and Lin (2005) note that female employment is less likely to lead to a shift to spending on food consumed away from home if grandparents are present, but more likely to if there are children in the household. Finally, Nti et al. (1999) note that rural working women were likely to use their parents or older children for childcare, and older children often carried out other household tasks, such as fetching water, cooking, and cleaning. The majority of rural working women also tried to synchronize tasks, although a few of those in paid employment were able to use paid village day care facilities (Nti et al. 1999, 167).

Coreil (1991, 230) argues that the interaction between mothers' time constraints and child health depends generally on household composition, the age of the child, and the presence of other children. In many studies, Coreil (1991, 222) reminds us that the age of the child in question is important, with clearer evidence that infants might suffer if there are additional calls on a mother's time, whereas older children may do better due to higher household income. Similarly, Ricci et al. (1996) argue that we cannot generalize from the impact on one child age group to another.

Zycherman (2013) points out the differences in time use not only between married and single women (and women with and without children) but also between senior and junior women within one household. In her study of a village of rural Bolivia, she finds that junior married women are able to engage in a greater amount of productive activity as senior married women take care of their children.

Desai and Jain (1994, 123) remind us that the relationship between women's work and child health should not ignore class and economic characteristics, as this affects the selectivity into employment, the remuneration of employment, and other household characteristics. At the same time, Desai and Jain (1994, 125, 127) argue that we should not use simple binary models of women's economic time and childcare—that is, relating the two in a dichotomous manner. Instead, they remind us that women face many work burdens and that women's other domestic responsibilities are likely to reduce their childcare time. Indeed, they argue that other domestic work often increases as wage work falls (p. 127). In their study, nonchildcare domestic tasks proved to be significant consumers of women's time, and they argue that few rural women are able to devote their domestic time solely to childcare (p. 130). As a result, rather than focus on the maternal employment-childcare relationship, they argue that policymakers should instead focus on the drudgery of other domestic tasks, such as food preparation, water collection, and firewood gathering.

The need to look at a more complex interaction between women's work and child health is underscored in Bamji and Thimayamma's (2000) study, where they found that working women carried out the same amount of childcare compared to nonworking women. There were two underlying reasons for this. First, nonworking women also were involved in many activities and so had numerous calls on their time. Second, working women restricted their own sleep and leisure time to meet childcare demands.

Indeed, some authors are able to make explicit reference to the energy demands related to time allocation. Mehretu and Mutambirwa (1992, 1675) argue that rural women in their study in Zimbabwe used up to 30 percent of their total calorie intake on trip-generating chores. Barrett and Browne (1994) remind us that energy demands are as important as time use. In their study of the introduction of village cereal mills in the Gambia, they find that the energy saved by women is possibly more crucial than the time saving. They estimate that the energy demands of hand grinding meant that rural women spent much of the year in calorie deficit. The seasonality of work and of women's food consumption was crucial in this study. Similarly, Coreil (1991, 231) reminds us that we should pay attention to mothers' physical and mental health and that the demands of filling multiple roles taxes women. This reminds us of the findings by Bamji and Thimayamma (2000) that working mothers slept and relaxed less than others. Nti et al. (1999) point to the energy expenditure and physiological problems that working women experience to fulfill their multiple roles.

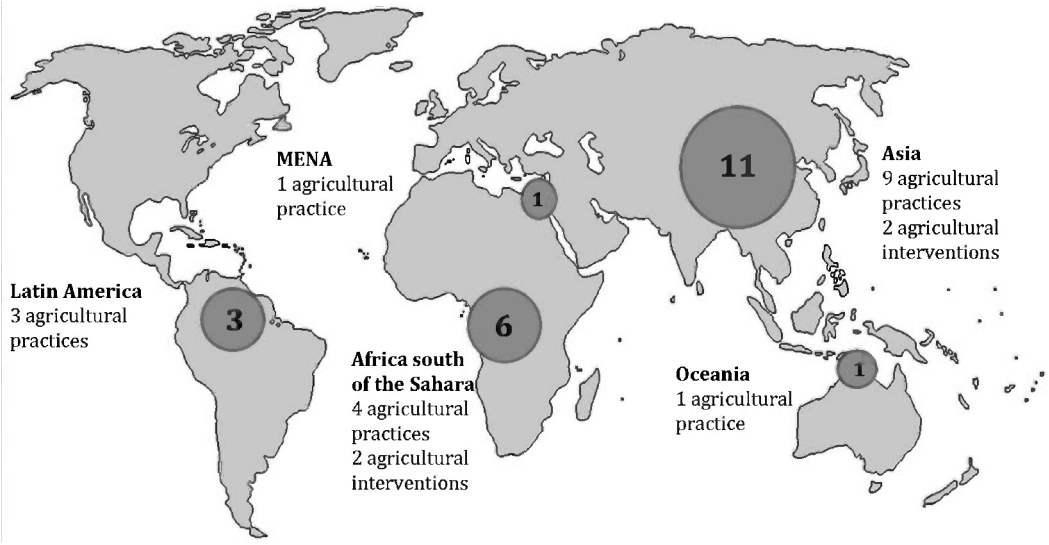
6. AGRICULTURAL INTERVENTIONS AND PRACTICES, TIME USE, AND NUTRITION

Mapping Studies on Agriculture, Time Use, and Nutrition

Geographic Area

The geographic coverage (Figure 6.1) remains extended even in this subgroup of studies. The included studies focus mostly on Asia and Africa south of the Sahara. In Asia, there are a number of studies on India, then Nepal, Bangladesh, China, and the Philippines. In Africa south of the Sahara, the studies are on Ghana, Nigeria, Tanzania, Zambia, and Sierra Leone. A few studies are on Latin America (Peru, Mexico, and Guatemala), the MENA region (Iran), and Papua New Guinea in Oceania.

Figure 6.1 Studies on agriculture, time use, and nutrition, by geographic area

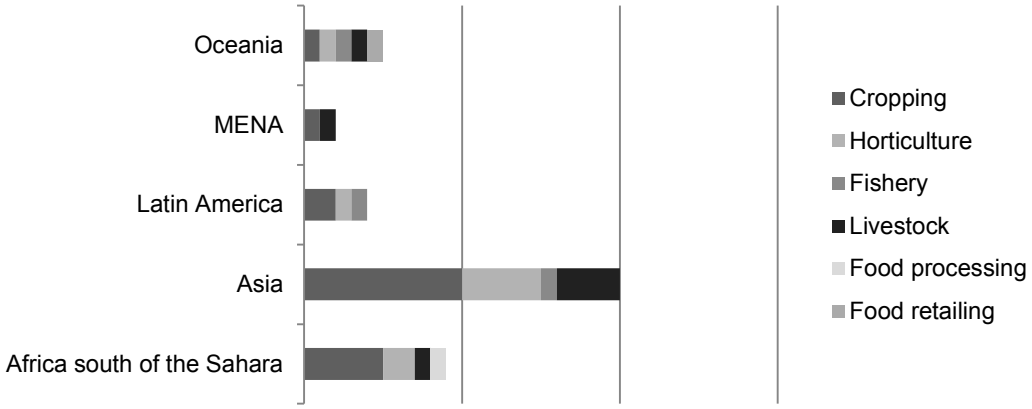


Source: Compiled by authors.
Note: MENA = Middle East and North Africa.

Agriculture and Food Systems, by Geographic Region

Figure 6.2 shows that the most frequent agricultural systems are cropping, horticulture, and livestock. Few studies looked at fishery, and very few studies addressed food distribution or retailing, as components of the food value chain. Also in this subgroup of studies persists a gap in research on agriculture and time use in the area of food value chains. How is time organized in employment and activities around food processing, distribution, and retailing? And what are the nutritional implications?

Figure 6.2 Agriculture and food systems



Source: Compiled by authors.
Note: MENA = Middle East and North Africa.

Time Use

In this subgroup of studies, the vast majority, 19, conduct a comprehensive investigation of time use patterns, whereas only 3 are concerned with detailed analysis of time spent on particular activities. As described in earlier sections, studies classified as using a comprehensive approach to time allocation not only look at time spent in agricultural activities but are concerned more broadly with allocation of time to nonagricultural activities, housework, or both. It makes sense that in the group of studies on agriculture, time use, and nutrition the investigation of time use tends to be comprehensive rather than focused on one or a narrow set of tasks. Although the analysis of time allocation may not be too detailed, it includes consideration for the use of time in a broad range of activities.

The methods used to collect time use data were interview based in 16 studies and observation based in 3. In 1 of these studies in fact interview and direct observation techniques were combined. In 3 studies the method used for collection of time allocation data was unclear.

Methods

The majority of the studies on agriculture and time use are quantitative (15). These include a range of studies, including some using only descriptive statistics and others using more or less sophisticated household models and regression analysis. There are no randomized studies in this group, although some of the included studies present comparisons between two or more groups of households.

There is only one qualitative study, Behrens (1992). Finally, six are mixed-methods studies.

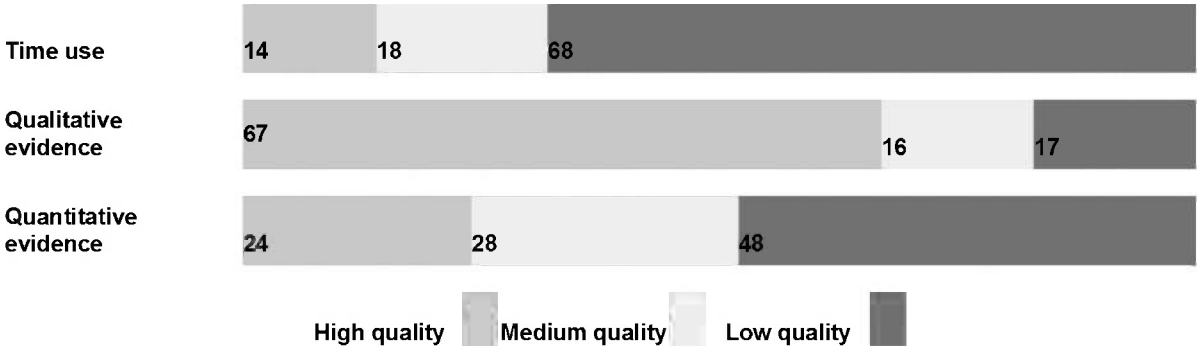
Quality Assessment

The quality of time use data continues to be relatively low. A high percentage of the studies in this group, 68 percent, use low-quality time use data. This may be due to unavailability of good-quality time use data or failure to report essential information of the methods of data collection or datasets used in the study. In general, we continue to note that time use research would benefit from an improvement in methods for primary collection of time allocation data. In particular, consideration for simultaneous activities and for literacy levels, the latter especially relevant in low- and middle-income countries, emerge as areas for improvement of time use data.

As for qualitative evidence, assessed for seven studies in this group, the criterion used looks at whether the study is peer reviewed or not. We continue to see that this technique may generate *generous* outcomes in terms of quality.

Finally, the results for quantitative evidence, contained in 21 studies in this group, are more mixed. Half were categorized as low quality on the basis of inappropriate model specification, poor inference methods, or uncertainty about peer review (Figure 6.3).

Figure 6.3 Quality assessment (in percentages)

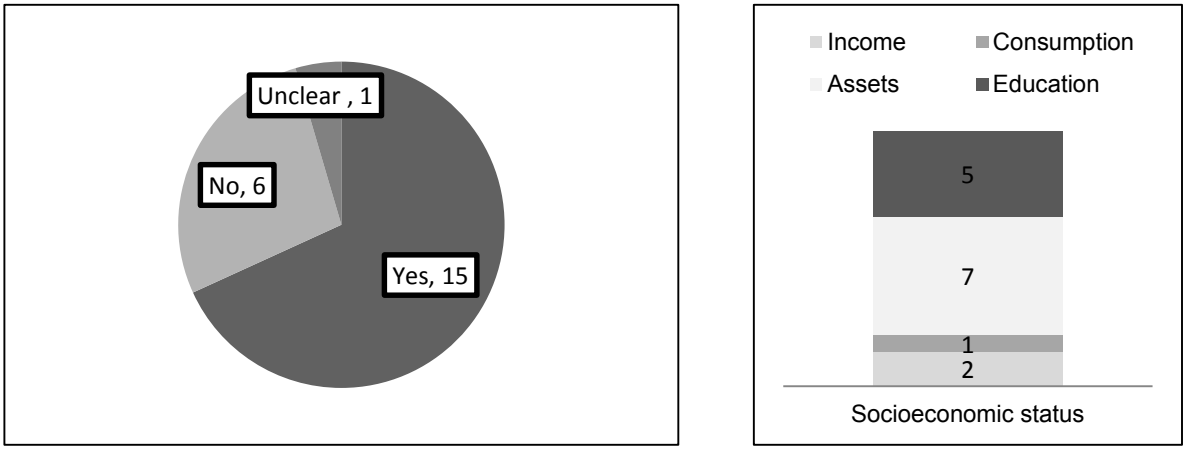


Source: Compiled by authors.

Socioeconomic Status

Figure 6.4 shows that 15 studies out of 22 used measurements or indicators of socioeconomic status. Of these, about half reported a measure of landholdings, given the focus of the studies on agriculture. The other commonly used indicator is education, whereas income and consumption are much less frequently used. However, 6 studies did not include any indicator of socioeconomic status.

Figure 6.4 Socioeconomic status



Source: Compiled by authors.

Agricultural Interventions, Time Use, and Nutrition

This section is dedicated to the descriptive analysis of the four studies on agricultural interventions, time use, and nutrition. Table 6.1 summarizes their main characteristics.

Table 6.1 Agricultural interventions, time use, and nutrition

Study	Intervention[a]	Country /provider	Outcome[a]	Impact
Paolisso et al. (2002)	Vegetable and Fruit Cash Crop (VFC) program—program to promote the commercialization of vegetable production	Nepal/Nepalese development organization	Time use: Male and female time allocation Nutrition: Care for preschoolers	For households with one preschooler, VFC participation results in more time for agricultural production of the cash crop for both men and women but also a decrease in care time for preschoolers from both men and women. For households with more than one preschooler, this trade-off is not so apparent.
Bellin (1994) in von Braun and Kennedy (1994)	Bo-Pujehun Rural Development Project—agricultural package including supply of coffee, cocoa, and oil palm technology	Sierra Leone/government of Sierra Leone	Comparison of "old" tree crop farmers, subsistence farmers, and new adopters Time use: Female and male labor allocation to food and tree crops Nutrition: Calorie consumption and children's nutrition	When farm households adopt tree crops, a significant reallocation of land and labor resources occurs in both the short and long runs. These changes impinge on consumption and nutrition in this study area, where income is generally very low. Resource commitments to perennial crops—the trees—require investment of time, land, and cash, but income flows start only after a considerable time has elapsed. Thus, there is a temporary reduction in the flow of income. However, the new adopters do not stand out with a lower level of average calorie consumption. Stunting is significantly higher among the poor in the two groups of old tree crop farmers and new adopters than among subsistence farmers, and the weight-for-age indicator is worse in these two groups than among subsistence farmers. Multivariate analysis also suggests adverse nutritional-status effects (weight-for-age) of new adoption in this poor setting. This may be related to increased time constraints of women in food crops, where they have partly taken over from men.

Table 6.1 Continued

Study	Intervention[a]	Country/ provider	Outcome[a]	Impact
Kumar (1994)	Adoption of hybrid maize	Zambia/government of Zambia	Comparison between adopters and nonadopters (region and household level) Time use: Time spent on farm work (men, women, and children) and household maintenance activities Nutrition: Food consumption (calories and nutrient intake), children's nutrition, adults' body mass index (BMI)	Seasonal variations are more pronounced for adopters (more hours of work) than for nonadopters; household maintenance activities (mostly performed by women) are more intensive for adopters. Time spent by women in household maintenance activities is positively associated with calories and protein intake. But overall food consumption is better for adopters. Time spent by women in household maintenance activities is also positively associated with children's nutrition. However, five- to ten-year-old children present higher levels of seasonal malnutrition in adopters' households, and adults' BMIs deteriorate seasonally for both adopters and nonadopters. This is due to seasonal increases in workload for all household members.
Quisumbing et al. (2013)	Strengthening the Dairy Value Chain Project	Bangladesh/CARE-Bangladesh, Bill & Melinda Gates Foundation	Time use: Beneficiary households' overall time use and intrahousehold time use Nutrition: Household time spent on childcare, child feeding, and food preparation	Beneficiary households spend more time in dairy-related activities; women spend more time on dairy-related activities and so do men. Impact on time spent on child feeding, childcare, and cooking is indeterminate due to different results obtained in relation to the two control groups.

Source: Compiled by authors.

Notes: [a] The types of interventions and outcomes summarized in this table do not necessarily reflect the overall scope of the study at hand but were selected due to their relevance to the review's questions.

Type of Intervention

The studies in this subgroup look at four agricultural interventions. The common feature is that all interventions and projects seek to promote agricultural commercialization, although they do so in different ways.

Kumar (1994) studies the impact of adoption of hybrid maize in Zambia. Bellin (1994, cited in von Braun and Kennedy 1994) looks at the adoption of tree crops in Sierra Leone. Paolisso et al. (2002) study the Fruit and Vegetable cash crop program aimed at commercializing food and vegetable production in Nepal. Quisumbing et al. (2013) look at the Strengthening the Dairy Value Chain Project, a program aimed at intensifying livestock production and dairy-related activities in Bangladesh.

The interventions were introduced by the national governments in Zambia and Sierra Leone, by a local development organization in Nepal, and by a nongovernmental organization (CARE-Bangladesh) in partnership with the Bill & Melinda Gates Foundation in Bangladesh.

Type of Employment

All of the studies focused on employment in agriculture. However, in all cases but one the distinction between own-account farming, wage work, and family labor is not clear.

Three studies took housework into account, whereas one looked only at agricultural work. Consideration for housework can be represented by recording time spent on particular activities such as child feeding practices (Paolisso et al. 2002; Quisumbing et al. 2013) or, more broadly, by reporting time spent on a range of reproductive and household maintenance activities (Kumar 1994).

None of the studies mentions nonagricultural work. It would be interesting to know whether households and residents in the studied context participate in employment outside the agricultural sector in addition to agricultural work.

Household Members and Life Cycle

The four studies in this subgroup include data on both women and men. One study also looks at children. However, there is a specific concern with women's agricultural work, women's time allocation, and children's nutrition. It is important to underline that the focus is precisely on women and not more specifically on mothers in this case.

When looking at intrahousehold time allocation, the studies use gender-disaggregated data to compare the time spent by women and men on a range of activities (see Kumar 1994; Quisumbing et al. 2013).

None of the studies in this group explicitly looks at or reports on life cycle. Therefore the studies offer no insight on age-specific patterns in terms of agricultural work, time use, and nutrition. However, Kumar (1994) underlines the difference in the nutritional status of children younger than five years old and older children between five and ten years old and suggests that the second group's worse nutritional status may be associated with seasonal participation in agricultural work.

Seasonality

Only two of these studies look at seasonality. Interesting to note, these two studies find important season-related variations in type and intensity of agricultural work, time use, and nutritional outcomes.

Outcome and Impact

In all of these studies, time covers a central role in the analysis. It is either investigated in its own right (for example, Paolisso et al. 2002) or it is explored as a possible counterbalancing factor in relation to other outcomes, such as asset control and intrahousehold decisionmaking (Quisumbing et al. 2013).

In general, all of the studies suggest that the examined intervention or participation in the agricultural project at hand is associated with longer hours spent in agricultural activities. However, the impact on food consumption, nutrition, or both is more mixed. It may vary across population groups, with differences between children of different ages (Kumar 1994) or between groups with different socioeconomic statuses (Bellin 1994, cited in von Braun and Kennedy 1994). It may vary in relation to the control groups (Quisumbing et al. 2013). It may vary across seasons (Kumar 1994) or depending on the number of children living in the household (Paolisso et al. 2002).

Agricultural Practices, Time Use, and Nutrition

In this section, we look in more detail at the 18 studies on agricultural practices, time use, and nutrition. Given the large number of studies, a summary table will not be provided. The relevant characteristics will be described in turn.

Type of Agricultural Practice

The studies in this subgroup can be broadly defined as studies aimed at investigating the relationship between agriculture and nutrition, and to do so, we explore time allocation as a mediating factor between agriculture and nutrition.

The agricultural systems, practices, or both are described at a general level (for example, Headey et al. 2011) or in detail (for example, Fami et al. 2002). Other studies look at processes of agricultural commercialization (for example, Bouis and Haddad 1990) or at the agricultural implications of other phenomena such as (male) migration (for example, Mu and van de Walle 2009).

A crosscutting characteristic of these studies is the specific interest in women's participation in agriculture, their time use, and the consequent effects on nutrition.

Type of Employment

In terms of employment, all of the studies look at agricultural work, and as for the studies on agriculture and time use, there is variation in terms of own-account farming, wage agricultural work, and family labor. These distinctions are clear in a small number of studies, but they remain unclear in all of the others.

A smaller, but nonetheless significant, number of studies, seven, look at employment in nonagricultural sectors. The level of detail varies, but it is important that some of these studies mention the presence of nonagricultural employment.

Finally, four of these studies consider housework. Per the above, housework is a category that includes time spent on specific reproductive activities or a broader range of household maintenance activities.

Household Members and Life Cycle

Almost all of these studies, 14 out of 18, focus on women. In 12 cases, data are collected on both women and men. But not a single study is on men only. A few studies, 4, collect data on children, and 1 study is specifically focused on adolescents (Gamboa and Garcia 2007). Three studies are on mothers.
In terms of considering life cycle, nine studies do include this aspect.

Seasonality

Seasonality and seasonal variations were taken into consideration in eight studies. In certain studies, seasonality is central. For example, Gamboa and Garcia (2007) look at seasonal variation in energy expenditure in Mexico. As for the studies discussed in the Agricultural Interventions, Time Use, and Nutrition section, the studies in this subgroup investigate seasonality find important changes across seasons.

Outcome

One finding that emerges as crosscutting is the widespread participation of women in both productive and reproductive activities, commercialized agriculture, and housework. Therefore, this result is in line with the result that emerged from the analysis of the group of studies on agriculture and time use.

A number of studies in this group highlighted the intensity of agricultural work. For example, Fami et al. (2002) find that women who participate in mixed farming in Iran tend to show negative energy balance despite having good body mass indexes. Similar considerations on agricultural work are found in the study by Higgins and Alderman (1997) in Ghana. However, one study (Headey et al. 2011) reports that the body mass indexes of women working in agriculture are not that different from those of women employed in other sectors in India.

Finally, the evidence is more mixed in terms of the nutritional implications. It is therefore impossible to draw a simple story on the relationship between agriculture, time use, and nutrition.

The following section will bring together and discuss the main lesson learned from the evidence reviewed and identify the key thematic links between agriculture, time use, and nutrition.

7. THEMATIC ISSUES LINKING AGRICULTURE, TIME USE, AND NUTRITION

Research Landscape and Gaps

The approach and methods used to conduct this systematic review led us to include a bigger set of studies than previous systematic review on agriculture and nutrition. The higher number of included studies can expand the possibility to explore the thematic linkages between agriculture, time use, and nutrition. See Table 7.1 (Webb and Kennedy 2014).

Table 7.1 Studies included in previous systematic reviews on agriculture and nutrition

Author (date)	Sector	Number of included studies
Ruel (2001)	Home gardens, small animals, aquaculture	14
Berti et al (2004)	Home gardens, animal husbandry, irrigation, cash cropping	30
Leroy and Frongillo (2007)	Animal husbandry, aquaculture, poultry	14
World Bank (2007)	All forms of agricultural activity	52
Bhutta et al (2008)	Home gardens, animal husbandry, small ruminants	29
Kawarazuka (2010)	Aquaculture	23
Masset et al (2011)	Biofortification, home gardens, aquaculture, poultry, husbandry, dairy development	23
Arimond et al (2011)	All forms of agricultural activity	39

Source: Webb and Kennedy (2014, Table 1).

In addition to the number of studies, the geographic coverage is extended. The maps presented in sections 4, 5, and 6 showed that the geographic regions where low- and middle-income countries are dominant are well represented in this review. The majority of the included studies are on Asia and Africa south of the Sahara.

It is important to note that the studies in the three subgroups examined—agriculture and time use, time use and nutrition, and agriculture, time use, and nutrition—show an overwhelming focus on women. In the case of studies on time use and nutrition, another group often considered is mothers. The focus on women and mothers is useful for a variety of reasons, including the recognition of the importance of women's roles in agriculture and of women's time—maternal time allocation, in some cases—for nutrition. In addition, studies on women counter male-dominated accounts of the reality.

However, we also note that in the several studies that collect data or use datasets containing data on women, men, and children, the analysis is often exclusively concentrated on women. In other words, a gender analysis tends to be replaced by an analysis of women only. Is the literature neglecting men? Is the literature neglecting age-based relations and other relations of power? Analyses of the interaction between different members of households and communities would be helpful to reach a deeper understanding of organization of agricultural work, use of time, and nutrition. For example, it is interesting to note that a few studies included in this review investigate children's participation in agricultural work. It would be important to know if children substitute mothers or other adult women in the household when they spend time on agricultural activities, or if there are divisions of labor between younger and older women that influence nutritional outcomes.

In the process of screening several thousand studies, we excluded many studies on time use and nutrition because they were focused on urban areas. This may also explain the relatively low number of studies on time use and nutrition, relative to those on agriculture and time use (and nutrition). There may be an assumption that time constraints and the associated changes in food consumption are urban phenomena. It appears to be a mistake to limit this area of research to urban settings while excluding rural ones. Evidence shows that agriculture is time and energy consuming and processed foods are available also in rural areas in low- and middle-income countries (references). Therefore, the linkages between time use, food, and nutrition should be studied in rural areas too.

The subgroup of studies on agriculture, time use, and nutrition include a few studies on farmers' and farmworkers' energy expenditure. In these studies, work intensity in agricultural work emerges as a significant factor, especially in relation to labor-intensive agricultural seasons. However, the vast majority of the included studies do not take work intensity into account. This confirms earlier criticism of time use studies (Jackson and Palmer-Jones 1998). Future time use research would benefit from expanding data collection techniques to include measures of work intensity.

An extremely low number of included studies focused on food processing, retailing, or both. It seems important that research on agriculture, time use, and nutrition develops also along the segments of the food value chain.

Overall Impact

The evidence does not describe a simple story on the nutritional impacts of agriculture via time use.

On the one hand, the findings of the systematic review indicate that women play a key role in agriculture, and this is reflected in their time commitments to these activities, whether as farmers or farmworkers. In addition, women are important actors in the uptake and response to agricultural interventions, and agricultural interventions tend to increase women's, men's, and children's time burdens. Agricultural interventions and commercialization may trigger reallocations of time to agriculture and away from other activities such as food preparation, child rearing, and leisure.

However, on the other hand, the findings suggest that the nutritional implications of agricultural practices and interventions are mixed, even when more time is spent on agricultural activities.

Why So?

Nutritional impacts are varied because households and household members respond to increased time burden and workload in different ways. In turn, responses are different because there are important differentiating factors that mediate the relationship between agriculture, time use, and nutrition. In the next section, we discuss the major factors that differentiate outcomes.

Key Factors that Differentiate Outcomes

Nutritional impacts are not clear-cut because there are several differentiating factors that intervene in the relationship between agriculture, time use, and nutrition. Drawing from the findings we review, we describe the key differentiating factors that are relevant to the time use pathway between agriculture and nutrition.

Income

It is well known that an important pathway linking agriculture and nutrition is income. Time constraints can be offset by income because households can purchase more food, possibly more nutritious foods, hire domestic servants, and in the case of farming households, hire agricultural workers. Obviously, the possibility of using income in any of these ways depends on income levels and uses.

Some of the studies included in this review find that agricultural interventions have no effect on household food consumption (Bellin 1994, cited in von Braun and Kennedy 1994) or are associated with improved food consumption, measured as calories and nutrients intake (Kumar 1994).

Whose Nutrition? Child Nutrition versus Women's Nutrition

It is important to differentiate between children's and women's nutritional outcomes. Although women's and mothers' time constraints may not have significant negative effects on children's nutrition, increased workloads in agriculture may still have negative consequences on women's nutrition and well-being.

For example, Fami et al. (2002) and Higgins and Alderman (1997) show that women's energy balance is in deficit when they engage in intensive agricultural work.

Food Consumption or Anthropometric Measures?

It can also happen that different indicators show opposite results (for example, Kumar 1994). Improvements in food consumption may occur alongside deterioration in nutritional status. This suggests that the choice of indicators is important and that a combination of indicators of food consumption and nutrition may yield better results than one only.

Household Type and Household Members

Household type also can be an important differentiating factor. Time constraints of certain household members may be minimized or offset by the presence of other household members who can take up housework and other household maintenance activities that are left behind by those more involved in agricultural work. For example, Paolisso et al. (2002) show that the agricultural intervention's impact on childcare and feeding was different for households with different numbers of children. In addition, many of the studies on time use and nutrition underline the importance of nonparental and nonmaternal care.

A specific study of the mechanisms of replacement is important, as it can be expected that these take place along lines of power such as age and gender.

Technology

Available technologies can make a difference in households' responses to increased time burdens. If households can access technologies that allow them to gain time savings in those activities, such as domestic work, that are particularly critical, then the ways in which increased time burden and workload are experienced can be different. Technology by itself is nevertheless insufficient to address the various negative implications of longer working days. The availability of time-saving technology does not ensure that the overall working day (of women, in particular) will be shortened, as it may simply allow women to reduce the burden of one activity and then replace it with another. To understand why this might happen, we need a broad view of government social policy and prevailing economic constraints and a picture of men's contribution to the household.

Nonagricultural Work

Although few included studies consider nonagricultural work, it is important to investigate the existence and prevalence of employment in nonagricultural sectors in rural areas. When households and individuals engage with multiple forms of employment, these interactions need to be taken into account to analyze time use patterns.

Seasonality

Many of the included studies that take seasonality into account find important seasonal variation in both time allocation and nutritional outcomes.

This suggests that time constraints as well as energy balance, nutrient intake, and nutritional outcomes can be seasonal. Therefore, they need to be measured and tackled at appropriate times.

Socioeconomic Status

Finally, time use may act as a mediating factor between agriculture and nutrition in different ways for different socioeconomic groups. For example, Bellin (1994, cited in von Braun and Kennedy 1994) show differentiated nutritional impacts for poorer households.

This suggests that socioeconomic status needs to be measured thoroughly. Indicators need to be adequately chosen to capture socioeconomic stratification in a given context. In agricultural research, it is useful to distinguish between net labor hirers and net labor sellers. A combination of measures of socioeconomic status may be better equipped than a single indicator.

8. POLICY AND RESEARCH IMPLICATIONS: DRAWING CONCLUSIONS

Implications for Policy

The findings of this systematic review confirm previous conclusions about the gendered nature and impact of agricultural practices and interventions. In particular, the evidence analyzed indicates that

- women play a key role in agriculture, and this is reflected in their time commitments to these activities, whether as farmers or farmworkers;
- women are important actors in the uptake and response to agricultural interventions; and
- agricultural interventions tend to increase women's, men's, and children's time burdens.

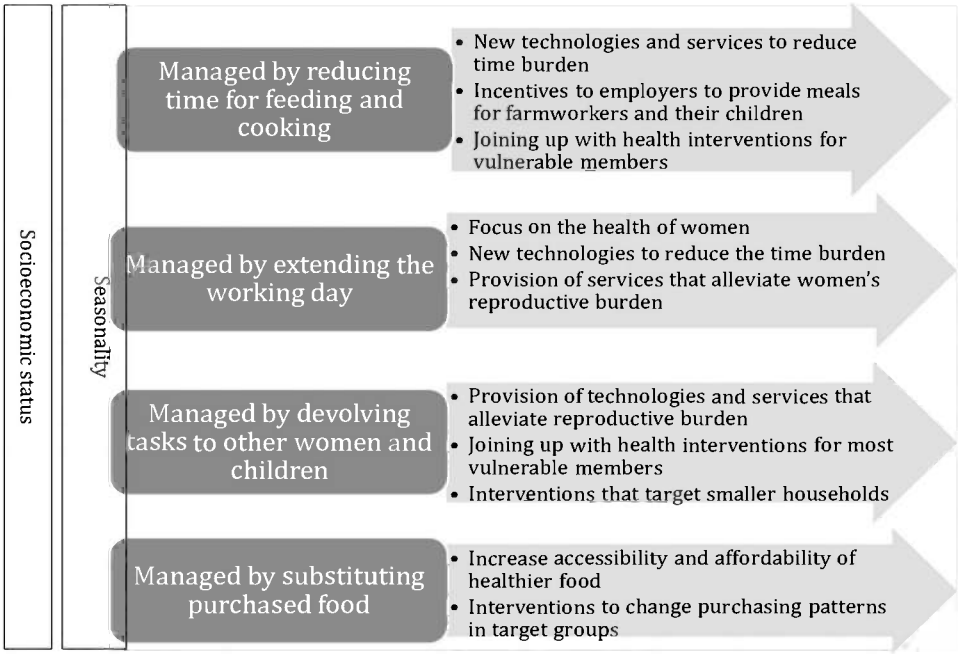
However, the studies included in this review do not provide clear-cut evidence on the nutritional implications of agricultural practices and interventions, even when these result in increased time spent on agricultural activities.

There are several policy conclusions to be drawn. On the one hand, the results reaffirm the need for gender-sensitive agricultural policy. On the other hand, the mixed evidence in terms of nutritional impacts highlights the importance of taking the differentiating factors into account in policy. What are the factors that lead to different nutritional outcomes, and how can these be addressed?

The evidence shows that the nutritional impacts are varied because households and household members respond to increased time burden in different ways. Therefore, the identification of the ways in which burden is managed is the starting point for gender-sensitive agricultural policy for improved nutrition. We argue that different sets of policies are needed to address specific forms of burden management, shouldered by households, individual household members, or both. It is important to underline that different ways of managing additional burden are not mutually exclusive, and therefore a combination of different policies may be appropriate depending on the context.

Figure 8.1 summarizes the different ways in which burden is managed, as they emerged from the systematic review, and draws policy implications for each of them.

Figure 8.1 Modes of management of increased agricultural time burdens and consequent policy responses



Source: Compiled by authors.

The systematic review provides evidence that a common response mechanism to increased time spent in agriculture is simply an **extension of the working day and the simultaneous erosion of resting, sleeping, and leisure time.** This may mean that the individuals whose working day is extended are those primarily affected by it. This pattern is especially problematic for women, as they are the most likely to combine agricultural and domestic work. Therefore, the policy implications in this scenario should try to limit the extension of the working day. This would include the introduction of technologies that can save time in agriculture, reproductive tasks, or both; health policy focused on women or other household members affected by lower leisure or sleep; and the provision of services (for childcare, for instance) that alleviate women's reproductive burden.

Another possible response is the **increased consumption of processed foods.** In contexts where this type of response is common, policies should be aimed at ensuring that processed foods are affordable and nutritious. Therefore, regulation and incentives can be used to guarantee accessibility and affordability of healthy and nutrient-rich processed foods as better substitutes for foods that require longer preparation. At the same time, the most affected groups, such as the poorest households, could be targeted with programs to increase their purchasing power.

In some cases, increased time spent in agriculture results in a **reduction of time for feeding and food preparation.** This can affect the individuals whose time is reduced as well as their children and families. Women's time is especially sensitive in this case as women are primarily responsible for feeding and food preparation across the world. Interventions could include the provision of time-saving technologies in agricultural and domestic work, incentives to encourage employers to provide meals to farmworkers and their children, and health policy focused on the most vulnerable in the affected households.

Important to note, additional burden is often managed by **devolving tasks to other members of the household, especially younger or older women and children.** In this scenario, members of smaller households may need to shoulder greater burdens, and therefore smaller households may be the appropriate target of interventions. In particular, health and nutrition policy should focus on the most vulnerable household members. It would still be important to enhance the provision of services (such as childcare) that reduce households' reproductive burden at large.

Finally, it is of crucial importance to take **crosscutting issues** into account. This systematic review highlighted two significant factors: **seasonality and household socioeconomic status.** All of the scenarios described above may change according to agricultural seasons, and for certain households, additional time burdens may be experienced only in labor-intensive agricultural seasons. This suggests that short-term interventions may need to be season specific. By the same token, household socioeconomic status may shape the response mechanisms to additional burdens. Poorer households have fewer resources to respond to time constraints and therefore should be given priority over households that also experience longer working days but have better resources to respond.

Implications for Research

Based on the mapping of the evidence on agriculture, time use, and nutrition, there are several implications to be drawn for future research in these areas.

The quality of time use data is certainly an area where improvements can be made. Little attention is paid to simultaneous activities and literacy levels. The former may result in underestimation of the burden of individuals who are more likely to carry out multiple activities, women especially. Consideration for the latter needs to inform the selection of the methods used for data collection and is particularly important in low- and middle-income countries where there may be greater difficulty in reporting the exact duration of the activities performed.

If informed by sound sampling techniques, direct observation remains an effective method to collect time use data. With regard to the use of surveys instead, there is growing consensus around the rigor of national time use surveys. We note that few studies in this review use data collected in national time use surveys, and therefore future research in the areas of agriculture and nutrition could make better use of the national time use surveys in the countries where these have been implemented.

A second point can be made on the need to improve the indicators used for employment. Given the complexity of employment patterns in contexts characterized by high levels of economic informality, which is one of the reasons time use surveys are considered especially useful in low- and middle-income countries (Hirway 2010), employment statistics need to improve on two fronts. First, the indicators used cannot be based on the distinction between primary and secondary activities because there is evidence that individuals engage in multiple occupations that cannot be classified as primary or secondary. Second, the employment statistics need to take into consideration seasonal changes.

As for the indicators of food consumption/security and nutrition, the systematic review underlines that outcomes may be different. For example, agricultural interventions may generate changes in time use and income that have positive effects on indicators of food consumption and dietary diversity and negative effects on anthropometry—see Kumar (1994). This suggests that future research on agriculture and nutrition would benefit from the simultaneous use of different indicators, such as calorie intake, dietary diversity, and anthropometric measures.

The earlier points indicate the need to improve primary data collection to have better datasets. We stress that studies in the areas of agriculture, time use, and nutrition will continue to benefit from field-based qualitative research and small-scale surveys. Despite the diminished opportunities for cross-country comparability, context-specific research has much to offer to these fields of study. Considering the importance of differentiating factors, this type of research is well equipped to shed light on the factors and processes that influence different ways of managing additional burdens.

Finally, the overwhelming focus on women is justified by the recognition that women's time is particularly sensitive for the reasons highlighted in the literature. However, future research in these areas could do more to look at other household members, children and men, as well as consider diversity among women. To understand the mechanisms described above whereby domestic work is devolved to other women or children, it is important to study the relations of power between older and younger women and other aspects of intrahousehold allocation of tasks. More work must also be done to understand men's time use, and we were surprised at how few studies focused on men.

In addition, studies on agriculture, time use, and nutrition would gain depth by contextualizing time allocation patterns in the structural characteristics of the economy and broader processes of change. For example, it would be interesting to consider the effects of trade liberalization on the use of time for different households and household members.

Limitations of Review

Some of the limitations of the review derive from the limitations in the quality of the studies. The low quality of time use data in many studies casts some doubts on the reliability of the information of time use contained in some studies. By the same token, the problems with the employment statistics described in the previous section may obscure important aspects of participation in the agricultural and nonagricultural sectors. The food and nutrition indicators used were different across the studies, and therefore there are limits to the conclusions that can be drawn on the impacts on food consumption or security and nutrition.

Despite initial intentions to combine meta-analysis with narrative-based synthesis, it was eventually impossible to conduct meta-analysis due to the inclusion of only one randomized experiment. Meta-analysis would have expanded the scope of the review to consider the size of impact in addition to the impact pathway.

Also, given the limitations of the studies, we were not able to differentiate between short- and long-run effects. It may be the case that in the short run the increase in time burdens prevails and has an effect on nutritional outcomes but in the long run the income effects may dominate.

It also is important to highlight some limitations of the systematic review process itself. We have identified some concerns. First, in conducting the review, we realized that there may be a bias against certain strands of literature, such as anthropological literature. For example, seminal ethnographic work on agriculture, diets, and time such as Richards (1939) and Moore and Vaughan (1994) was not captured in the systematic review. This may be because search strategies used in systematic reviews may be better equipped to capture studies that look specifically at the themes or question of interest rather than as part

of broader investigations, which is also reflected in the words used in titles and abstracts. It could also be due to the need for narrow definitions of the concepts at hand, which, if expanded, would yield thousands of studies. Differing disciplinary approaches to communicating and synthesizing content means that some are less readily captured by the narrow criteria imposed by the systematic review process.

It is clear that many studies excluded from the systematic review would be extremely useful to understand the impact pathway between agriculture, time use, and nutrition. For instance, literature dealing with time use in relation to the more general sphere of nonagricultural work would likely yield important theoretical insights that could be applied to agricultural contexts. The mixed studies approach did, however, mean that the methodology was less conservative than it would otherwise have been if a conventional protocol had been followed.

The second limitation of the systematic review method is that it fails to identify the changes in methodological and theoretical approaches over time. All studies are subject to the same screening process, resulting in a flattening of the historical shifts in disciplinary trends and approaches. In the case of time use, this has important implications. A closer comparative reading of the studies reveals that in the 1980s, time use was an important and explicit focus of research. This reflected the influence of feminist approaches that represented a major shift in thinking from the late 1970s, precipitating a change in focus from productive activities to the formerly invisible and unpaid, female sphere of reproduction. By the early 1990s, nuanced gender analysis became a critical component of understanding the unequal intrahousehold distributions of resources and responsibilities. By the 2000s, it is evident that gender and issues of women's empowerment had been mainstreamed, not only in academia but in policy and development circles as well. The most recent papers return to issues of time use—but often less explicitly and frequently without recognition of the earlier feminist approaches that preceded them. This historical trajectory has important implications. For instance, one of the risks of overlooking the earlier, feminist literature is that there has been a shift of focus from analyzing gender relations to a more narrow attention to the behavior of women: gender concerns have become synonymous with women's concerns. Seen in this light, the absence of attention to men's time use is not simply a methodological weakness but a reflection of the development of thinking over time, in which earlier critical feminist approaches have been sidelined. Evidently, prevailing disciplinary and theoretical concerns change through time and influence the way that time use is conceptualized and data are collected. By applying uniform criteria and treating articles as analogous and unrelated to one another, systematic reviews flatten the historical development of knowledge over time.

A final issue is the main thesis of this study, which links agricultural activities to nutrition via time use. There are two aspects that should be elaborated. First, while this study arises from an interest in informing nutrition-sensitive agricultural policy, it is also true that the most pressing time burdens may not emanate from agriculture. In this respect, some of the more comprehensive studies in our search are illuminating—so where women's overall time use has been investigated, we often see that reproductive activities dominate in terms of time use. Also, employment in nonagricultural activities is increasingly relevant for rural inhabitants, so even when the focus is on productive activities, agriculture may not be the predominant occupation. At the same time, our underlying thesis may be remiss in its vision of trade-off in time use. In this systematic review, we have investigated how agriculture draws on the time of women, men, and children and what the nutritional implications are. Of course, this ignores reverse causality (where nutritional status affects the ability to or extent to which one can engage in agricultural own production or wage work). It also has a somewhat simplistic vision of trade-off embedded in it. Our study has focused on nutritional outcomes and not looked more widely at the link between agriculture, time use, and household welfare. The picture in reality is more complex. For example, if as a result of an agricultural intervention, household members spend more time on agricultural activities and their nutritional status stays the same or improves but they have less leisure time, then how can this situation be assessed from a household welfare viewpoint? More quantitative and qualitative research embedded in more comprehensive approaches would contribute to a better understanding of the links between agriculture, time use, and household welfare.

9. AUDIT OF NEW DATA SOURCES

Rationale and Procedure

Based on the findings of the systematic review, this part of the research project explores the key characteristics of the International Food Policy Research Institute Women's Empowerment in Agriculture Index (WEAI) datasets. The scope is to provide insight on how these data sources can be used for research on agriculture, time use, and nutrition.

We reviewed eight datasets that contain information about time use, agriculture, and/or nutrition. The common denominator is the WEAI module, which is almost identical across the board (with the slight exception of Nepal). However, the surveys that host the WEAI module can be different across countries. Some of them, especially those conducted by the United States Agency for International Development Feed the Future present some similarities, but others are quite diverse.

The summary tables (Tables 9.1–9.8) contain information about the geographic coverage, nationally representative only in the case of Bangladesh; the sample size; the month and year when the survey was conducted; the indicators used to record agricultural practices; and the food and nutrition indicators used. With regard to time use data, the tables report information about some key characteristics:

- Respondent(s) (whose time?)
- Whether simultaneous activities were recorded
- Whether contextual or background information to help interpret time use data was collected
- Whether literacy levels were taken into consideration in the process of data collection

For each dataset we also look at a set of key indicators, including the following:

- Household socioeconomic status (was it considered and what measurements were used?)
- Household composition
- Intrahousehold decisionmaking
- Seasonality
- Employment in nonagricultural sectors
- Work intensity

These factors were selected because they emerged as important for agriculture-nutrition pathways in the systematic review.

Table 9.1 Characteristics of Bangladesh Women's Empowerment in Agriculture Index dataset

Geographic coverage	Sample size	Year of survey	Agriculture indicators	Nutrition indicators	Time use
Nationally representative of rural areas	2,040 households	October–November 2011	Crops grown	Food consumption (household expenditure)	Female and male respondents
			Irrigation	Anthropometry (all household members)	Simultaneous activities
			Use of agricultural chemicals	Household food consumption (24-hour recall)	Contextual information recorded
			Labor usage by gender for crop plantations	Intrahousehold food distribution	Literacy levels taken into account (enumerators guidance)
			Postharvest labor	Household dietary diversity (7-day recall)	
			Livestock, poultry, fishery	Child feeding practices and use of macronutrients	
				Mother's nutrition knowledge	

Socioeconomic indicators	Household composition	Intrahousehold decisionmaking	Seasonality	Employment in nonagricultural sectors	Work intensity
Education	Recorded	Recorded	Considered for agriculture only	Recorded	Not recorded
Household income					
Household expenditure					

Source: Compiled by authors.

Table 9.2 Characteristics of Ghana Women's Empowerment in Agriculture Index dataset

Geographic coverage	Sample size	Year of survey	Agriculture indicators	Nutrition indicators	Time use
Feed the Future zone of influence, Northern Ghana	4,410 households	July–August 2012	X	Household Hunger Scale	Female and male respondents
				Child nutritional intake	Simultaneous activities
				Child anthropometry	Contextual information recorded
				Women's underweight	Literacy levels taken into account (enumerators guidance)
				Women's dietary diversity	

Socioeconomic indicators	Household composition	Intrahousehold decisionmaking	Seasonality	Employment in nonagricultural sectors	Work intensity
Household expenditure	Recorded	Recorded	Not considered	Not recorded	Not recorded

Source: Compiled by authors.

Table 9.3 Characteristics of Haiti Women's Empowerment in Agriculture Index dataset

Geographic coverage	Sample size	Year of survey	Agriculture indicators	Nutrition indicators	Time use
Unclear	1,550 households	October–December 2012	Land	X	Female and male respondents
			Crop		Simultaneous activities
			Agricultural production by season		Contextual information recorded
			Agricultural inputs		Literacy levels taken into account (enumerators guidance)

Socioeconomic indicators	Household composition	Intrahousehold decisionmaking	Seasonality	Employment in nonagricultural sectors	Work intensity
Household expenditure	Recorded	Recorded	Considered for agriculture only	Not recorded	Not recorded

Source: Compiled by authors.

Table 9.4 Characteristics of Malawi Women's Empowerment in Agriculture Index dataset

Geographic coverage	Sample size	Year of survey	Agriculture indicators	Nutrition indicators	Time use
7 districts in central Malawi, rural areas only	3,528 households	2012	X	Household Hunger Scale Women's anthropometry Women's dietary diversity	Female and male respondents Simultaneous activities Contextual information recorded Literacy levels taken into account (enumerators guidance)

Socioeconomic indicators	Household composition	Intrahousehold decisionmaking	Seasonality	Employment in nonagricultural sectors	Work intensity
Education Household expenditure	Recorded	Recorded	Considered for agriculture only	Recorded	Not recorded

Source: Compiled by authors.

Table 9.5 Characteristics of Nepal Women's Empowerment in Agriculture Index dataset

Geographic coverage	Sample size	Year of survey	Agriculture indicators	Nutrition indicators	Time use
Zone of influence for the baseline data	2,000 households	April–May 2013	Agricultural practices and use of land Field crop production and sale Animal ownership	Maternal health Infant and young child feeding: knowledge, attitudes, and perceptions Mother's weight, height, and hemoglobin level Child anthropometry Child hemoglobin measurements Grandmother's perspective on maternal and child health/nutrition	Female and male respondents Simultaneous activities Contextual information recorded Literacy levels taken into account (enumerators guidance)

Socioeconomic indicators	Household composition	Intrahousehold decisionmaking	Seasonality	Employment in nonagricultural sectors	Work intensity
Education Household income Household assets	Recorded	Recorded	Not considered	Not recorded	Not recorded

Source: Compiled by authors.

Table 9.6 Characteristics of Rwanda Women's Empowerment in Agriculture Index dataset

Geographic coverage	Sample size	Year of survey	Agriculture indicators	Nutrition indicators	Time use
Feed the Future zone of influence, which comprises 27 of 30 districts (all of Rwanda except Kigali)	2,000 households	Not clear	X	Household Hunger Scale Women's dietary diversity	Female and male respondents Simultaneous activities Contextual information recorded Literacy levels taken into account (enumerators guidance)

Socioeconomic indicators	Household composition	Intrahousehold decisionmaking	Seasonality	Employment in nonagricultural sectors	Work intensity
Education	Recorded	Recorded	Not considered	Not recorded	Not recorded
Household assets					

Source: Compiled by authors.

Table 9.7 Characteristics of Uganda Women's Empowerment in Agriculture Index dataset

Geographic coverage	Sample size	Year of survey	Agriculture indicators	Nutrition indicators	Time use
140 enumeration areas	2,566 households	December 2012	X	Household Hunger Scale Women's dietary diversity Women's anthropometry Child anthropometry Child anemia Infant and young child feeding	Female and male respondents Simultaneous activities Contextual information recorded Literacy levels taken into account (enumerators guidance)

Socioeconomic indicators	Household composition	Intrahousehold decisionmaking	Seasonality	Employment in nonagricultural sectors	Work intensity
Education	Recorded	Recorded	Not considered	Not recorded	Not recorded

Source: Compiled by authors.

Table 9.8 Characteristics of Zambia Women's Empowerment in Agriculture Index dataset

Geographic coverage	Sample size	Year of survey	Agriculture indicators	Nutrition indicators	Time use
Feed the Future zone of influence (5 districts)	1,640 households	December 2012	X	Household Hunger Scale	Female and male respondents
				Women's dietary diversity	Simultaneous activities
				Women's anthropometry	Contextual information recorded
				Child anthropometry	Literacy levels taken into account (enumerators guidance)
				Child anemia	
				Infant and young child feeding	

Socioeconomic indicators	Household composition	Intrahousehold decisionmaking	Seasonality	Employment in nonagricultural sectors	Work intensity
Education	Recorded	Recorded	Not considered	Not recorded	Not recorded

Source: Compiled by authors.

Many of the datasets audited do not contain data on all of the components of interest: agriculture, time use, and nutrition. Only two datasets, Bangladesh and Nepal, from the list of eight include information about the three relevant variables. The others do not have a module on agricultural practices or, in the case of Haiti, do not have nutrition indicators.

Linking Datasets

Given that few datasets have all the variables of interest, the second component of this exercise looks at possible ways in which the datasets can be linked to others, available for specific countries, which contain the missing information. We provide an example of potential links with two datasets for Ghana (Table 9.9) and Malawi (Table 9.10).

Table 9.9 Ghana Living Standards Survey

Variables of interest	Time use data	Year of survey	Seasonality	Geographic coverage	Sample size
Agriculture, assets, land, livestock, and equipment Livestock/fishing/poultry equipment Farmland Harvest and disposal of crops Seasonality of sales and purchases (key staples only) Other agricultural income (in cash and in kind) Expenses of agricultural inputs Processing of agricultural produce Consumption of own produce	How many hours per week did each member of the household roster (5 years or older) spend on • primary and secondary activity in the last 7 days, • main and secondary occupations in the last 12 months, and • housekeeping activities in the last 7 days? The amount of money spent in last 12 months on • hired labor for cropping, • paid labor for herding and hired labor for livestock, and • hired labor for fishing. The amount of money in cash and kind spent in the last 2 weeks on • labor in food processing and fish/meat smoking.	October 2012–October 2013	Unclear	Nationally and regionally representative indicators	18,000 households nationwide

Source: Compiled by authors.

Table 9.10 Malawi Third Integrated Household Survey

Variables of interest	Time-use data	Year of survey	Season of survey	Geographic coverage	Sample size
For rainy and dry season: Crop planting and harvesting Use of harvest Harvest storage and loss Landholding Decisionmaking over land use and over use of agricultural income Use of inputs Access and use of government input coupon scheme Seed use Sales and storage produce	How many weeks, days per week, and hours per day did each member of the household roster work during the rainy and dry seasons on • land preparation, planting, or both; • weeding, fertilizing, and/or any other nonharvest activity; and • harvesting? How many days of labor were hired during the rainy and dry seasons (men/women/children <15 years) • for all activities, • for nonharvesting activities, and • for harvesting activities? How many days of free/exchange labor were used during the rainy and dry seasons (men/women/children <15 years): • for all activities, • for nonharvesting activities, and • for harvesting activities? How much was spent on hired labor in last 12 months • on livestock activities? *Time use module* Hours spent yesterday collecting water/firewood Hours spent in the past 7 days on agricultural activities/household business/*ganyu* labor/apprenticeship Detailed questions on main job/secondary job/unpaid apprenticeship/ganyu labor/other unpaid work	March 2010–March 2011	Agricultural questions about rainy season 2008/2009 and rainy season 2009/2010; dry season 2009 and dry season 2010	Indicators representative of nation and three broad regions: North, Central, and South.	12,271 households nationwide

Source: Compiled by authors.

Conclusions on Audit of WEAI Datasets

This audit has shown the potential for deepening our understanding of the links between agriculture, time use, and nutrition through the use of WEAI data. The WEAI module adopts the gold standard method to collect time use data. The WEAI component is integrated into larger surveys, so there is background information about household socioeconomic characteristics, which helps analyze time use data. Arguably the main strength of the module is that it collects information about all activities performed in the 24 hours prior to the interview, which is simultaneously taken into account. In addition, time use data are collected from two respondents, a female and a male household member. This is useful as it allows for gendered comparisons, although it remains fairly insufficient to conduct a comprehensive analysis of intrahousehold dynamics.

The WEAI data are not sensitive to seasonality and work intensity. However, it should be possible to work out energy expenditure using the time use data provided by the dataset. The training given to WEAI enumerators includes clear guidance on ways of asking questions that make reference to daily activities normally performed at certain times of the day to enhance accuracy and overcome potentially low literacy levels. Finally, information about employment in nonagricultural sectors is uneven, however, and depends somewhat on the particular dataset in which the WEAI is nested.

We have provided information about the ability to link to other datasets in two examples. This gives an idea of what information researchers may find available in different datasets. The potential for linking datasets clearly exists in some cases and may further help us link the rich time use data collected in the WEAI with data on agricultural output.

APPENDIX A: SEARCH STRATEGY

Example Search Strategy

CAB Abstracts (Ovid) <1990 to 2014 Week 51>
Searched December 11, 2014

1. (Afghanistan or Angola or Albania or "American Samoa" or Argentina or Armenia or Armenian or Azerbaijan or Bangladesh or Belarus or Belize or Benin or Bolivia or Bosnia or Herzegovina or Botswana or Brazil or Bulgaria or Burkina Faso or Burkina Fasso or Burundi or Urundi or Cambodia or Cameroon or Cameroons or Cameron or Camerons or Central African Republic or Chad or China or Colombia or Comoros or Comoro Islands or Comores or Congo or Costa Rica or Cuba or Zaire or Cote d'Ivoire or Ivory Coast or Djibouti or Dominica* or East Timor or East Timur or Timor Leste or Ecuador or Egypt or United Arab Republic or El Salvador or Eritrea or Ethiopia or Fiji or Gabon or Gambia or Gaza or Georgia Republic or Georgian Republic or Ghana or Grenada or Guatemala or Guinea or Guiana or Guyana or Haiti or Honduras or Hungary or India or Indonesia or Iran or Iraq or Kazakhstan or Kenya or Kiribati or Korea or Kosovo or Kyrgyzstan or Kirghizia or Kyrgyz Republic or Kirghiz or Kirgizstan or Lao PDR or Laos or Lebanon or Lesotho or Liberia or Libya or Macedonia or Madagascar or Malagasy Republic or Malawi or Malaysia or Maldives or Marshall Islands or Mali or Mauritania or Mauritius or Agalega Islands or Mexico or Micronesia or Moldova or Moldovia or Moldovian or Mongolia or Montenegro or Morocco or Ifni or Mozambique or Myanmar or Myanma or Burma or Namibia or Nepal or Nicaragua or Niger or Nigeria or Pakistan or Palau or Palestine or Panama or Paraguay or Peru or Philippines or Philipines or Phillipines or Phillippines or Romania or Rwanda or Ruanda or Samoa or Samoan Islands or Sao Tome or Senegal or Serbia or Seychelles or Sierra Leone or Sri Lanka or Solomon Islands or Somalia or South Africa or St Lucia or St Vincent or Grenadines or Sudan or Suriname or Swaziland or Syria or Tajikistan or Tadzhikistan or Tadjikistan or Tadzhik or Tanzania or Thailand or Tonga or Togo or Togolese Republic or Tunisia or Turkey or Turkmenistan or Tuvalu or Uganda or Ukraine or Uzbekistan or Uzbek or Vanuatu or Venezuela or New Hebrides or Vietnam or Viet Nam or West Bank or Yemen or Zambia or Zimbabwe).hw,ti,ab,cp. (1876865)

2. ((developing or less* developed or under developed or underdeveloped or middle income or low* income or underserved or under served or deprived or poor*) adj (countr* or nation? or population? or world)).ti,ab. (41475)

3. ((developing or less* developed or under developed or underdeveloped or middle income or low* income) adj (economy or economies)).ti,ab. (663)

4. (low* adj (gdp or gnp or gross domestic or gross national)).ti,ab. (38)

5. (low adj3 middle adj3 countr*).ti,ab. (1502)

6. (lmic or lmics or third world or lami countr*).ti,ab. (2175)

7. transitional countr*.ti,ab. (70)

8. exp developing countries/ (1263397)

9. or/1-8 (1938149)

10. time allocation/ or time management/ (575)

11. (time adj3 (use* or utilis* or utiliz* or diary or diaries or poverty or pattern* or expend* or spent or spend* or save or saved or saving* or constrain* or allocat* or apportion* or allot* or allow* or assign* or manag*)).ti,ab. (29640)

12. (women* adj2 ("use" or "uses") adj2 time).ti,ab. (13)

13. 10 or 11 or 12 (29809)

14. (home garden or home gardening or home gardens or home-garden or home-gardens or home-gardening or vegetable garden or homestead food production or household garden or household gardening or household gardens or garden based nutrition program or kitchen garden or kitchen gardens or kitchen gardening or project garden or project gardens or project garden or homestead plot or food garden or food gardens or food gardening or HFP or HFPP or home based food or home-based food or home based garden or home-based garden).ti,ab. (2119)

15. (dairy development or dairy farming or dairy program or dairy programme or smallholder dairy development or dairy development or dairy cooperative or dairy extension).ti,ab. (3591)

16. (fish-pond or fishpond or fisheries or fishery or aquaculture or aqua-culture or aquafarm* or aqua-farm* or fishfarm* or fish-farm or fishfarm or capture fisheries or pond polyculture or mariculture or mari-culture or small-scale fisheries or small-scale fishery or small fish species or fish consumption).ti,ab. (38458)

17. (animal husbandry or animal source foods or animal-source foods or animal production or livestock promotion or livestock production or poultry promotion or poultry production or chicken promotion or chicken production or pastoralism or pastoral farming or pastoralist* or agro-pastoralist* or agropastoralist* or cattle production or camel production or goat production or sheep production or small ruminates).ti,ab. (27062)

18. (agricultur* or smallhold* or "small hold*" or farm* or "food production" or horticultur* or flower* or biofortification or bio-fortification).ti,ab. (659591)

19. agriculture/ or agropisciculture/ or animal husbandry/ or crop husbandry/ or crop production/ or farming/ or food production/ or horticulture/ or market gardens/ (73823)

20. or/14-19 (727160)

21. 9 and 13 and 20 (2100)

22. limit 21 to English language (1683)

23. nutrition/ or child nutrition/ or diets/ or elderly nutrition/ or famine/ or feeding/ or living standards/ or malnutrition/ or maternal nutrition/ or nutrition surveys/ or nutritional adequacy/ or nutritional anaemia/ or nutritional assessment/ or nutritional disorders/ or nutritional state/ (195782)

24. food consumption/ or home food preparation/ or food security/ or food deprivation/ or food preparation/ or food shortages/ or hunger/ or undernutrition/ (34398)

25. diet/ (34378)

26. dietary surveys/ (1350)

27. trace element deficiencies/ (3329)

28. (nutrition* or malnutrition or malnourished or anthropometr* or feed* or diet* or foodway* or food way* or food security or micronutrient deficienc* or hunger or undernutrition).ti,ab. (642860)

29. 23 or 24 or 25 or 26 or 27 or 28 (682941)

30. 9 and 13 and 29 (1416)

31. limit 30 to english language (1082)

32. "man".od. (691181)

33. "Homo".bt. (691072)

34. "Hominidae".bt. (691096)

35. 32 or 33 or 34 (691208)

36. 22 and 35 (306)

37. 31 and 35 (357)

38. 22 not 36 (1377)

39. 31 not 37 (725)

Table A.1 Database searches

Database	Search date
CAB Abstract	December 11, 2014
Web of Science	December 31, 2014
Econlit	December 31, 2014
Scopus	January 1, 2015
Proquest[a]	January 2, 2015

Source: Compiled by authors.
Notes: [a.] The IBSS Proquest database search timed out, making completion impossible. Therefore, it was possible to download only 80 out of 159 results for the Time/Nutrition search.

Table A.2 Internet searches

Organization	Website	Search date
International Food Policy Research Institute	http://ebrary.ifpri.org/cdm/	December 29, 2014
Food and Agriculture Organization of the United Nations	http://www4.fao.org/faobib/	January 5, 2015
World Health Organization	http://apps.who.int/iris/	January 5, 2015

Source: Compiled by authors.

Table A.3 Number of results

Pairwise searches	Number of results
Agriculture and time use	5,263
Time use and nutrition	2,942
Total	8,205
Total after elimination of duplicates	5,938

Source: Compiled by authors.

APPENDIX B: SUPPLEMENTARY TABLES

Table B.1 Thematic codes for data extraction

Themes	Codes
Geographic area	o Africa south of the Sahara o Asia o Latin America o Middle East and North Africa o Oceania o More than one
Agricultural or food system	o Cropping o Horticulture o Fishery o Livestock o Food storage o Food processing o Food distribution o Food retailing o No agriculture/food o Unclear
Type of employment	o Agriculture - Own account - Wage work ▪ Contracted ▪ Noncontracted ▪ Unclear - Family labor - Unclear o Nonagriculture - Own account - Wage work ▪ Contracted ▪ Noncontracted ▪ Unclear - Family labor Unclear o Multiple occupations - Own account - Wage work ▪ Contracted ▪ Noncontracted ▪ Unclear - Family labor Unclear o Housework o No employment o Unclear
Household members	o Women o Mothers - Pregnant women - Lactating mothers o Children o Adolescents o Men o Unclear
Does it look at household headship?	o Yes o No o Unclear

Table B.1 Continued

Themes	Codes
Does it look at socioeconomic status?	o Yes - Income - Consumption - Assets - Education o No o Unclear
Does it consider life cycle?	o Yes o No o Unclear
Does it consider seasonality?	o Yes o No o Unclear
Focus	o Agriculture and time use - Agricultural practice - Agricultural Intervention o Time use and nutrition o Agriculture, time use, and nutrition - Agricultural practice - Agricultural intervention
Method	o Qualitative o Quantitative o Mixed methods

Source: Compiled by authors.

Table B.2 Critical appraisal methods

Time use data	Codes
What are the overarching objectives of time use data?	o Comprehensive investigation of time use patterns o Detailed investigation of particular activities o Unclear
Are activities described in a way appropriate to the objective?	o Yes o No o Unclear
Are simultaneous activities considered?	o Yes o No o Unclear
How is time recorded?	o Interview - Fixed intervals - Open intervals - Unclear o Observation o Unclear
Is contextual or background information recorded?	o Yes o No o Unclear
Are literacy levels taken into consideration?	o Yes o No o Unclear
Qualitative evidence Is the study peer reviewed?	o Yes o No o Unclear

Table B.2 Continued

Time use data	Codes
Quantitative evidence	
Randomized studies	
Were there attempts to control for selection bias?	○ Yes and appropriate ○ Yes but inappropriate ○ No ○ Unclear
Were there attempts to control for confounding?	○ Yes and appropriate ○ Yes but inappropriate ○ No ○ Unclear
Were there attempts to control for motivation bias?	○ Yes and appropriate ○ Yes but inappropriate ○ No ○ Unclear
Were there attempts to control for performance bias?	○ Yes and appropriate ○ Yes but inappropriate ○ No ○ Unclear
Were there attempts to control for reporting bias?	○ Yes and appropriate ○ Yes but inappropriate ○ No ○ Unclear
Were there any attempts to control for any other form of bias?	○ Yes and appropriate ○ Yes but inappropriate ○ No ○ Unclear
Nonrandomized studies	○
Is the model specification appropriate?	○ Yes ○ No ○ Unclear
Are the methods of inference appropriate?	○ Yes ○ No ○ Unclear
Is the study peer reviewed?	○ Yes ○ No ○ Unclear

Component	Cut-off points	Category
Time use	0–5	Low quality
0–12	6–8	Medium quality
	9–12	High quality
Qualitative evidence	0	Low quality
0–2	1	Medium quality
	2	High quality
Quantitative evidence	0–2	Low quality
0–6	3–5	Medium quality
	6	High quality

Source: Compiled by authors.

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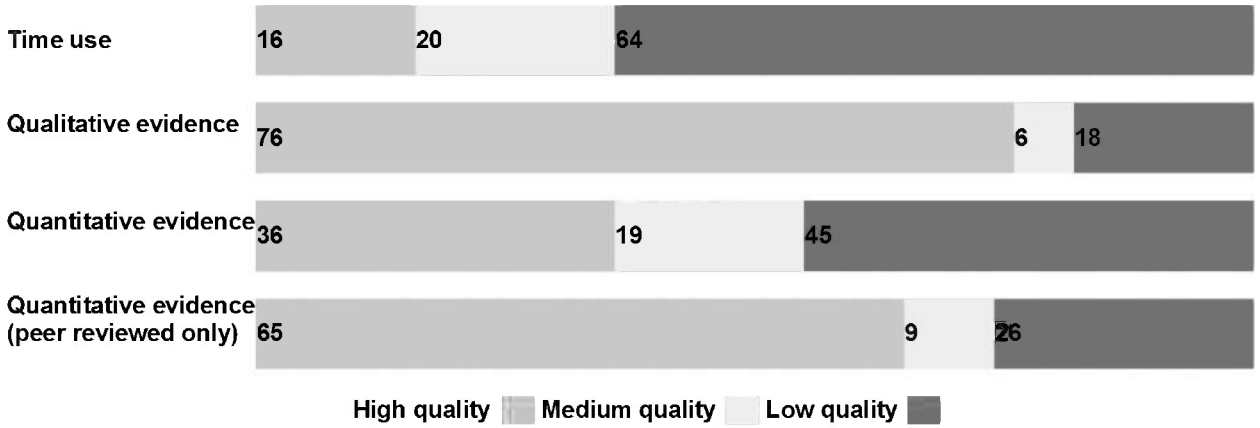
Figure B.1 An alternative quality assessment for quantitative evidence (in percentages)



Source: Compiled by authors.

Table B.3 Agricultural interventions and time use

Study	Agricultural intervention	Time use outcomes				
		Farming	Waged agricultural work	Nonagricultural work	Domestic work	Leisure
Admassie and Bedi (2003)	Introduction of agricultural technology: machinery, improved seeds; Ethiopia	↓ **children (girls and boys)** ↑ **girls**	Not reported	Not reported	Not reported	Not reported
Dammert (2008)	Anticoca policies; Peru	↑ **children**	Not reported	↑ **men**	↑ **children**	Not reported
Riley and Krogman (1993)	Irrigation projects to promote vegetable production; Lesotho	↑ **women**	Not reported	Not reported	↓ **women**	↓ **women**
Rubin (1990)	Sugarcane out-growers scheme; Kenya	Not reported	Not reported	↑ **women**	↑ **women**	↑ **women**
Shirajee et al. (2010)	Aquaculture extension project; Bangladesh	Not reported	↑ **women**	↑ **women**	→ **women**	Not reported

Source: Compiled by authors.
Notes: ↑= increase in the outcome variable;↓= decrease in the outcome variable; → = no effect on the outcome variable; Not reported = not reported in the study.

Table B.4 Agricultural interventions, time use, and nutrition

Study	Agricultural intervention	Time use					Nutrition				
		Farming	Waged agricultural work	Non-agricultural work	Domestic work	Leisure	Childcare/ feeding	Calorie intake	Nutrient intake	Child nutrition	Adult body mass index
Paolisso et al. (2002)	Vegetable and Fruit Cash Crop program; Nepal	↑ **women and men in HHs with one preschooler**	Not reported	Not reported	Not reported	Not reported	↓ **HHs with one preschooler → HHs with more than one preschooler**	Not reported	Not reported	Not reported	Not reported
Bellin (1994) in von Braun and Kennedy (1994)	Bo-Pujehun Development Project; Sierra Leone	↑ **women and men**	Not reported	Not reported	Not reported	Not reported	Not reported	→ **HH expenditure**	Not reported	↓ **especially in poorer HHs (anthropo-metric indicators)**	Not reported
Kumar (1994)	Adoption of hybrid maize; Zambia	↑ **women and men**	Not reported	Not reported	↑ **women**	Not reported	Not reported	↑ **HH expenditure**	↑ **HH expendi ture**	↓ **seasonally (stunting, wasting)**	↓ **seasonally women and men**
Quisumbing et al. (2013)	Strengthening the Dairy Value Chain Project; Bangladesh	↑ **women and men**	Not reported	Not reported	Not reported	Not reported	↓ **in relation to control group C1**	Not reported	Not reported	Not reported	Not reported

Source: Compiled by authors.

Note: ↑= increase in the outcome variable;↓= decrease in the outcome variable; → = no effect on the outcome variable; Not reported = not reported in the study; hh = household; hhs = households.

APPENDIX C: STUDIES INCLUDED IN THE SYSTEMATIC REVIEW

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