

UC Davis

UC Davis Electronic Theses and Dissertations

Title

The impact of agricultural extension programs on women's empowerment in agriculture and food systems in the global south: A systematic review

Permalink

<https://escholarship.org/uc/item/9pv1j7hh>

Author

Acosta, Saraí Lillian

Publication Date

2024

Peer reviewed|Thesis/dissertation

The impact of agricultural extension programs on women’s empowerment in agriculture and food systems in the global south: A systematic review

By

SARAÍ LILLIAN ACOSTA
THESIS

Submitted in partial satisfaction of the requirements for the degree of

MASTER OF SCIENCE

in

International Agricultural Development

in the

OFFICE OF GRADUATE STUDIES

of the

UNIVERSITY OF CALIFORNIA

DAVIS

Approved:

Amanda Crump

Vikram Koundinya

Cary Trexler

Committee in Charge

2024

Abstract

This systematic review examines the best agricultural extension methods in the context of women's empowerment, centering improvements in agency, achievements, and resources. Agricultural extension programs use projects and trainings to improve a community's agriculture system by disseminating information through individual or group trainings, focus groups, on-farm demonstrations, or through the transfer of technologies. Many extension programs work in rural, impoverished communities.

Unfortunately, extension practitioners often overlook women's roles, failing to consider how the program may affect them, despite women being the primary farm laborers [2]. In this thesis research, I analyzed studies published since 2000 with the coding assistance of other students and my advisor. The studies included in this systematic review include at least one dimension of women's empowerment (or disempowerment). In this review, I investigated the extension practices with highest retention rates, adaptability, and consideration for cultural and social realities to understand how agricultural extension empowers women. Most studies in this review involved communities in Sub-Saharan Africa and Southeast Asia and provided training on the several different types of agriculture topics: irrigation, climate change resilience, inputs and fertilizer, plant breeding, and more. Using online databases like SCOPUS and Agricola, I gathered 62,517 papers and narrowed them down to the 90 final papers analyzed in this systematic review, through an extensive series of reviewing and coding. Using Naila Kabeer's multidimensional empowerment research [7] as a theoretical framework, I found that most studies that measured women's empowerment had indicated some level of empowerment while some did have unintended consequences provoking disempowerment while others showed empowerment in unintended areas. In this systematic review, I offer insight to understand women's roles in agricultural communities and the significant socio-economic implications that may occur as a result from empowerment agendas in extension.

Acknowledgements

Firstly, I would like to express my sincerest gratitude in my committee, Dr. Amanda Crump, Dr. Cary Trexler, and Dr. Vikram Koundinya. You are all inspirational researchers, development scholars, and agricultural extension practitioners. Thank you for your guidance, words of wisdom, and perspectives on this project.

Amanda, I do not have the words to express how instrumental you have been as an advisor, a colleague, and a friend. Your commitment to ethics, critical thought, and pedagogy makes you one of the finest people I have ever had the privilege of working with. You create lasting change through your mentorship that persist long past our graduate journey. Thank you for always reminding me that I have a voice and that my ideas have merit, for teaching me restraint and objectivity, and always seeing promise in me when I did not see it myself.

A special thank you to my undergraduate assistant Ms. Nyah Mallak. You have been with me every step of the way and provided amazing ideas and critical thought that only served to enrich this project. You are an incredible thinker and scholar who will do great things in development. Thank you for everything, but most of all thank you for always being your amazing authentic self.

Thank you to my partner and my family who always listens and appreciates my rambling and thoughts on the world. I appreciate the effort you have all made to try to understand my research and ideas over the years. I could not be here without your love and support.

Lastly, a special thanks to Amanda Crump's Research Group on Agricultural Equity and Inclusion for your support, ideas, and feedback.

This review could not be possible without funding from the CGIAR GENDER Impact Platform.

Positionality Statement

I am first and foremost a woman of color and a daughter to Panamanian immigrants. I have been privileged enough to spend quality time in my home county, where I have been able to learn from my ancestors and appreciate my indigenous and Latin roots. Coming from rural communities and agricultural heritage, my community is not unlike the communities represented through this thesis and many of my critiques of western development stem from personal and professional experience. Throughout my studies I have looked to critical development scholars and post-colonial thinkers such as Amartya Sen, Arturo Escobar, and Gayatri Chakravorty Spivak to learn how to articulate the lived experiences of my people to a western audience.

Through a post-colonial and feministic lens, this research challenges the notion of western elitism as it corresponds to providing solutions and answers to all the world's problems. Many of the issues represented throughout this study stem from unbridled capitalism and projects founded on patriarchal views, which only serve to provide myopic solutions based on male centered production models. Intersectional feminism can explain the reasons why so many women face a triple burden or face compounding barriers as a result of western "solutions" to non-western problems. In part, this study is an interrogation of the exploitative paradigms which necessitate the existence of international aid.

While so much of my being has been shaped through my lived experiences, my academic education has been wholly western, and I am a privileged English speaking U.S. scholar. While my point of view is to always question institutions of power and give the power back to my community, I complete this thesis from a position of power and the inability to produce direct evidence from the communities in question. Conclusions from this paper are not firsthand accounts, nor are they conclusions of a non-western researcher, and they should be recognized as such. I only hope to encourage and emphasize the need to connect with communities directly before embarking on a quest to provide solutions.

Dedication

I dedicate this thesis to all *women*- everywhere, in all forms, shapes, and sizes.

To the women who thanklessly continue to provide domestically, economically, emotionally, and socially to their families and communities.

To the women who pioneer and inspire us to keep fighting for a more equitable world.

To the women who have endured needles violence on the basis of sex.

To the women in my life who have persevered in spite of injustice and violence.

To my students who are the next generation of change.

To everyone I have not met and will never meet, but will change the world one step at a time.

I dedicate this to anyone who will listen, anyone who is interested in a different perspective, anyone who wants to challenge the status quo, and anyone who wants to change the default approach to inequity.

And lastly to the subaltern, powerless and oppressed.

List of Tables

Table 1: Study Criteria.....	8
Table 2: Countries Distribution	13
Table 3: Summary of Study Demographics	15
Table 4: Participating organization Type	28
Table 5: Most Common Participating Organizations.....	28

List of Figures

Figure 1: Distribution of Extension Types.....	30
--	----

Table of Contents

Abstract	ii
Acknowledgements	iii
Positionality Statement	iv
Dedication	v
List of Tables	vi
List of Figures.....	vii
Chapter 1: Introduction and Theoretical Framework	1
Introduction.....	1
Theoretical Framework	3
Chapter Two: Methods.....	7
Methods	7
Study Definitions	7
Abstract and Final Paper Inclusion Determination	9
Paper Coding	11
Chapter Three: Findings	13
Findings.....	13
Case Studies.....	31
Overview of Final Dataset	41
Agricultural Value Chains	43
Extension methods, projects, approaches, and tools	45

Multiple Methods.....	47
Gendered aspects of extension trainings.....	51
Chapter Four: Discussion, Conclusion, Limitations	59
Discussion – Empowerment through Extension Methodologies	59
Conclusion – Integrating Gender within Extension Services to Empower	63
Key Takeaways.....	64
In Conclusion	66
Limitations and Opportunities.....	68
Final Remarks	71
Papers Included in the Systematic Review (alphabetical).....	73
References Cited.....	85
Appendix A	97
Appendix B.....	99
Appendix C.....	109

Chapter 1: Introduction and Theoretical Framework

Introduction

Agricultural extension, referred to as Rural Advisory Services by some, encompasses educational and training activities or projects used to assist farmers in developing agricultural skills or in adopting new technologies [1]. In emerging economies, agricultural extension and rural advisory services are key resources for providing farmers access to new knowledge and technologies. Extension has been credited with advances in agricultural yields, food security, and community empowerment [2]. However, there have been documented disparities in the impact of extension based on farm size and the sex of the farmer, leaving small-scale farmers and women farmers behind [2].

Historically, extension services have largely targeted men who farm larger plots, are literate, can tolerate risk, and can purchase inputs such as chemical fertilizers and labor-saving machinery [3]. These extension services are also influenced by cultural norms which may prevent women from accessing extension due to sociocultural, socioeconomic, or caste-based barriers [3]. In 1970, Boserup illuminated how training overlooked the specific needs of women farmers – resulting in increased interest in gender equity in agriculture, development practice, and extension education [4]. Despite Boserup's and others' calls for attention to gender inequities, the lack of attention to the needs of women farmers by extension services remains pervasive, resulting in limited access to new agricultural technologies and knowledge for women [2-5]. However, research suggests that reducing gender inequity in access to public extension and similar services (such as training provided by non-governmental organizations or the private sector) could increase yields for women's farms by 20 to 30 percent [6].

There are several factors preventing women from accessing and benefiting from agricultural extension services. For any given context, it is important to understand that agricultural technologies

and interventions are not gender neutral although they may claim to be, and many technologies or interventions are targeted towards men [107]. Instead, the uptake of technologies is more informed by sociocultural context [108]. For example, certain farm tasks or machinery may be culturally categorized as belonging to men or women (one common “women’s” task is weeding, for example). Gendered norms around who can own land or be a community leader in some societies impacts the ability for women to engage in agricultural interventions or decision-making [109]. The lack of women extension agents is one of the largest barriers across the field and may also negatively impact trust-building between extension programs and women farmers [2]. Women's access to formal education can also impact the effectiveness of certain extension education approaches that require reading and writing capabilities [2].

It is my working hypothesis that understanding and accommodating for gendered differences is key for extension interventions that lead to women’s empowerment. Through this systematic literature review, I aim to uncover the best-fit practices for extension services to empower women. Specifically, I explore, which extension methodologies have had the most impact on the empowerment of rural women in agriculture and food systems, and how, if at all, they have catered to the differentiated demands of men and women farmers in diverse contexts. The data coding team utilized Kabeer’s empowerment framework to assess the impact of extension methods on increasing women’s resources, agency, or achievements [7].

This thesis begins by defining the theoretical framework of empowerment. I then describe the methods used in this systematic review before outlining the findings. I end with a discussion of extension services, empowerment, and gender before making recommendations for further research.

Theoretical Framework

The research team who processed the papers in this systematic review and I rely heavily on Naila Kabeer's (1999) empowerment framework to develop our coding and analysis methods [7]. In addition to being highly cited within women's empowerment literature, Kabeer's framework is the backbone of the Women's Empowerment in Agriculture Index (WEAI) and the Evidence-based Measures of Empowerment for Research on Gender Equality (EMERGE) index. Kabeer provides a structure to characterize empowerment within extension.

According to Kabeer, empowerment involves expanding an individual's ability to make decisions based on existing conditions [7]. An empowered person has the ability to make choices on various scales, including on their own actions, household decision-making, and community or environmental actions. Within the context of agricultural extension, it is important to consider the scale of programmatic empowerment and ask if projects, trainings, or interventions improve women's ability to make change within their personal lives, their community, or their region. Kabeer's definition of empowerment assesses whether programs or interventions improve women's ability to make changes in their personal lives or the lives of others [7]. The basis of empowerment within this study means that, at one point, these individuals lacked power to make decisions, create social change, or perceive themselves as effective agents prior to an extension intervention. In this systematic review, extension programs and interventions were measured through three interrelated dimensions of empowerment outlined by Kabeer: Resources, Agency, and Achievements. Each dimension of empowerment is outlined below as it relates to women in agricultural extension projects, trainings, and interventions.

The first dimension of empowerment is resources, defined as the tangible and non-tangible items that allow a person to practice agency or allow that individual to expand the choices that are available to them. Resources can include any physical objects, ideas, or knowledge that present expanded options

or alternative scenarios for individuals to choose from. For example, if a farmer lives in a drought-prone zone, they will have greater agency, or ability to choose how to respond to drought, if there are more resources available to them. In this scenario, choice-amplifying resources could include drought-resistant crops, groundwater retrieval technology, or farmer forums to share best practices around drought response. Extension resource-empowerment could also include increasing availability of and access to the following resources:

- Farm inputs, such as seeds, fertilizers, veterinary services, pesticides or machinery.
- Workshops, forums, trainings or farm demonstrations.
- Informational videos, pamphlets, notebooks, books, or radio programming.
- Food, feed, medicine, land, schools, transportation, storage, markets, and financial institutions that provide saving and credit services.

A second dimension of empowerment is agency, defined as an individual's ability to set goals and act upon those goals, or the ability to act according to one's own choices [7]. Examples of agency within the realm of agricultural extension include the following:

- A woman farmer chooses and then adopts or uses a certain agricultural technology.
- A woman farmer prioritizes or grows certain crops or varieties, rears certain species or breeds of livestock, or determines which commodities will be allocated for commercial or personal use.
- A woman farmer determines which marketing channels to utilize.
- A woman farmer analyzes and chooses farming techniques based on what they learned from extension educators or resources.

The third dimension of empowerment is achievement, defined as the outcomes of utilizing resources to practice agency, or the results of making choices based on available resources. Any time a person makes a choice, translates that choice into action, and experiences positive change because of

that action, that individual has increased their empowerment in the form of an achievement.

Achievements can be presented in various forms, but typically reflect improved living situations, improved health metrics, higher positions of power, and the acquisition of additional resources.

Examples of achievements within the realm of agricultural extension include the following:

- Women farmers become leaders in each community, society, or organization, including establishment of cooperation or self-help groups.
- Farmer families experience improved health outcomes, income generation, and productive contributions.
- Farmer family members achieve higher levels of education because they have improved financial resources that allow for members to spend time off-farm.
- Living conditions improve in farming communities due to availability of public infrastructure.
- Women farmers' productivity increases so that their contributions to household income also increases, which results in a change in social status.
- A woman farmer enjoys higher levels of influence in household decision-making and feels more respected by fellow family members.

As a counter metric or unintended program outcome or consequence, the coding team also coded for cases of decreased empowerment of women, or *disempowerment*. Disempowerment within this study are the results of extension interventions which are counterfactual to the lists above. In these cases, extension programs, trainings, methods, or the agricultural technologies championed by extension educators deprive women of choice, overburden women with duties, limit their traditional access to resources, push women out of business, or empower men at the cost of reducing empowerment for women. Many of these issues *inherently* exist within the cultural fabric of these regions. There is an inherent patriarchy as leaning towards male dominated spaces and extension can perpetuate these sociocultural norms. Many of the issues that prevent women from being empowered

through extension-based practices stem from deep cultural and social roots in a system that seeks to empower men over women. For the purpose of this review, these factors are considered factors that disempower women, whether or not they originate from extension services or practices, they serve to counter the benefits of extension services and perpetuate the social norms which disempower women as a whole.

Within extension programming, disempowerment can occur when the specific needs of women are overlooked, or existing sociocultural dimensions of a community is not accounted for. As a result of deprivation, disempowerment by extension educators or systems inadvertently or actively decrease the decision-making capabilities of women. The following outcomes of extension activities would disempower women:

- Women farmers are burdened with additional labor requirements.
- Extension services and support are accessible to men, not women.
- Women farmers are outcompeted by men or unable to access the same market opportunities.
- Women farmers cannot break free from social norms that hinder their educational or leadership opportunities.
- Women do not feel safe participating in extension programming or experience domestic violence because of participating in extension programming.
- Women farmers have decreased decision making capabilities and influence either within the household or within the community at large.

Based on the above theoretical framework of empowerment and disempowerment, the following research question was established for this systematic review:

Which extension methods, projects, approaches, and tools have had the greatest impact on the empowerment of rural women in agriculture and food systems and how, if at all, have these

extension services catered to the differentiated demands of male and female farmers in diverse contexts?

Chapter Two: Methods

Methods

To conduct the review, we utilized the Consultative Group for International Agricultural Research (CGIAR) guidelines for systematic reviews [11]. These guidelines are based on the Cochrane method of Systematic Reviews, which operates on a set of principles of inclusion and exclusion categorizing the study question [12]. Below, I detail the specific variables that the research team utilized for either including or excluding publications from our review.

Study Definitions

In this section, I define the variables that were utilized for paper inclusion in our systematic review. Table 1 illustrates the criteria used to excluded studies on the basis of content presented in the abstract. This method was modeled after the CGIAR and Cochrane guidelines for Systematic reviews. The first step was to exclude studies based on whether or not they meet the most minimum criteria. Studies were excluded on the basis of being based in the global north or being considered a High Income County, were not involved with agricultural extension or agricultural intervention, were not inclusive of women, or were published before 2000. After studies were excluded , the remaining studies were revised a second time to determine if they were suitable to be included in the systematic review on the basis of agricultural involvement, analysis of women’s participation, analysis of empowerment in some metric, and credibility of source.

Table 1: Study Criteria. Exclusion and inclusion criteria used to determine which studies were included in the final analysis for this systematic review of women's empowerment through extension.

Study Exclusion Criteria	Study Inclusion Criteria
<i>Studies were excluded from the review if they met any of the following criteria</i>	<i>Studies were included for full processing if they satisfied the following criteria</i>
<ol style="list-style-type: none"> 1. Project was based in the global North 2. Project did not involve extension or development interventions 3. Published in languages other than English 4. Research was not rooted in agriculture or agricultural supply chain 5. Interventions not specific to or not involving women 6. Research published before 2000 	<ol style="list-style-type: none"> 1. Project described some form of intervention in one single region or had clearly defined regions 2. Presented a clear measurement of gender participation 3. Assessed some aspect of the agricultural value chain 4. Empowerment was discussed or measured clearly 5. Incorporated some form of extension or development 6. Intervention or practice was analyzed 7. Project or intervention was led by some established organization 8. Paper specifically looked at the effectiveness of the intervention 9. Extension tool or method is identifiable

Agricultural Extension. This review focuses on agricultural extension. In some parts of the world, extension is called rural advisory services (RAS) and some extension researchers write “agricultural extension and rural advisory services.” *Extension* is the term used to describe the technical assistance given to rural populations by an institution or group of people [1]. While many forms of extension exist, historically extension has been a way for governments to assist rural populations with resource development and improvement [1].

Gender Disaggregation. Many extension programs ignore the importance of gender norms and fail to properly assess the role or impact of women in agriculture. To assess the nuances between gender groups, studies were only included that separated extension intervention outcomes based on gender or sex, otherwise known as gender- or sex-disaggregation. Studies which did not separate outcomes based

on gender or sex were excluded because one couldn't be sure if those studies empowered women, men, or both.

Empowerment. As mentioned above, this study defines empowerment using the three dimensions outlined in our theoretical framework: resources, agency and achievements [7]. Below is a review of these three empowerment dimensions:

- Resources: Tangible items, such as capital, credit, or educational materials, that allow individuals to have greater choice and decision-making capacity.
- Agency: Any increase in women's ability to identify goals and act on their own desires or wants by utilizing available resources. For example, a woman can utilize extension educational resources to decide how to better manage their crops to better combat drought.
- Achievements: Positive outcomes resulting from the increase of resources and agency. This could include personal and societal outcomes such as graduating from a university, becoming a politician, owning a business, improving one's health and nutrition, and participating in markets or collective actions.

Abstract and Final Paper Inclusion Determination

For this systematic review, the analysis team focused on published papers, limiting to peer-reviewed papers published in academic journals. We located papers by first collecting abstracts related to the research question. Using the SCOPUS, CABI, and Agricola databases, we searched for abstracts using Boolean search logic (Appendix A). Two different reviewers searched each database with five to ten search permutations using terms including but not limited to "agriculture," "extension," "gender," "women," and "technology." These terms were used in various permutations to obtain as many possible studies as possible and can be viewed in Appendix A. The sources collected were published on or after

2000 both to examine recent developments in extension (assumed to be more relevant), and to examine extension interventions that occurred after Kabeer's 1999 publication on empowerment [7].

After the searches, we had generated a list of papers and accompanied abstracts. 62,517 abstracts were collected by continuously refining search terms to ensure specificity. These results were subsequently downloaded into RIS in BibTex format and uploaded to Endnote for processing. Duplicate documents were removed in Endnote, resulting in 34,241 final abstracts for review.

Following the Cochrane method, the abstracts were sorted using the exclusion criteria listed in Table 1. Any abstract that did not fall within the criteria was deleted and removed from consideration. Each abstract was read by two different reviewers to reduce bias, resulting in 3,737 papers retained for more intensive screening.

After final abstracts were identified, we compiled full papers utilizing Zotero and Endnote for the final elimination review. Many papers were not accessible, despite multiple attempts to access papers both within and outside of the UC Davis library system, resulting in 1,825 full papers for final vetting. Full papers were then sorted using the study inclusion criteria listed in Table 1. This phase was originally set to be completed with two researchers screening each paper in full. During this phase in our research, the University of California had an academic workers strike. This delayed project completion and affected the number of personnel involved in the exclusion process. The original team of eight researchers decreased to four due to the strike and the nature of graduate student academic appointments. As a result, only one researcher reviewed each paper during this secondary screening process, reducing our built-in bias-protection for this step. Researchers were thorough, and any papers that did not fit our criteria were removed from the study, resulting in 183 papers in total. The inclusion and exclusion processes assisted in critical and straightforward methods to screen the retrieved material and ensure enough papers were included in the systematic review.

Paper Coding

After our papers were selected, I standardized data analysis and processing by creating a systematic deductive coding method utilizing Dedoose qualitative analysis software. The code can be found in Appendix B. This method allowed readers to centralize and standardize data processing by collecting basic information about each paper, including country, extension methods, and project outcomes. During the coding process, we identified an additional 84 papers that failed to qualify under our inclusion criteria. Under fine scrutiny with the coding process, papers were removed for lack of study clarity, lack of discussion surrounding participant impact, for not relating to agriculture, or for not discussing or analyzing a specific extension intervention. This resulted in a total of 99 papers for final coding and analysis. While these papers, at first glance, fit our criteria, the review process required an inductive approach as we continually reassessed our positionality and the data set. One study, in particular, required a unique analysis because all referenced the same 2006-2009 study in Benin regarding Parboiling and extension videos [13-15]. These three papers were considered relevant, each identifying and studying a different aspect of the project, however I assessed the three studies as one intervention example for statistical analysis so as not to overrepresent our data.

After the final exclusion process and first round of deductive coding, a final total of 90 papers were further analyzed for empowerment metrics and extension interventions. Coding was completed in two passes to ensure all themes were accurately recorded and to enhance data validity. Following the second pass of coding, papers were again deductively coded with additional descriptors to improve statistical analysis. The descriptors included: empowerment metrics, sample demographics, and participating organizations. Papers were coded for all three dimensions of empowerment, along with disempowerment if the paper discussed or mentioned detrimental effects to women throughout the study.

Initial results were visualized in Dedoose, with many supplemental tables and images created in Microsoft Excel or NVivo for clarity and refinement.

Chapter Three: Findings

Findings

1,825 papers were analyzed for general demographics. Of these papers, 1,357 (74.36%) were published between 2015 and 2022, with 467 published between 2000 and 2014. From these, 443 journals were represented across the world and across disciplines. The most represented journals were *Sustainability* (45), *World Development* (38), *Development in Practice* (35), *Food Security* (35), and *Asian Journal of Medicine* (31). Of the final 90 papers that I analyzed for empowerment metrics [15-103], 25 different countries were represented, with 92% of the interventions conducted in South Asia and Sub-Saharan Africa and 27% of the reported interventions being conducted in India (Table 2, Table 3).

Table 2: Countries where the studies included in this systematic review took place.

Region/Country	Count
South Asia	39
Bangladesh	9
India	25
Nepal	3
Pakistan	2
East Asia and Pacific	6
Indonesia	1
Lao PD	1
Myanmar	3
Timor-Leste	1
Europe and Central Asia	1
Tajikistan	1
Latin America and the Caribbean	2
Honduras	2
Sub-Saharan Africa	42
Benin	2
Burkina Faso	2
Congo, Dem. Rep	1
Ethiopia	7
Gambia	1
Ghana	3

Kenya	4
Kenya, Uganda, and Tanzania	2
Malawi	6
Mali	2
Nigeria	2
Rwanda	1
Senegal	2
Tanzania	2
Uganda	3
Uganda and Tanzania	1
Zambia and Malawi	1
Grand Total	90

Of these studies, only 30 (33%) employed some measurements for empowerment with other studies reporting impacts that coincided with our theoretical framework of empowerment. All 90 studies reported some increase in resources, 72 (80%) reported some increase in agency, and 58 studies reported increases in achievements (Table 3). Alternatively, 33 (37%) studies discovered some level of disempowerment while 16 (18%) of them reported no ill effects on women. Disempowerment was assessed through mention of decreased resources, the project inhibiting some agency for women, or the intervention contributing to environments, or which inhibit women’s achievements. Not all papers assessed, commented, or acknowledged possible negative effects on women so it was determined that the remaining 41 (46%) studies were not able to report on disempowerment.

Table 3: Overview of articles used in Systematic Review

Article	Country	Sample Size	Gender Demographics	Empowerment Measurement Framework	Empowerment Outcomes	Decreased Empowerment	Organization Types	Extension Types
Naughton et al. (2017)	Mali	120	Women	None	Increase in Resources	Decreased empowerment	National Government, International NGO, Foreign University, Foreign Government	Research for improving extension/figuring out what works
Ramkumar et al. (2004)	India	40	Women	None	Increase in Resources, Agency, Achievements	Not measured	National University, National Government, International NGO	Research for improving extension/figuring out what works, Development, Regionally specific policy
Kinkinginhou un-Médagbé et al. (2008)	Benin	45	Mixed Sample	None	Increase in Resources	Decreased empowerment	International NGO	Community forum, Research for improving extension/figuring out what works
Alam et al. (2020)	Bangladesh	58	Women	None	Increase in Resources, Agency, Achievements	Not measured	National Government, National NGO, National Non-Profit, National Other, Foreign University	Consulting, Workshops, Meetings, Courses, Public awareness, Research for improving extension/figuring out what works
Ragasa et al. (2019)	Malawi	6282	Mixed Sample	Mixed methods-Analysis of gendered pathways from agriculture, food security, and nutrition	Increase in Resources, Agency, Achievements	No Disempowerment found	National Government, International NGO, Foreign University	Community forum, Research for improving extension/figuring out what works
Biswas et al. (2022)	Bangladesh	22	Mixed Sample	Sustainable Livelihood Framework	Increase in Resources, Agency, Achievements	Not measured	National Government, National NGO, International NGO, Foreign University	Research for improving extension/figuring out what works, Development
Prayoga and Yulianti (2015)	Indonesia	49	Women	None	Increase in Resources	Decreased empowerment	National University, National Government	Research for improving extension/figuring out what works

Article	Country	Sample Size	Gender Demographics	Empowerment Measurement Framework	Empowerment Outcomes	Decreased Empowerment	Organization Types	Extension Types
Malabasari and Hiremath (2016)	India	254	Women	None	Increase in Resources, Agency, Achievements	Not measured	None	Workshops, Meetings, Courses, Research for improving extension/figuring out what works
Suma and Großmann (2016)	India	115	Mixed Sample	None	Increase in Resources	Decreased empowerment	National University, National Non-Profit, Foreign University	Self-help groups, Research for improving extension/figuring out what works
Raghunathan et al. (2019)	India	977	Women	Mixed: WEAI, Livelihood Capitals	Increase in Resources, Agency, Achievements	No Disempowerment found	National NGO, International NGO, International Non-Profit	Research for improving extension/figuring out what works
Desai and Joshi (2013)	India	1475	Women	None	Increase in Resources, Agency, Achievements	Not measured	National University, National Other, Foreign University	Farmer-to-Farmer, Self-help groups, Clubs, Research for improving extension/figuring out what works
Murage et al. (2019)	Kenya, Uganda, Tanzania	2615	Mixed Sample	None	Increase in Resources, Agency	Decreased empowerment	National Government, International NGO, Foreign University	Research for improving extension/figuring out what works
Waid et al. (2022)	Bangladesh	480	Mixed Sample	Pro-WEAI	Increase in Resources, Agency, Achievements	No Disempowerment found	National Government, International Non-Profit, Foreign University	Training of trainers, Farm or home visits, Research station tours, demonstrations, Community forum, Research for improving extension/figuring out what works
Biswas (2014)	India	100	Women	Mixed: Agricultural, production, consumption, perception, income	Increase in Resources, Agency, Achievements	Not measured	National University	Training of trainers, Research station tours, demonstrations, Field days, Research for improving extension/figuring out what works
Mancini et al. (2007)	India	95	Mixed Sample	Sustainable Livelihood Framework	Increase in Resources, Agency, Achievements	Decreased empowerment	International NGO, Foreign University, Foreign Government	Self-help groups, Research station tours, demonstrations, Community forum, Research for improving extension/figuring out what works

Article	Country	Sample Size	Gender Demographics	Empowerment Measurement Framework	Empowerment Outcomes	Decreased Empowerment	Organization Types	Extension Types
Balasubramanya (2019)	Tajikistan	1855	Mixed Sample	None	Increase in Resources	Decreased empowerment	National Government, International NGO, Foreign Government	Research for improving extension/figuring out what works
Devkota et al. (2020)	Nepal	56	Women	None	Increase in Resources, Agency, Achievements	Not measured	National University, National Government, National NGO, National Non-Profit, Foreign University	Community forum, Public awareness, Research for improving extension/figuring out what works, Simulation
Mensah et al. (2021)	Ghana	482	Mixed Sample	None	Increase in Resources	Not measured	International NGO	Research for improving extension/figuring out what works, Simulation
Kadiyala et al. (2016)	India	115	Mixed Sample	None	Increase in Resources, Agency, Achievements	Not measured	National Government, National NGO, National Non-Profit, Foreign University, Foreign Government	Self-help groups, Training of trainers, Community forum, Public awareness, Research for improving extension/figuring out what works, Development, Tool innovation
Deka et al. (2019)	India	24055	Mixed Sample	None	Increase in Resources, Agency, Achievements	Not measured	None	Self-help groups, Research for improving extension/figuring out what works, Micro-credit
Vanderwal et al. (2011)	Gambia	48	Women	None	Increase in Resources	Not measured	National University, National Government, National NGO, Foreign University	Training of trainers, Farm or home visits, Community forum, Research for improving extension/figuring out what works, Tool innovation
Zossou et al. (2012)	Benin	144	Women	Sustainable Livelihood Framework	Increase in Resources, Agency, Achievements	Not measured	National Government, International Other, Foreign University	Farmer-to-Farmer, Community forum, Research for improving extension/figuring out what works, Tool innovation

Article	Country	Sample Size	Gender Demographics	Empowerment Measurement Framework	Empowerment Outcomes	Decreased Empowerment	Organization Types	Extension Types
Bezner Kerr et al. (2019)	Tanzania	520	Mixed Sample	None	Increase in Resources, Agency, Achievements	Not measured	National Other, Foreign University	Farmer-to-Farmer, Training of trainers, Debates, Role-playing, Field days, Community forum, Research for improving extension/figuring out what works
O'Brien et al. (2022)	Senegal	112	Women	WEAI inspired (study conducted before WEAI finalized)	Increase in Resources, Agency, Achievements	Not measured	National University, National Government, Foreign University, Foreign Government	Training of trainers, Community forum, Research for improving extension/figuring out what works, Tool innovation
Paris et al. (2008)	Senegal	300	Mixed Sample	Participatory Rural Appraisal	Increase in Resources, Agency, Achievements	Decreased empowerment	International NGO	Farmer-led demonstrations, Workshops, Meetings, Courses, Field days, Community forum, Research for improving extension/figuring out what works, GM/Biofortification
Lecoutere and Wuyts (2020)	Uganda	1243	Mixed Sample	Gender Household Approach	Increase in Resources, Agency, Achievements	No Disempowerment found	National University, National Government, International Non-Profit, Foreign University	Consulting, Farm or home visits, Workshops, Meetings, Courses, Community forum, Lectures, Research for improving extension/figuring out what works
Yasmin et al. (2013)	Pakistan	1055	Women	None	Increase in Resources, Agency, Achievements	No Disempowerment found	National University, National Government, National NGO, International NGO, Foreign University	Farmer-to-Farmer, Training of trainers, Farm or field tours, Farmer-led demonstrations, Field days, Community forum, Debates, Research for improving extension/figuring out what works
Tiwari et al. (2015)	India	30	Women	None	Increase in Resources	Not measured	National Government	Farmer-led demonstrations, Consulting, Farm or home visits, Community forum, Research for improving extension/figuring out what works, Tool innovation

Article	Country	Sample Size	Gender Demographics	Empowerment Measurement Framework	Empowerment Outcomes	Decreased Empowerment	Organization Types	Extension Types
Larson et al. (2020)	Lao PD	72	Mixed Sample	None	Increase in Resources	Not measured	National University, National Government, National NGO, International NGO, Foreign University	Role-playing, Role-playing, Research for improving extension/figuring out what work, Simulation
Frings-Hessami and Sarker (2022)	Bangladesh	300	Women	None	Increase in Resources, Agency, Achievements	Decreased empowerment	National University, National Government, International NGO, Foreign University	Telephone answering, advice systems, Research for improving extension/figuring out what works, Tool innovation
Fuller-Wimbush and Adebayo (2014)	Nigeria	6964	Women	None	Increase in Resources, Agency, Achievements	Decreased empowerment	National Government	Training of trainers, Research for improving extension/figuring out what works, Micro-credit
Ndenga et al. (2013)	Kenya	103	Mixed Sample	None	Increase in Resources, Agency	Not measured	International NGO, Foreign University	Training of trainers, Farm or home visits, Community forum, Research for improving extension/figuring out what works, Development
Bayisenge et al. (2014)	Rwanda	20	Mixed Sample	Mixed: Perceptions, conflict management, awareness	Increase in Resources, Agency, Achievements	Decreased empowerment	Foreign University	Training of trainers, Community forum, Public awareness, Radio, TV, Research for improving extension/figuring out what works, Land Tenure, Regionally specific policy
Pandey et al. (2021)	India	800	Mixed Sample	Intra Household Resource Allocation	Increase in Resources, Agency, Achievements	Not measured	None	Self-help groups, Research station tours, demonstrations, Role-playing, Research for improving extension/figuring out what works
Carnegie et al. (2020)	Myanmar	80	Mixed Sample	None	Increase in Resources, Agency, Achievements	Not measured	National University, National Government, Foreign University	Farm or field tours, Role-playing, Farm or home visits, Community forum, Research for improving extension/figuring out what works, Simulation

Article	Country	Sample Size	Gender Demographics	Empowerment Measurement Framework	Empowerment Outcomes	Decreased Empowerment	Organization Types	Extension Types
Lamontagne et al. (2019)	Pakistan	401	Mixed Sample	None	Increase in Resources	Decreased empowerment	National University, National Government, International Non-Profit, Foreign University	Consulting, Research station tours, demonstrations, Community forum, Online courses, Research for improving extension/figuring out what works
Bose (2019)	India	35	Mixed Sample	None	Increase in Resources	Decreased empowerment	National University, National Other	Community forum, Research for improving extension/figuring out what works, Land Tenure, Regionally specific policy
Olney et al. (2016)	Burkina Faso	1272	Women	Essential Action Nutrition Actions framework with added empowerment questions	Increase in Resources, Agency, Achievements	Not measured	National Government, International NGO, International Non-Profit, Foreign University	Training of trainers, Research station tours, demonstrations, Field days, Community forum, Short courses, Research for improving extension/figuring out what works, Micro-credit, GM/Biofortification, Land Tenure
Lambrecht et al. (2016)	Congo, Dem. Rep	775	Mixed Sample	None	Increase in Resources, Agency	No Disempowerment found	National Government, International NGO	Research station tours, demonstrations, Community forum, Radio, Research for improving extension/figuring out what works, Tool innovation
Gupta and Rathore (2020)	India	360	Women	Mixed: social empowerment, economic empowerment, political empowerment	Increase in Resources, Agency, Achievements	Not measured	None	Self-help groups, Community forum, Research for improving extension/figuring out what works
Zoundji et al. (2017)	Mali	122	Mixed Sample	None	Increase in Resources, Agency, Achievements	Not measured	National University, National Government, National NGO, National Other, International NGO	Training of trainers, Research station tours, demonstrations, Online courses, Public awareness, YouTube, Research for improving extension/figuring out what works
Kamwamba-Mtethiwa et al. (2012)	Malawi	100	Mixed Sample	None	Increase in Resources, Agency, Achievements	No Disempowerment found	National University, National Government, International NGO, Foreign University	Research for improving extension/figuring out what works, Tool innovation

Article	Country	Sample Size	Gender Demographics	Empowerment Measurement Framework	Empowerment Outcomes	Decreased Empowerment	Organization Types	Extension Types
Geleta et al. (2018)	Ethiopia	90	Mixed Sample	None	Increase in Resources, Agency, Achievements	No Disempowerment found	Foreign University	Training of trainers, Farmer-led demonstrations, Research station tours, demonstrations, Community forum, Research for improving extension/figuring out what works, Tool innovation
O'Brien et al. (2016)	Ethiopia	470	Mixed Sample	None	Increase in Resources	Decreased empowerment	National NGO, National Non-Profit, National Other, International NGO, International Non-Profit	Research station tours, demonstrations, Field days, Community forum, Research for improving extension/figuring out what works, GM/Biofortification
Esther (2018)	Ghana	120	Mixed Sample	None	Increase in Resources, Agency, Achievements	Decreased empowerment	National University, National Government, National NGO, International NGO	Farmer-to-Farmer, Farmer-led demonstrations, Community forum, Radio, Research for improving extension/figuring out what works
Balasubramanian and Thamizoli (2003)	India	270	Mixed Sample	None	Increase in Resources, Agency	Not measured	National University, National Government, National Non-Profit	Self-help groups, Training of trainers, Research station tours, demonstrations, Research for improving extension/figuring out what works
Nagarathinam et al. (2022)	India	66	Women	None	Increase in Resources, Agency, Achievements	Not measured	National Government	Farmer-to-Farmer, Farmer-led demonstrations, Research station tours, demonstrations, Field days, Research for improving extension/figuring out what works, Tool innovation
LN68_188-Humphries.pdf Humphries et al. (2012)	Honduras	300	Mixed Sample	Mixed: ethnography, personal history statements, perceptions of liberty	Increase in Resources, Agency, Achievements	Decreased empowerment	National NGO, International NGO, Foreign University	Farmer-to-Farmer, Training of trainers, Farmer-led demonstrations, Debates, Community forum, Research for improving extension/figuring out what works
Bain et al. (2020)	Uganda	609	Mixed Sample	Modified WEAI survey	Increase in Resources, Agency, Achievements	Decreased empowerment	International Non-Profit, Foreign University	Training of trainers, Clubs, Research for improving extension/figuring out what works, Development

Article	Country	Sample Size	Gender Demographics	Empowerment Measurement Framework	Empowerment Outcomes	Decreased Empowerment	Organization Types	Extension Types
Rubio-Jovel (2021)	Honduras	88	Mixed Sample	Pro-WEAI	Increase in Resources, Agency	Decreased empowerment	National University, Foreign University	Training of trainers, Research station tours, demonstrations, Community forum, Research for improving extension/figuring out what works
Connor and San (2020)	Myanmar	13	Women	None	Increase in Resources, Agency, Achievements	Not measured	International NGO	Research for improving extension/figuring out what works, Development, Micro-credit, GM/Biofortification
Adams et al. (2019)	Malawi	72	Mixed Sample	None	Increase in Resources, Agency	Decreased empowerment	National Other, International NGO, Foreign University	Community forum, Research for improving extension/figuring out what works
Kuma (2015)	Ethiopia	57	Women	None	Increase in Resources, Agency, Achievements	Decreased empowerment	None	Farm or field tours, Farmer-led demonstrations, Clubs, Farm or home visits, Research station tours, demonstrations, Community forum, Research for improving extension/figuring out what works
Raghuprasad et al. (2011)	India	80	Women	Social Capital Assessment Tool	Increase in Resources, Agency, Achievements	Not measured	National Government	Self-help groups, Clubs, Farm or home visits, Research station tours, demonstrations, Community forum, Research for improving extension/figuring out what works
Amare et al. (2021)	Zambia and Malawi	62	Women	None	Increase in Resources, Agency, Achievements	Not measured	National University, National Government, International NGO, Foreign University	Training of trainers, Community forum, Research for improving extension/figuring out what works, GM/Biofortification
Kjeldsberg et al. (2018)	Nepal	73	Women	None	Increase in Resources, Agency, Achievements	Decreased empowerment	National Government, International Non-Profit	Training of trainers, Farmer-led demonstrations, Community forum, Research for improving extension/figuring out what works, Development

Article	Country	Sample Size	Gender Demographics	Empowerment Measurement Framework	Empowerment Outcomes	Decreased Empowerment	Organization Types	Extension Types
Tripathy (2014)	India	40	Women	None	Increase in Resources, Agency	Not measured	National NGO	Self-help groups, Research for improving extension/figuring out what works, Micro-credit
Okali and Sumberg (2012)	Ghana	27	Mixed Sample	None	Increase in Resources, Agency, Achievements	Not measured	National NGO, International NGO, Foreign Government	Community forum, Research for improving extension/figuring out what works, Regionally specific policy
VanLeeuwen et al. (2012)	Kenya	30	Mixed Sample	None	Increase in Resources, Agency, Achievements	Not measured	National Other, International Non-Profit, Foreign University	Self-help groups, Farm or home visits, Telephone answering, advice systems, Veterinary Services for livestock, Community forum, Lectures, Research for improving extension/figuring out what works, Tool innovation
de Boef et al. (2021)	India		Women	Social Capital	Increase in Resources, Agency, Achievements	No Disempowerment found	National University, National Government, National Non-Profit, Foreign University	Farmer-to-Farmer, Self-help groups, Field days, Research for improving extension/figuring out what works, Development
Alemu et al. (2018)	Ethiopia	192	Mixed Sample	Empowerment as defined by Kabeer 1999	Increase in Resources, Agency, Achievements	Decreased empowerment	National Government, Foreign University	Self-help groups, Community forum, Research for improving extension/figuring out what works
Mancini et al. (2008)	India	173	Mixed Sample	None	Increase in Resources, Agency	Decreased empowerment	National University, Foreign University	Farmer-to-Farmer, Research for improving extension/figuring out what works
Thar et al. (2020)	Myanmar	600	Mixed Sample	None	Increase in Resources	Decreased empowerment	National Government	Public awareness, Social Media, Research for improving extension/figuring out what works, Tool innovation
Dupuis et al. (2022)	Bangladesh	2706	Women	Pro-WEAI	Increase in Resources, Agency, Achievements	Decreased empowerment	National University, National Government, National NGO, International NGO	Self-help groups, Short courses, Research for improving extension/figuring out what works, Development, Tool innovation

Article	Country	Sample Size	Gender Demographics	Empowerment Measurement Framework	Empowerment Outcomes	Decreased Empowerment	Organization Types	Extension Types
Dar et al. (2020)	India	1220	Mixed Sample	None	Increase in Resources, Agency	Not measured	National Other, International NGO	Farm or home visits, Short courses, Research for improving extension/figuring out what works, GM/Biofortification
Quisumbing et al. (2021)	Bangladesh	2739	Mixed Sample	Pro-WEAI	Increase in Resources, Agency, Achievements	No Disempowerment found	National University, International NGO, Foreign University	Research station tours, demonstrations, Lectures, Q&A sessions, Research for improving extension/figuring out what works
Teklewold et al. (2020)	Uganda and Tanzania	1000	Mixed Sample	Mixed: Intra household resource dynamics, agricultural production	Increase in Resources, Agency	Not measured	National University, National Government, International NGO	Research for improving extension/figuring out what works, GM/Biofortification
Tavener and Crane (2018)	Kenya	34	Mixed Sample	None	Increase in Resources, Agency	Decreased empowerment	National Government, National Non-Profit, National Other, International NGO	Community forum, Research for improving extension/figuring out what works, Development
Chowdhury et al. (2011)	Bangladesh	140	Women	Mixed methods: household characteristics and decision making, production, social and human capital	Increase in Resources, Agency, Achievements	No Disempowerment found	National Government, National NGO, International NGO, Foreign Other	Community forum, TV, Research for improving extension/figuring out what works
Nagwekar et al. (2020)	India	200	Women	None	Increase in Resources, Agency, Achievements	No Disempowerment found	National Government, National NGO	Research station tours, demonstrations, Short courses, Research for improving extension/figuring out what works, Tool innovation

Article	Country	Sample Size	Gender Demographics	Empowerment Measurement Framework	Empowerment Outcomes	Decreased Empowerment	Organization Types	Extension Types
Oumer et al. (2014)		25	Women	Mixed methods: Participatory Rural Appraisal, production and agricultural adoption	Increase in Resources, Agency, Achievements	No Disempowerment found	National University, National Government	Self-help groups, Training of trainers, Farmer-led demonstrations, Clubs, Field days, Community forum, Short courses, Research for improving extension/figuring out what works, GM/Biofortification
Raman and Dubey (2016)	India	244	Mixed Sample	None	Increase in Resources	Not measured	None	Short courses, Labs, Research for improving extension/figuring out what works
Sarkar et al. (2021)	India	10	Women	None	Increase in Resources	No Disempowerment found	National University, National Government	Short courses, Research for improving extension/figuring out what works, Tool innovation
Duffy et al. (2020)	Malawi	150	Mixed Sample	None	Increase in Resources, Agency, Achievements	Decreased empowerment	National University, National Government, National NGO, National Non-Profit, International NGO, Foreign University	Self-help groups, Training of trainers, Farmer-led demonstrations, Farm or home visits, Community forum, Short courses, Research for improving extension/figuring out what works
Medendorp et al. (2022)	Bangladesh	104	Women	None	Increase in Resources	No Disempowerment found	International NGO, Foreign University, Foreign Other	Short courses, Lectures, Panels, TV, Research for improving extension/figuring out what works
Gichungi et al. (2020)	Kenya	470	Mixed Sample	Pro-WEAI	Increase in Resources, Agency, Achievements	Decreased empowerment	International NGO	Self-help groups, Short courses, Research for improving extension/figuring out what works, Tool innovation
Gilligan et al. (2020)	Uganda	775	Mixed Sample	Modified bargaining power framework from De Braw et al. 2010	Increase in Resources, Agency, Achievements	Not measured	International NGO, Foreign University	Clubs, Farm or home visits, Short courses, Research for improving extension/figuring out what works, GM/Biofortification

Article	Country	Sample Size	Gender Demographics	Empowerment Measurement Framework	Empowerment Outcomes	Decreased Empowerment	Organization Types	Extension Types
Goldman et al. (2016)	Tanzania	213	Women	None	Increase in Resources, Agency, Achievements	Not measured	National NGO, Foreign University	Community forum, Short courses, Research for improving extension/figuring out what works, Land Tenure
Crookston et al. (2021)	Burkina Faso	760	Mixed Sample	Pro-WEAI	Increase in Resources, Agency	Decreased empowerment	National University, National Government, International NGO, Foreign University	Consulting, Research for improving extension/figuring out what works, Micro-credit
Srinath et al. (2000)	India	50	Women	None	Increase in Resources, Agency, Achievements	Not measured	National NGO, National Non-Profit, National Other	Clubs, Farm or home visits, Research station tours, demonstrations, Community forum, Research for improving extension/figuring out what works
Mudege et al. (2015)	Malawi	350	Mixed Sample	Mixed: Gender and Development approach, Social Relations Approach	Increase in Resources, Agency, Achievements	Not measured	International NGO	Self-help groups, Community forum, Research for improving extension/figuring out what works
Kuma (2015)	Ethiopia	236	Women	None	Increase in Resources, Agency, Achievements	Decreased empowerment	None	Self-help groups, Farm or home visits, Research station tours, demonstrations, Community forum, Newsletters, Research for improving extension/figuring out what works, GM/Biofortification
Cai et al. (2019)	Malawi	60	Mixed Sample	None	Increase in Resources, Agency	Not measured	National University, National Government, Foreign University	Farmer-to-Farmer, Community forum, Online courses, TV, Research for improving extension/figuring out what works
Murage et al. (2019)	Kenya, Uganda, Tanzania	2615	Mixed Sample	None	Increase in Resources, Agency	Decreased empowerment	National University, International NGO, Foreign University	Field days, Public awareness, Research for improving extension/figuring out what works

Article	Country	Sample Size	Gender Demographics	Empowerment Measurement Framework	Empowerment Outcomes	Decreased Empowerment	Organization Types	Extension Types
Lawal (2011)	Nigeria	180	Mixed Sample	None	Increase in Resources, Agency, Achievements	No Disempowerment found	National Other	Research for improving extension/figuring out what works
Mercykutty and Rashida (2020)	India	30	Women	None	Increase in Resources, Agency, Achievements	Not measured	National Government	Farmer-to-Farmer, Research for improving extension/figuring out what works, Micro-credit,
Goodrich et al. (2008)	Nepal		Mixed Sample	None	Increase in Resources, Agency, Achievements	Not measured	National University, International NGO, Foreign Government	Training of trainers, Farmer-led demonstrations, Field days, Research for improving extension/figuring out what works
Akter et al. (2020)	Timor-Leste	672	Mixed Sample	None	Increase in Resources, Agency, Achievements	Not measured	Foreign University	Self-help groups, Farm or home visits, Short courses, Research for improving extension/figuring out what works, GM/Biofortification
Uddin et al. (2020)	Bangladesh	225	Mixed Sample	Livelihood Capitals	Increase in Resources	Decreased empowerment	National Government, National Other, Foreign University	Farm or home visits, Telephone answering, advice systems, Veterinary Services for livestock, Research station tours, demonstrations, Field days, Research for improving extension/figuring out what works
Vandercasteelen et al. (2018)	Ethiopia	537	Mixed Sample	None	Increase in Resources	Decreased empowerment	National University, International NGO, Foreign University	Field days, Short courses, Research for improving extension/figuring out what works, Tool innovation, GM/Biofortification

The majority of studies in our sample were conducted by people working in national governments (48), national universities (35), international NGOs (41), and foreign universities (universities located outside of the project country) (46) (Table 4). Only 20 organizations were listed in the papers more than once, with the International Food Policy Research Institute listed with the highest frequency in 7 different studies (Table 5). A full list of all organizations mentioned in the papers can be found in Appendix C. Thirty studies included 100 or fewer individuals with 21 studies including 200 or fewer, resulting in 61.5% (56) of studies working with 200 or fewer individuals. Only 15 studies assessed large groups of over 1000 people.

Table 4: Distribution of the types of participating organizations across the included studies.

Organization Type	Count
National Government	48
Foreign University	46
International NGO	41
National University	35
National NGO	20
National Other	13
National Non-Profit	10
International Non-Profit	9
Foreign Government	7
Foreign Other	2
International Other	1

Table 5: Common organizations found within the papers included in this systematic review of women’s empowerment in extension. Organizations were considered common if they were listed in more than 2 studies.

Organization Name	Type and Origin
Agro-Insight-Belgium (formerly Africa Rice Center-Benin); CABI/Africa Rice Center	International Non-profit
Bill and Melinda Gates Foundation	International NGO
Cornell University	United States University
Hawassa University	Ethiopian University
Hellen Keller International	International Non-profit
Holetta Research Center (HARC)	Ethiopian Governmental Agency
International Center for Insect Physiology (ICEPE)	International NGO

International Food Policy Research Institute (IFPRI)	International Non-profit
International Maize and Wheat Improvement Center (CIMMYT)	International NGO
International Rice Research Institute (IRRI)	International NGO
International Water Management Institute (IWMI)	International NGO
Michigan State University	United States University
MS Swaminathan Research Foundation	Indian Non-profit NGO Trust
Rothamsted Research	United Kingdom Non-profit
San Diego State University	United States University
United States Agency for International Development (USAID)	United States Governmental Agency
University of Abomey-Calavi	Benin University
University of Guelph	Canadian University
University of Reading	United Kingdom University
Wageningen University	Netherlands University

Seevers and Graham’s definitions of extension types were used to classify our studies [104]. There were a variety of different extension techniques and programs utilized across the studies (Figure 1). Within the dataset, 44 papers focused on Community Forums, 22 utilized training of trainer methods, 20 employed self-help groups, and 20 used research station tours and demonstrations. The least employed methods in one to two studies were panel presentations, Q&A sessions, newsletters, labs, social media, debates, providing veterinary services for livestock, and YouTube® (Table 3).

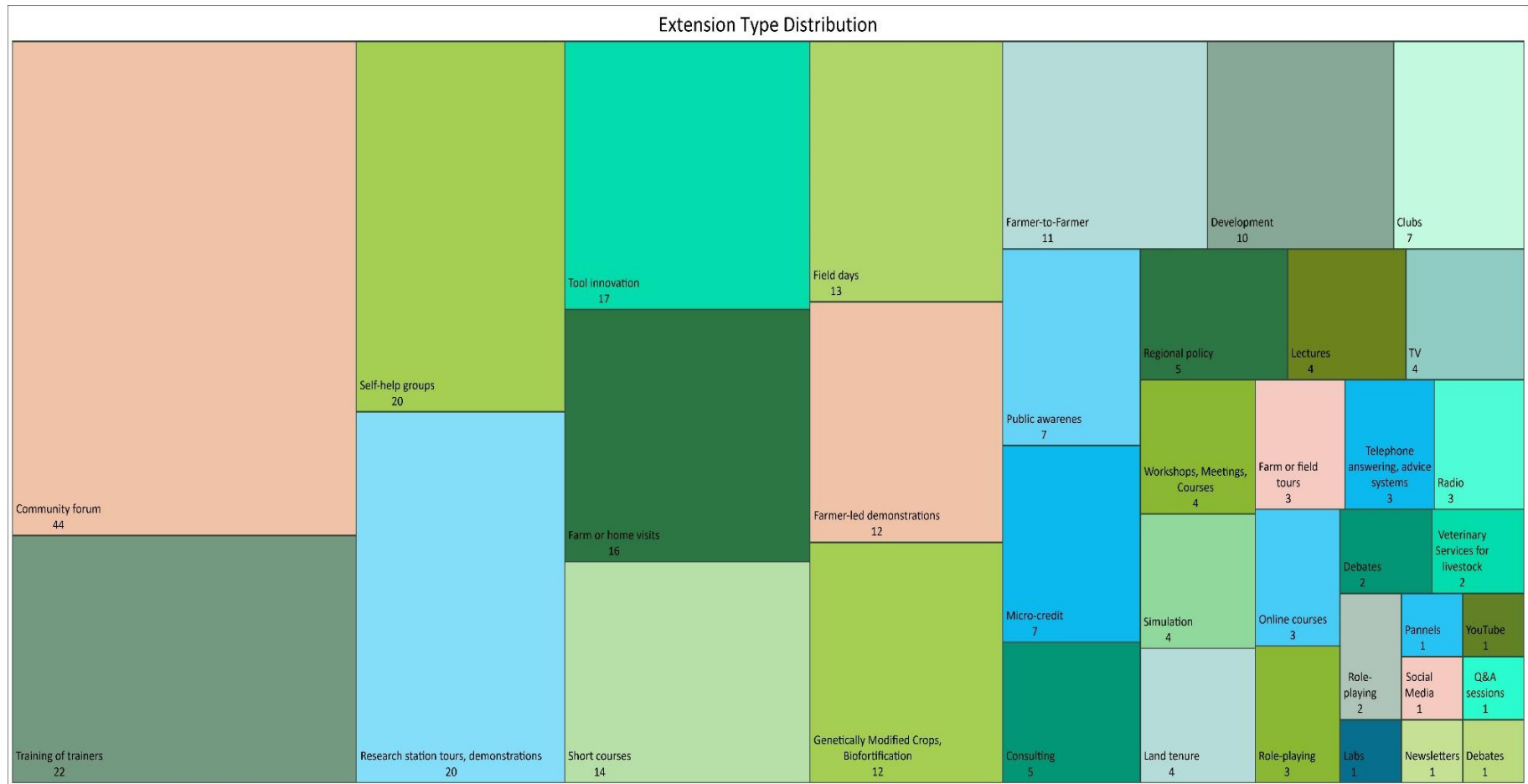


Figure 1: Tree Map illustrating extension practices used across the reviewed papers. Larger boxes indicate more prevalent practices.

Case Studies

The three case studies below highlight community input as was captured in the papers reviewed for this review and provide firsthand accounts of each intervention. I've included them as the best examples of the types of empowering extension programs that were in the sample.

Case Study 1. Devkota et al. (2020) [38] assessed the use of printed picture lessons and willingness to pay for resources utilizing the Theory of Planned Behavior framework. This study was conducted in 3 phases between 2015 and 2018 and incorporated community input at various stages. The first phase involved lesson plan concepts and preliminary testing based on previous studies resulting on 100 picture lessons and added text. Phase 2 involved participatory editing, where farmers who had utilized the first set of lessons supplied feedback and researchers incorporated around 500 edits resulting in 141 final lessons in Nepali and English. Phase 3 involved field testing of 20 lessons, booklet distribution, and study assessment through interviews. Overall reception of the lessons and lessons material was very positive with 93% of female farmers indicating the preference for picture books as opposed to other forms of media.

“I never knew that a fruit picking tool is also available in the market. Every season we have a huge loss of oranges, pears, guava and several other fruits due to picking difficulties. I am old and my husband also cannot climb the trees now. My sons and daughter are in the city to study and for jobs. Mostly, we shake the fruits trees so that ripe fruits fall to the ground and we collect them and sell them, or we use a stick to pick them. We get a low price as there is lots of damage to the skin while picking. But the fruit picking tool shown in the picture lesson looks relevant for us as it saves the fruit quality and is also easy to handle”. (53-year-old tribal women, Kot village, Jogimara VDC, Dhading District, Nepal)

Many of the edits were made to better explain and target women of this population of rural, illiterate, and solitary women. Nepal, like other countries in Asia has many rural villages comprised of women and children, a result of international migration of men in search for jobs or the forced exodus of youth searching for jobs and education in urban centers. This makes relatable and useable material extremely valuable for women who are largely illiterate and used to different stricter social norms:

“I saw a woman wearing a white long dress and thought these lessons were from other countries. It feels like these practices are for foreign women, not for us, because we rural women always wear saris in our day-to-day life. If this lesson is for us, then it would be better to make the pictured women similar to us.” (45-year-old woman farmer, Majhthana, Kaski District, Nepal)

By incorporating farmer feedback and usage of the materials, women were able to see themselves reflected in the materials and felt empowered to practice the methods seen in the lesson plans. Across all villages, both men and women found the lesson plans helpful for improved agricultural production on their plots, with 81% indicating that the booklets were extremely helpful and 19% indicating they were a little bit helpful. Many women were able to, not only obtain resources and feel encouraged to utilize these new lessons, but also immediately benefit from these methods by improving crops, assisting their immediate community with new information, and provide a sense of achievement from successfully interpreting the information and being able to implement it.

“In most of the lessons, it showed that woman farmers were doing the task, or had exposure to new tools. It feels good to see women everywhere in the book.” (52-year-old woman farmer, Kot, Jogimara, Dhading, Nepal)

Although this study shows how women empowerment can be done using community engagement, the researchers also discovered underlying social issues preventing and inhibiting the use and of the picture books.

“I never touch a book by myself, as women were supposed to stay at home and take care of the household and kids in our time. Now, I don’t have the belief and courage that I can learn by seeing a book or picture lessons by myself. I need big support, not only technical support to read it but also emotional support to hold a book and to convince my heart and brain to focus on the picture and gain the knowledge out of it. It looks simple for you but for me it’s too personal and a deep process.” (66-year-old woman farmer, Kot, Jogimara VDC, Dhading District, Nepal)

Many women indicated that they were more likely to participate and use this practice if their neighbors or others in the community were doing it too, indicating the impact of social dynamics and community support for these programs to be effective and sustainable. In many ways, this is a clear example of sociocultural differences and biases that permeate extension and development work. Even though these books were constructed and collaborated on with various community members, underlying social issues will need to be addresses for successful extension programs. The needs of women vary by region and in these communities, researchers identified the need to additionally promote positive attitudes towards reading and knowledge exchange in order to encourage use of extension materials. Although the overall successful adoption of those in the study indicates that the need for culturally and community inclusive methods for the development of materials in necessary, there is still the element of added education and long-term interventions to disseminate education.

Case Study 2. Humphries et al. (2012) [50] evaluated the changes in women’s perception of their gender roles and identities, following a mixed-methods approach on women’s empowerment in the agricultural town of Yorito, Yoro in northern Honduras. The Foundation for Participatory Research with

Honduran Farmers (FIPAH) was the facilitating NGO which conducted mixed-gendered CIALs (local agricultural research communities), semi-structured interviews, ethnographic field notes, and focus group discussions (FGDs). FIPAH followed a farmer field school (FFS) approach through the CIALs, where extension agents facilitated discussion and training on agricultural topics, in addition to providing an open space for illiterate women to learn agricultural and social skills that were previously dominated by men. Of the 105 CIALs, 96 were mixed-gendered and these groups saw the most significant improvements in women's empowerment and growth, as opposed to the four all-women groups and five all-men groups. The study found exceptionally positive impacts on women's empowerment, which was closely tied to men's participation in CIALs.

Interviews with women CIAL members revealed that one of the most significant improvements was in their agency and decision-making power. Before joining the CIALs, women faced four barriers to their decision-making capabilities: lack of opportunity, constraints from husbands, conformity to traditional domestic roles, and limited education and self-confidence. However, the CIALs minimized these barriers as it promoted mixed-gendered group discussion with an emphasis on letting women speak. Here, women discussed their current roles and tasks, this was information that husbands were often not previously aware of. CIAL facilitators informed participants on agricultural topics which increased women's skillset, making them more capable and valuable in the eyes of their husbands. This dynamic of the husbands learning about their wives' roles and their new skills allotted women more opportunities to make decisions, and many explained that their household now functions as a team.

“Before, only he decided what and where to plant and now we decide together because of the communication and support I give him in his work... Before, my husband decided alone and now he takes me into account because of integration into the CIAL.” (CIAL woman participant, Yorito, Yoro, Honduras)

Men also recognized the increase in women's engagement and decision making. Learning about their roles in a formal setting legitimized women's work and improved men's perspectives on their wives.

"[My wife can] now pollinate maize plants, classify seeds. [My wife] helps to identify the problems that harm the yields, as in the case of crop disease, and soil fertility." (CIAL man participant, Yorito, Yoro, Honduras)

Participation in the CIALs also improved women's connectivity to their community. Prior to the CIALs, women had limited access to organizations and seldomly communicated with other households. FIPAH allowed households to collaborate, and broadened participants' agricultural skillset which strengthened the entire community. Women started working with other organizations to improve their livelihoods and have leadership roles within their discussion groups.

"Before the CIAL, women would not go out anywhere because the men were very traditional. The women here were not organized. They were stuck in the kitchen making tortillas and cooking beans. If we went to a meeting, only men spoke, only the men would take part, and we would sit there quietly." (CIAL participant, Yorito, Yoro, Honduras)

"Now it is astonishing! Look at how many CIAL groups are managed by women, including coordinator and treasurer positions. Have you noticed how they speak, how they defend themselves when someone attacks them? If the men humiliate the women, the women of the CIAL can defend themselves because they feel important, they feel like persons." (CIAL man participant, Yorito, Yoro, Honduras)

This improved status has earned women in CIAL groups to be favored members amongst the community. Not only have women reached out to other organizations, but they have also been recognized and contacted by other groups to become members.

“One change that is noticeable is that the women who form part of a CIAL are preferred by other groups, like the community committees, water committees, school parent groups, etc. because they are trained to carry out responsibilities - whatever the position.” (CIAL man participant, Yorito, Yoro, Honduras)

Significant improvement in self-confidence was another widely shared benefit of CIAL group participation. Learning more skills has furthered women’s perceptions of competency. As CIAL groups offered physical training, women directly saw that they were able to do tasks that were formerly daunting.

“Before, she didn’t know anything about crops; today she is an expert in this area. Instead of paying for labor, my children and my wife help me in the fields and the money stays at home.” (CIAL man participant, Yorito, Yoro, Honduras)

Similarly, improvements in status inside and outside of the household strengthened women’s confidence, allowing them to advocate for themselves and continue learning without barriers. Self-confidence plays a considerable role in women’s empowerment as this factor influences women’s willingness to learn and implement new skills, in addition to their overall self-value. A main goal of the CIAL groups was to increase women’s self-worth because their traditional domestic household roles prevented this type of empowerment. Now, women have attributed their enhanced perceptions of confidence to participation in CIALs.

“Before, I was afraid to even say my name when someone asked but now no, because [the CIAL] advised us that we should value ourselves as women and we should lose the fear that we can’t contribute to making positive change in our lives.” (CIAL woman participant, Yorito, Yoro, Honduras)

Although this study focused on women, it was demonstrated that men played a significant role in the improvements and understanding of women's empowerment. Because the CIAL groups were mixed-gendered, men and women learned to collaborate equally, and listen to each other in uncomfortable situations. Hearing of each other's work legitimized their roles, and learning new skills served as a bonding experience which fostered the teamwork dynamic which many have reported to adopt within their households. Women can attend copious amounts of training on women's empowerment, but empowerment will not happen in their social context unless the men also learn and see the value of women. Women-only training has been a flaw of past studies but this paper has been such a success story because men were trained alongside women and now recognize the importance of empowering women. Increases in women's agency and status were greatest when women participated in mixed-gendered CIALs as opposed to women-only groups.

"Before, I couldn't [attend workshops outside the community] because my husband didn't like it and on top of that there was no opportunity to work with an organization and now yes, because my husband has become aware that I have a lot of capacity." (CIAL woman participant, Yorito, Yoro, Honduras)

While many community members favored the groups and shared the benefits, non-participating women criticized participants due to challenging traditional gender roles. Villages in this rural region of Honduras are very traditional, so FIPAH's introduction of CIALs may have been viewed as an uncomfortably progressive project which could have fueled the negative comments from non-participants.

"This is how [our parents taught us]. We [girls] would never go out anywhere, we would sit down in one area, do our housework and none of this leaving and wandering about, we would only be able to pick up a broom and clean." (Woman non-participant, Yorito, Yoro, Honduras)

In some cases, women also accused participants of neglecting their children or dominating their husbands. In some cases, comments were so harsh that some women opted out of the CIALs and returned to their previous roles. However, generally, the community supported women's participation and these instances of women leaving groups did not occur when husbands were also in the CIAL.

The implementation of CIALs in Yorito sparked tremendous growth in women's empowerment and in men's perceptions of their wives. A recurring theme in the study was improvements in women's "libertad" (liberty). For many women this involved leaving the house, engaging in agricultural activities, and expanding their social networks. Women reported that 57% of their empowerment was social (leaving the house, public speaking, and making friends), while 40% was agricultural. Men also experienced empowerment however 61% was agricultural and 35% was social. Agricultural advancements included learning about seed selection, sowing, harvesting techniques, and livestock management. Social improvements were reported to be more significant and the high participation rate of women in addition to their enhancements in decision making demonstrate this. While this paper confirms the success of FIPAH's CIAL groups, this approach to women's empowerment and agricultural development should be further explored in other regions to better determine the flexibility and accomplishments of the framework.

Case Study 3. Quisumbing et al. (2021) [80] address the gendered gap in knowledge regarding the actual improvement in women's empowerment following agricultural projects. The study provides evidence from the Agriculture, Nutrition, and Gender Linkages (ANGeL) project carried out in Bangladesh which involved both men and women in a series of up to three interventions. This included high-value crop production training, behavior change communication (BCC) workshops, and gender sensitization activities. The randomized control trial had four treatments in which male and female participants experienced one, two, or all three of the interventions, and naturally there was a control group.

The ANGeL project was delivered by agriculture extension agents (AEAs) over 17 months with each intervention having 17-19 sessions, lasting about one and a half hours. Participants of the crop production training (T-A) learned practices on bed preparation, weed and pest management, harvest, storage, crop calendaring, marketing, and livestock management. After these training sessions, focus group discussions were held to further examine material. BCC workshops (T-N) involved lectures, games, discussions, and cooking demonstrations. Topics covered in this treatment include nutrient requirements and sources, food preparation and preservation, and maternal health. These treatments were coupled to create T-AN, then the gender sensitization activities occurred in the last treatment option (T-ANG). Here, Helen Keller International (HKI) staff facilitated activities based on their Nurturing Connections curriculum which focused on communication and appreciation within households and communities. This treatment also included mothers-in-law of the participants.

The project was well received by the community as 89% of men and 90% of women participants noted that they understood the material and had positive experiences. Empowerment scores measured by the Women's Empowerment in Agriculture Index (pro-WEAI) demonstrated that women's empowerment increased with more interventions, or treatments T-AN and T-ANG.

“After training, taking a joint decision is easier. It's better than before. Earlier, I used to buy things for cooking. I used to cook as I wish. Now, we take decision together and we can avoid any confusion or complexities.” (T-ANG woman beneficiary, Bangladesh)

Involving men in the project was an essential role in empowering women as the interventions exposed men to women's perspectives and insights on agricultural and household topics, things that are often overlooked. As men were being educated in the BCC workshops alongside the women, their attitudes on gender increased by 2 to 3%. This demonstrated that both genders learning and discussing topics together served as a bonding experience and promoted equity for women. The ANGeL project

increased men and women's empowerment scores which is correlated to the increase in households receiving gender parity.

“As we both attended ANGeL training, we both know that taking decisions together is good. After participating in ANGeL, my wife could take the right decision, and sometimes the husband's decision is wrong.” (T-ANG man beneficiary, Bangladesh)

The men in the village now recognize women as an equal decision-maker, something that was missing prior to ANGeL. Decision-making is a telling indicator of empowerment thus as the men are now recognizing and advocating for women's role in this, it shows great success of the project. Similarly, as the man states in the previous comment, both he and his wife know that shared decision-making is beneficial; this training validated women's roles and gave them the environment to demonstrate that they are capable of taking on responsibilities that were previously structured to be a man's.

It is important to note that, in this study, the increase in women's empowerment had no negative effect on men's empowerment, rather they increased simultaneously. Communities targeted by agriculture and empowerment projects often have men unsupportive of wives' participation as they fear that women's empowerment will be the product of men's disempowerment. Men may feel that as women become educated and more skilled, men will lose authority and value. Previous studies have noted that men will discourage their wives from participating or denounce the activities of the project. This project addresses the men's concerns as both genders had significant increases in empowerment.

The prevalence of women empowerment increased by 8 to 13 percentage points, a statistically meaningful change. The most impactful intervention was that which featured trainings on crop production, BCC, and gender sensitization (T-ANG). Although both genders experienced increases in empowerment scores and status, their patterns of empowerment impacts differ. Women's empowerment was uplifted across all treatments, bundled or not, T-ANG having the greatest impact.

Men however only experienced empowerment when the nutrition training (BCC) was conducted (in T-N, T-AN, and T-ANG). The authors predict that impacts were greatest when involving decision-making with credit. The men in the study already used credit in the agricultural context, but not with household nutrition and food; exposure to this topic may correlate to their empowerment increasing only with those trainings. This would also then explain why women benefited from any treatment as prior to ANGeL they had no participation in credit-based decision-making.

The positive experiences and results described by the women and men confirm that joint participation in interventions is a highly benefitting factor to women's empowerment, and that this is an area of research that should be further explored. Men's education on women's perspectives and roles was transformative for women's increases in agency and resources. Women's high participation rate indicated the value and relevance of the topics in the project. The high retention of men and women participants imply that both genders found the project valuable and that husbands were supportive of wives' attendance. The study presents interest in discovering the ideal number of training sessions to achieve desired outcomes. Additionally, the authors suggest that a randomized controlled trial which has men-only, women-only, and joint gendered treatments would shed light on why couples like to participate in interventions together, something that was observed in this project.

Overview of Final Dataset

Within this thesis, I will refer to each paper as a "study". This systematic review contains an in-depth analysis of 90 independently written papers published through the peer review process. The studies kept in this systematic review implemented an extension program and then assessed the impacts of that program on empowerment and included disaggregated data. All studies analyzed were accessed in English. Many of the studies I reference were published by universities or international NGOs based out of the UK, Australia, Canada, the Netherlands, or the United States (thus, they were in English primarily).

I did not include funding sources or funding partners in our final analysis, as not all studies mentioned all funding sources. Through a cursory analysis of extension funding and diversity of partnerships, I ascertained that certain areas of the world obtain more funding through partnerships, have more access to robust extension programs, and only certain information is accessible due to language barriers. Latin America, as well as North Africa and the Middle East, were underrepresented with 3 studies between the two regions.

Most of the studies (60%) worked with 200 or fewer participants and it can be determined that most interventions operate within smaller communities and subsets of a general region. There are many factors that determine the target population of extension interventions, such as funding constraints, limited personnel, and length of study. Most studies were conducted within three years, reflecting the short timeframe of studies which likely mask the long-term sustainability and efficacy of interventions.

About 40% of the studies focused on women-only interventions. Of the remaining mixed-gender program interventions, six studies (6.6%) discussed the lack of women's engagement and had less than 30% women among the program participants. On the other hand, there were four mixed-gender sample studies that intentionally worked with couples or men and women with the intention of fostering community dialogue to change social norms or assumptions based on gender.

Below I discuss the findings in greater detail. I begin with findings of the studies within different aspects of extension, empowerment, and gender equity in an aim to answer the research question of which extension methods, projects, approaches, and tools empower women.

Agricultural Topics Covered by Extension Services. As this study conducted a deep analysis of many papers, there was a wide range of agricultural extension activities involved within the studies. This included training on improved seed sowing and selection techniques, land preparation, irrigation application and innovation, harvest and storage, food preparation, general nutrition, livestock

management, and the benefits of genetic engineering. Many papers in the dataset included extension on multiple topics, thus the sum of the percentages exceeded 100. The most prominent category was “crops” which was represented in 69% of the papers. Crop programming covered everything related to the farming of edible crops; processes like seed sowing, cultivation, and harvest. The papers included a diversity of crops including nuts, grains, fruits, vegetables, and legumes. Pest management was the second largest category (44% of the papers) and included topics related to Integrated Pest Management (IPM), insects, diseases, weeds, and herbivory.

The next most prominent topic across the papers was mechanical technology or new techniques (39%). These projects were classified as technology development if they provided access to improved land preparation technologies, food preparation or cooking technologies, and general farm equipment. Agribusiness, found in 24% of the papers, often incorporated training on micro-credit, market exposure and involvement, and how to price goods. Lessons on agribusiness were most often paired with other training. For example, projects which worked with communities to improve their maize yields also frequently informed participants on how to sell the marketable surplus and advertise their product in markets. While most papers focused on the crop aspect of agriculture, animal products were a topic featured in 21% of the papers, and included livestock management, rotational grazing, and utilizing animals as a means of tillage. Next, abiotic farm management (18%) was involved in papers exploring weather patterns, natural disasters, and often related to Climate Smart Agriculture (CSA) practices. The last categories of extension topics include production (8%) and market/non-edible goods (2%).

Agricultural Value Chains

Agriculture is a uniquely risky industry as it involves living organisms which must sustain the global population. The agricultural value chain traces agricultural commodities as they move from farmer to consumer and can generally be divided into five stages: inputs, growth or production, processing and

packaging, storage and distribution, and the end market [110]. These broad stages are applicable to small, medium, and large-scale growers and markets, although practices on particular farms may vary.

The *inputs* stage involves land preparation and labor; this is a critical step in the value chain as this determines the success of plant growth, and the yield's profitability. Many agricultural extension projects operate in the production stage of the value chain. The *growth or production* stage in the value chain is closely linked to the input stage, because of the immense labor, protection and nourishment required to keep fragile plants or animals alive and producing. Projects aiming to develop the growth or production stage often involve improving input use and efficiency, for example, water. It is common for projects to couple these first two stages of the agricultural value chain as there is often overlap in processes and concepts. After harvest, crops or animals enter the *processing and packaging* phase where they are inspected, sorted, refined, packaged, and stored. This step looks different depending on the scale and location of the grower; commercial growers in high income countries have highly developed technologies which minimize human labor while smallholder farmers in lower-income countries rely on manual labor and may have less consumer criteria like sanitary guidelines. Next, products enter the *storage and distribution* phase and are transported locally or across the globe. Finally, products enter markets and are bought by consumers in the *end market* stage.

In the studies that were reviewed that included ex-post programmatic analysis, many communities failed to sustainably adopt or implement the improved agricultural practices they were taught. Whereas reasons for long-term program failure are specific to each community, there is an overarching theme that organizations fail to address all parts of the value chain as part of their interventions. Improving one value chain stage without addressing how the other subsequent and connected stages might be affected or may need adjustment is not effective nor realistic [110]. For example, developments in the initial inputs stage may increase yield, but if storage is not expanded to accommodate that yield, then farmers'

crops will spoil. It is imperative that projects holistically address the agriculture value chain to foster lasting improvements.

In settings with prevalent subsistence farming or unstable food sources, home or community gardens could be more relevant end-market goals than commercialization. There was an overarching focus in the literature on large-scale, high-input market-oriented crops like maize, rice, potatoes, and yams. While these are dietary staples that are often needed for basic caloric security, this concentration may further worsen micronutrient deficiencies and weaken food security without a focus on dietary diversity for smallholder producers or other key elements of empowerment that must be embedded within the value chain, such as equitable distribution and reimbursement of goods.

Extension methods, projects, approaches, and tools

The papers included in this review varied greatly in agricultural context (as noted above), however there were clear commonalities in the frameworks and objectives of the included extension projects. First, given the inclusion criteria, all projects aimed to foster some sort of development or improvement, whether that was in agriculture, women's empowerment, community cohesion, or, in many cases, all of the above. Many of these studies employed strikingly similar extension frameworks and methodologies to cater to a wide variety of social contexts; many of the papers used nearly identical extension activities and concepts but these were revised to better target to fit a specific setting and group. Nearly all the papers adopted a participatory development approach (Figure 1 illustrates all deployed extension types and each study's extension practices are shown in Table 3). It is of note that 30 (33%) studies employed evaluation metrics and could otherwise be categorized as evaluation research; however, as all studies that I referenced could be categorized as research projects relating to extension, I eliminated the category of 'research for improving extension' from Figure 1 to focus on distinctions more clearly among the included studies. Overall, the most prominent types of extension practices utilized involved

community-based participation and organization through community forums, self-help groups, demonstrations, farmer-to-farmer trainings, or farm visits.

Community Forums. Community forums were the most common intervention approaches, as these provided a space to integrate real-time community responses, ideas, and questions, which then helped steer the direction of the project. I have included “focus groups” within the community forum category as there was no clear or distinct differentiation across countries and different extension programs. Here community forum refers to an extensionist-led discussion group. These forums were often paired with other extension activities like improved seed sowing techniques or workshops highlighting the benefits of improved seed, although there were instances where the forums were the main activity (normally if the project’s focus was on women’s empowerment). Case Study 1 [38] illustrates the paired approach of using this type of extension practice to create improved extension methods with community input. Throughout the study, Devkota et al. used community input to create better lessons for their agricultural extension trainings [38]. Overall, 44 (49%) of the studies explored community forums as an extension education method.

Self-Help Groups. Self-help groups were also prominently featured, sometimes in addition to community forums. The main difference between community forums and self-help groups lies within the person or parties leading the groups. Unlike community forums, self-help groups focus on community-led participation in community-led spaces for conversation, education, and discussion. In these, extension educators were present but were not the instigators. It is important to note, however, that not all self-help groups were uniquely led by community members, some began by being led by extension agents, but the goal was to create a space where community members or community subgroups (such as women’s groups) could discuss things together. Together, the number of self-help groups/community forums represented 73% of extension methods practiced across all 90 papers.

Self-help groups and community forums were reported to be particularly popular across South Asia and Sub-Saharan Africa for both men and women. Across both genders, the self-help groups and community forums allowed for a dedicated space for farmers to discuss novel techniques, collectively problem-solve issues with crops or agricultural processes and provide continual support for fellow community members. Case Study 2 [50], looks at combined extension interventions to educate both men and women on both gender biases and agricultural practices in Honduras. One of the key elements seen through this paper and many others, is the recognition by both men and women of the importance of gender-based groups. Men see it as a great space for women to speak and share ideas, recognizing that gender norms do not allow many women to share ideas with one another. Women feel the freedom to learn and speak their minds without fear of social repercussions. These women-only groups provided a space for women to speak freely without the presence of men suppressing their abilities to speak their minds, ask questions, and connect with each other.

Multiple Methods

All studies and interventions employed multiple types of extension methodologies. Often, interventions that provided technology, resource, or educational access were paired with workshops, forums, focus groups, self-help groups, or other types of trainings (Table 3). Not all programs utilized participatory extension methodologies such as focus groups, forums, or seminars. Studies that relied on a top-down approach to information dissemination noted the need to include community partners and participatory work in future studies [41, 43, 45, 46, 73, 75, 80, 84, 95].

Parboiling Rice Example. Studies that used multidisciplinary approaches emphasized the need for participatory, farmer-to-farmer, learning-by-doing approaches that were inclusive for literacy, educational differences, and cultural context [13, 31, 64, 102]. An example of this process was seen in a series of four published papers which referenced different stages of the same study, interdisciplinary

approaches are needed to improve the quality and outcomes of agricultural extension programs. Each paper refers to the same study with different insights to the effectiveness of the process. These four papers were treated as one study in this systematic review as no paper added additional methods past the first intervention [13-15, 103]. These four papers [13-15, 103] provide a longitudinal analysis of the impacts of rice parboiling videos shown to rural women in central Benin. Rice parboiling is the process of soaking and pre-cooking rice as a means of enhancing the nutrition and food safety of rice. The villages studied were previously accompanied by NGOs following a training and visit system (T&V). These community workshops intended to teach improved rice parboiling techniques; however, many participants did not like the strict monitoring and felt that their true needs were not being met. This prompted the West Africa Rice Development Association (WARDA) to try a video approach which was proving success in other regions of the world.

WARDA used a Zooming-In Zooming-Out (ZIZO) framework which focuses on first consulting with communities then basing the project on the participants' knowledge, skills, and needs [13]. To increase community participation, WARDA partnered with regional Benin NGOs that worked directly with women to produce a video series on parboiling rice [13]. The videos featured local women presenting new parboiling techniques involving a metal pot with a perforated bottom that sits above hot water, allowing steam to pre-cook the rice and were shown to a total of 20 villages [13]. After video viewings, data from interviews and observations revealed an abundance of positive responses [13]. The initial filming began in 2006 and by 2008, 130,000 farmers were educated by the videos [103]. WARDA partnered with over 500 organizations to distribute the videos, and many agencies have continued to dispense videos since [103]. Farm Radio International (FRI), a Canada-based NGO, partnered with WARDA to transform the video information into radio scripts then distributed them to over 300 rural African radio stations and government agencies [103]. Increased NGO participation in this region has provided communities with training on other systems and technologies, contributing to further livelihood improvements and

strengthened relationships between institutions and communities [103]. WARDA has since worked with the private and public sector to further explore equitable video distribution [103].

One way to increase empowerment is through increasing resources or capitals that allow for improvements in any of the three empowerment metrics as outlined by Kabeer. Using Bourdieu's capitals [105] framework, Zossou et al. [15] elaborate on the impacts on women by assessing changes in capitals and using the Sustainable Livelihoods Framework [106]. Results were further compared to four control villages which did not have any video showings on improved rice parboiling [15]. The researchers explain that those who watched the videos perceived improvements in all but one capital; they reported natural capital to remain neutral [15]. Women reported that their human capital improvements involved better rice quality, health, and knowledge, while their social capital related to enhanced group cohesion, and stronger institutional linkage and support [15]. The women mentioned that as a result of this improved connection between communities and institutions, their communication equipment and public services advanced (physical capital) [15]. Of those who watched the videos, 90% implemented some aspect of the improved techniques, indicating the power of video as a technique [15]. This included but is not limited to, buying the improved parboiler all together (24% of women), or innovating their existing pots or creating one from scratch (67% of women) [15]. Innovation of parboilers enhanced the quality of rice, allowing women to sell at a price 42% higher than that of traditionally parboiled rice [15]. As a result, women's financial capital grew in terms of increased income and thus funding towards children's education and investments [15]. No significant change in natural capital was reported however in the control villages, women felt a decrease in this due to using more firewood for their traditional parboilers [15].

Expanding on the improvements to empowerment, the videos strengthened social cohesion, entrepreneurship, and collaboration with markets [14]. Watching the videos stimulated innovation for nearly all viewers and promoted networking and collaboration among women [14]. Of those who

watched the videos, 80% participated in these groups [14]. Women originally organized themselves into groups to parboil rice but as profits accumulated, these groups also began applying for micro-credit together, and supporting each other through the marketing process [14]. Collaboration empowered women financially and socially [14]. Profits were funneled towards children's education and technological investments like smartphones [14]. While there were some women in the test villages who did not watch the videos, 87% still accessed information either by joining groups or hearing from a neighbor [14]. Working in groups also gave communities bargaining power for receiving training on other technologies [14]. Women requested training from NGOs on an improved cookstove they noticed in the parboiling videos, then were instructed on the construction of those stoves [14]. NGOs visited these communities two years after the viewings and groups were still highly functional [14].

Similarly, women's health benefited from this project [14]. Laboratory grain analysis proved the rice to be of higher quality and have more nutritional value. Aware of these health benefits, women have replaced low yielding crops with rice to feed their families and sell in markets [14]. Now, 88% of women parboil rice for profit. Improvements in health, income, and social relations have earned women more status and respect within households [14]. These videos have allowed women control over finances and decision making which is demonstrating to be beneficial for all community members [14]. Through this study women were able to be empowered in all 3 categories of empowerment. Women gained access to new resources such as training videos, rice seeds, and education on the health benefits of rice, parboiling methods, and agricultural methods. Having these new resources, women were able to increase their won agency by having the ability to choose from the resources they were given and decide to adopt the parboiling practice, relace low-yield crops with rice, consume parboiled rice at home, and sell parboiled rice in community markets. With women able to have agency and adopting parboiling rice methods, they gain achievements for themselves and the community such as increased female independence, healthier households with the consumption of more nutritious agricultural goods,

increase income generation for households, and overall community improvements through nutritional and economic factors. Overall, the benefits of providing extension services and education to these women allowed for greater personal and social gains and improved empowerment for women, according to the Kabeer model.

Gendered aspects of extension trainings

Although many papers showcased the impacts of independently led self-help groups and community forums, it is essential to understand that these groups function as complements to the resources provided by extension training and extension education. All studies provided resources through extension workshops, educational courses, or helpful media such as videos or pamphlets. The ability for women to learn and apply these technical skills is contingent and dependent on greater social norms and cultural constructs. In some studies, women remarked that male perceptions of women hindered their ability to access communal resources such as farming equipment, extension agents, or informational outlets [22, 55, 58, 67, 90]. It was noted in the papers centered around Sub-Saharan African crop production programs, where the men quickly adopted whatever novel agricultural technology the women were utilizing because they saw greater gains, effectively pushing women out of labor-saving or income-generating technologies (a form of disempowerment which is discussed further below) [45, 46, 53, 77]. In these instances, in which women reported competition with their husbands or other male farmers for resources, a competition which they typically lost.

Gender based stereotypes. Many extension programs traditionally focus on men and male-based agriculture, which undermines women empowerment in extension interventions [39, 67, 95]. Men are perceived as agricultural stewards, leaders, and innovators because they are often consulted as the front-facing representatives for farmer households [46, 95]. However, women are responsible for a major share of farm labor that focuses less on production and more on maintenance [111]. In the 99

papers covered in this analysis, women were less likely to have the power to make decisions regarding seed types, inputs, or crop changes, but ended up doing much of the weeding, planting, and harvesting of the crop or maintenance of livestock [35, 59, 62, 63, 95]. In some of the studies, there were villages of women who did not have husbands due to increased rates of male migration to cities or other countries to find off-farm work [65, 67]. In these circumstances, women were more likely to serve as the agricultural head-of-household, in addition to their primary caregiver role for other family members [46, 65, 67]. Recognizing women's central role in agriculture, extensionists have made a variety of attempts to target programming to women farmers. Due to the nature of male-centered extension education, effective extension support for women would need to adjust to the different forms of capital that hold currency with women empowerment, namely social capital [105].

Though some scientists and engineers would say otherwise, technology and extension processes are not gender neutral as they have historically been designed for men and their respective agricultural activities [107]. To increase gender access, different technological innovations tailored to women have been attempted, however technology is not enough, and it must be paired with training and capacity building [48]. Kinkinginhoun-Médagbé and Diagne [53] showed that when providing access to farm equipment, women were trained and felt confident to operate the equipment, however reported hostility from men who would keep the farm implements for extended amounts of time, preventing women from using it on purpose. In these cases, it was noted that a third-party mediator was the only way to ensure fair access for all community members. Additionally, many technological extension practices rely on written technical communication, which is difficult for rural women to understand in societies where male education is favored. The lack of capital and education of rural women prohibits them from participating in some types of extension practice that requires access to certain technologies or resources [18]. Additional arguments have encouraged for co-training with men and women where training focuses on highlighting women's skills or providing men with women's empowerment education

[112]. Allowing men to see the ways in which women can contribute to agricultural operations in a controlled setting decreases the repercussion of male relation such as domestic violence [112].

Whereas some methodologies such as participatory engagement proved useful for empowerment in a variety of contexts, many extension projects undermined empowerment through an excessive focus on large-scale market engagement, an approach was inappropriate for many communities [17, 45, 46, 53, 77]. One case study of an out-grower scheme in Malawi demonstrated how an intense focus on sugarcane production dispossessed thousands of land users, and negatively impacted crop diversity [17]. In this study, the Dwanga Cane Growers Trust (DCGT) worked with the Malawi government to improve smallholders' participation in the cane industry. In short, DCGT redistributed land to only men, and implemented strict production deadlines that caused massive shifts in domestic and non-domestic labor for men and women. Men now allocated all their time to sugar cane production, and women also participated in this, costing them time previously spent on food crops and domestic activities. The demands of the contracts were unrealistic and contributed to women's disempowerment, limited revenue sources, and restricted crop variety. This illustrates that extension cannot take a one-size-fits-all approach because of the interconnectedness of the value chain. Labor availability and financial access impact the inputs needed for scales of production while consumer demand and dietary needs also inform decisions around production and inputs.

Traditional interventions that rely solely on agricultural inputs do not have community-centered approaches, as extension agents tend to be men providing services to other men, providing services that work less effectively for women. Many studies failed to provide training for spouses or entire households because women were perceived as powerless within the household. Combatting this unequal perception of who benefits from extension and who does which kind of work is further illustrated by Case Study 3 [81]. The ANGeL project works with couples to create improved intra-household communication about nutrition, finances, agricultural production, and education. The goal of

this project was to provide resources so that gender roles and norms would shift inside the household, ultimately improving household gender imbalances and creating a stronger familial unit.

Gender induced barriers. One of the common reasons I found that traditional extension methods were not found to empower women was limited reliable access to extension information due to the scarcity of extension agents, lack of access to mobile or transportation technology, and low rates of literacy and education [18, 46, 64]. Not all regions had extension agencies or reliable extension agent which was a result of funding, structuring, or perceived need by funding institutions. Since men are more likely to have the resources needed to call an extension agent, read a document, or travel to a location, the dispersed and decentralized nature of extension agencies in many countries does not provide access to women, who often lack the same social freedoms as men [64]. Training that employs visual teaching tools such as demonstrations, videos, or field experiments allowed women to remember or learn quickly despite literacy levels [13-15, 31, 38, 64, 103]. However, it is important to note any resource constraints that women might have that could hinder access to visual tools.

Women's Financial control and independence is varied across the world and dependent on regional sociocultural factors. In some regions women have their own separate income, while their husbands control all finances in others. Throughout this review it was found that most women do not control household finances and are reticent to invest in items such as a phone, transportation, or other technologies that would allow them to obtain necessary information. In Devkota and Hambly Odame [38] (Case Study 1), extension and research agencies worked to provide picture based educational materials that could be distributed to rural areas. Whereas this visual format was an effective method of conveying information, women were not able to access these materials due to inability to control finances and therefore unable to purchase the informational booklets. Other studies looked at phone-based information networks, television based educational programming, or centralized training offered at one place through the region. Many of these opportunities failed to work sustainably due to income

access [26, 29, 42]. Frings-Hessami and Sarker [42] describe a program that tested the impact of cellphones on women's access to extension services. This study provided women in Bangladesh with cellphones while also setting up an information phone advisory service for the region to access. At first the service worked extremely well, but then participants ran into issues when their cellphones broke or encountered issues. By the end of the three-year study, no women still had access to their original phone. The advisory service worked extremely well until the project funding ended and no regular advisory services were available, leaving women with no new information or advice for their agricultural practices. The studies indicate that, in order to overcome social constraints to serve women farmers, extension interventions must work within the limitations that women face to provide regular, in-person, visual, and low-cost training.

In many of the studies reviewed, women were reported to or were observed to have a lack of confidence or the social support to speak up in front of men, leading men to dominate spaces of discourse, most likely out of fear of long-term repercussions [40, 50, 67, 81]. Most women indicated a preference for speaking to other women, including other women extension agents, but also understood that it was hard for women to become extension agents due to their own social standing amongst other farmers [50, 67]. Women were more likely to engage in conversations during any step of the intervention process when working with a female lead, as opposed to a male lead [50, 67]. Women also indicated that husband jealousy affected their ability to speak to male extension agents on their own [40, 50, 81]. An additional constraint to women's engagement with extension related to the lack of extension agents that are women. Overall, the need for more female extension agents is acknowledged as a benefit because it allows women and husbands the comfort of having gender targeted interventions while not crossing any social boundaries [50, 67].

Where there were fewer women extension agents, the use of women's groups can be a substitute. When asked, most men perceived women's groups as being a positive and helpful thing for the

community and acknowledged women's hinderances and inabilities to speak in a room full of men [40, 81]. It was found to be helpful for men and women to obtain trainings together but be able to work problems or issues out separately in their own smaller groups [50, 67]. In separate groups, men received training on domestic violence, women's empowerment and how women's independence could benefit the community [40, 50, 81]. In most other cases, men and women received the same training, simply in disaggregated groups. In both cases, general improvement was seen in inter-gender collaboration, however the best results were seen when men were given additional trainings on gender dynamics and the ideas behind gender roles. These instances increased undertaking between household members and allowed men to see their wives as capable actors in the household [40, 81]. These studies show that extension can be a space that transcends social stigma or existing power dynamics, where gender norms can be challenged and men and women can jointly participate; however, reaching that state first requires women-only spaces.

Most studies reported difficulties in creating spaces that challenge existing norms due to an underlying misconception that women are unable to lead. These misconceptions were reported by extension workers, community members, and the researchers performing these interventions. Many papers addressed a longstanding myth that women are unable to innovate, the interventions presented were an attempt to provide innovation strategies to communities and observed the decision-making capabilities and capacities of each gender group [i.e., 39, 52, 72, 90, 95, 99]. It was found that women are, in fact, better at some types of innovation than men [95, 99]. Men tend to prioritize agricultural productivity while women are far more likely to value social outcomes and relationship building; showing women invest directly in the community while men tend to focus on independent successes.

Women's perceptions. Many studies assessing women's perceptions and adoption rates on new technologies found that women were not only more likely to adopt novel technologies, but also consider the ecological ramifications of each. Suma and Großmann [90] assessed indigenous knowledge

of women in Kerala, India. Their findings illustrate the vast array of knowledge women carry and use throughout various agricultural processes; however, the most important aspect is hidden from them due to cultural norms. In this community, rice seeds are retained and maintained by male tribal elders. This prevents women from accessing or stewarding seeds and takes away their ability to become environmental advocates. Women in these communities are extremely proficient at seed saving endeavors, however they are not trusted to choose which seeds to plant for the next year, regardless of their knowledge. It is of note that Kerala, India is an outlier in many metrics, as it is one of the most educated states in India and has a unique sociocultural and sociopolitical composition in comparison to other parts of India [113]. Another study by Medendorp and Reeves [64] discusses women's ability to create agroforestry systems and choose environmentally friendly pathways that also improve household income. Many studies looking at women's innovation, adoption, and environmental education show that women will choose practices that improve outcomes across the board [39, 52, 72, 90, 95].

In the studies reviewed, gender differences were rooted in the communal perception and drive of women with many improvements reflected across households and the community as opposed to the individual. Women were found to be more flexible, possess better understanding of systems, and more likely to share information with neighbors and friends [31, 44, 46, 81]. Geleta and Henry [44] mentioned that seed varieties adopted or encouraged by women focused more on taste and storability, irrespective of income. Other studies showed women prioritizing simple income-generating tasks that also simplified home alimentation or adopting practices based on factors such as taste, replicability, long-term impact, and techniques as opposed to men who chose financial gain over sustainable solutions [31, 46, 81]. While women do not have an inherent focus on immediate economics and income generation, they are able to factor in the hidden costs associated with these practices, that are often overlooked when focusing solely on economic capital. The gender roles that women hold open them up to different concerns and issues that may be encountered throughout their day-to-day activities and can factor in

human and environmental capital. The focus on simple and replicable methods is important when considering the time burdened women inherently face. Additionally, taste and storage are imperative to women as they are responsible for feeding large households. Interventions that try to supply crops that do not meet acceptable thresholds food storage, replicability, taste, or utility, run the risk of causing more economic hardship through the time rescored required by women. Lastly, women possess a very different social connection with other women in comparison to men in these studies. Women were eager to share and help and share beneficial practices with their neighbors, while men showed less propensity to openly share techniques for fear of competition.

Chapter Four: Discussion, Conclusion, Limitations

Discussion – Empowerment through Extension Methodologies

We measured empowerment by analyzing the reported outcomes in each of the 90 papers. Only 32% of papers used some form of empowerment metric with 6.6% using Pro-WEAI (Women's Empowerment in Agriculture Index) methods and the rest of the papers using other methods. Pro-WEAI methods used WEAI standardized surveys or study designs to collect specific data relating to resources, agency, and empowerment. Studies using other methods assessed empowerment through other measures of project success such as increase in income, information retention, or intervention adoptability. Studies not using Pro-WEAI used different methods of reporting achievements, resources, and agency, such as community capitals, Bourdieu's five capitals, human capital, human energy, or power distribution. With these studies I analyzed increases or decreases in empowerment based on reported outcomes from post-project assessments. Studies not using analysis of study outcomes were assessed by analyzing the successes and failures reported in each study.

Using Kabeer's work as the theoretical framework I found that all studies in the sample provided participants with resources through the extension intervention. Study after study concurred that through obtaining extension services or participating with the interventions or research studies, that all women obtained empowerment through the access of resources. While every study was different, at the most basic level women were exposed to new ideas and given an opportunity to learn new skills or utilize a new technology. All extension programs offered resource empowerment because each extension intervention, at the bare minimum, exposed participants to different ideas, technologies, techniques, or resources. However, only 80% resulted in increases in Agency and 64% resulted in increases in achievements or outcomes. Conversely, some studies also found evidence of disempowerment of some form as a consequence of the intervention, including increases in domestic

violence, increases in labor requirements, loss of business, or decreases in income. Only 17% of studies explicitly stated that no disempowerment was found with 37% noticing disempowerment and 46% not discussing any form of disempowerment.

Community forums, including focus groups, resulted in empowerment in all three categories, however it was also the most common type of extension practice. Due to the diverse and wide range of these practices, it was determined that little correlation between extension type and empowerment could be deduced. Achievements were found to be the hardest type of empowerment to affect. This most likely is caused by the extent of internal power women have in their communities to affect change and improve livelihoods. I have identified a few studies that showed considerable empowerment for women and their communities [25, 38, 70, 81, 96]. One of the key factors is the interdisciplinary nature of these projects. For projects to be successful and indicate some level of empowerment, they must focus on much more than one issue and address social, agricultural, economic, and access issues [25, 38, 70, 81, 96].

VanLeeuwen and Mellish [99] assessed the dynamics of a Bangladeshi dairy cooperative that supported dairy producers to gain access to markets. The cooperative paired with Canadian NGO's where rural families were trained on identifying disease, representation practices, and health and safety requirements for food storage. The cooperative then purchased the milk from the farmers, allowing some form of market access with the dairy cooperative acting as a market liaison. This study illustrated the different forms of empowerment. As the cooperative began working with this community, increased resources came in the form of extension services, education, and market access. As the cooperative began its program, it supported the growth of family farming, but also encouraged women and men to work together and tend to their herds. Having regular access to extension workers and veterinarians allowed women to obtain knowledge and decide which best practices to use when tending to cattle or addressing herd concerns. This ability to use the knowledge and make independent executive decisions

is an example of agency. The cooperative created a new market for dairy production in the region, allowing families to focus on dairy production and often leaving the tending of the cows to the women, while the men worked other jobs, or sought income elsewhere. This increase in achievement is illustrated by women having the opportunity to take over an enterprise, increase income for the household leading to more stability or educational opportunities for children. This extension-cooperative partnership also impacted community achievements: more human capital was spent generating income, more financial capital increased local health and nutritional outcomes, and job opportunities were created through the region. Alongside job opportunities, specific opportunities arose for women, as focus group leaders, community leaders, and even as community advocates within the dairy cooperative itself. The role of women as lead dairy headers, farmers, and stewards opened up new opportunities for women within their own households and across the community. Many women commented on the ability to see that women could, in fact, hold some community power as positive, being thankful for those women who managed focus groups and communication with the dairy cooperative. This provides further example of women's achievements; women can not only create resources for their own families but provide community change through enhancements of the role of women in their local societies.

While the empowerment shown above is a clear example of Kabeer's empowerment metrics, Lecoutere and Wuyts [60] furthers this discussion by commenting that empowerment is not just about the neoliberal approaches of getting women to better engage in export markets or increase productivity, but rather empowerment is about challenging power dynamics. Empowerment can often be a contradictory process. Whereas empowering women is shown to better empower the whole household and women are better at sharing innovations with others (men cannot be relied upon to diffuse information/benefits of empowerment to women) or taking risks and following through with innovations (men are more conservative), burdens cannot be solely on women; otherwise, it will

increase their time burdens and undermine empowerment. Again, I found it to be important to involve men (or youth).

Lecoutere and Wuyts [60] assess the impact of intrahousehold decision-making processes in smallholder coffee farming. Researchers used a PRO-WEAI framework to organize trainings and seminars for both couples and women. The hope was to understand if the seminars improved understanding of the basic social structure around the community and around gender segregated roles and their underlying cultural relevance. This uncovered internal social structures that impeded women's ability to successfully be empowered by extension programs, showing that women are limited due to their gender roles in society. Through the project it was learned that women were involved in about 40% of livestock sales yet receive no income or access to funds, women must request permission to do farm activities on their husband's land, the husband has the final decision power and does the coffee sales, men have greater decision-making power and income use, but most importantly, women are heavily involved in domestic and agricultural work. Women's ideal empowerment involves having significant control over the land and equal decision making. Extension interventions and projects should consider the existing role, resources, and power that women do have and build off these factors, while also challenging the dominant male role in the household. These studies must target existing sociocultural factors if they are to succeed in the long-term.

Throughout this study, women discussed how different interventions and tools would either help or hinder the standing in the home, often referring to domestic violence or internal household issues when the internal household hierarchy was questioned. In the couples' seminars, both parties discussed the importance of transparency and the benefits of coworking in internal decision-making and created farm plans, budgets, and personal goals together. However, after the women attended their own leadership and farm training seminar, the desired results were not achieved. The intensive coaching did not enhance women's involvement in strategic farm and household decision-making, did not improve

intra-household decision-making, resulted in no increased transparency over funds or coffee production, and no changes in women's time and energy spent in crop or livestock production. However, some improvements such as improved shared access to household income, improved shared consideration or household wellbeing and food security did occur. Most importantly, women reported feeling an improved sense of agency when viewing their roles and leadership within the household. The researchers argued that illustrating the ways in which women do have power was just as important for women to appreciate and understand their value. Although the study did not show many successes, it contributes to understanding the role of gender norms as they impact empowerment and frames a different process to improve women's empowerment through extension interventions.

One of the most important aspects that Lecoutere and Wuyts [60] illustrates is that not all extension interventions will lead to empowerment. Instead, they argue for the need to understand underlying social factors to truly empower the target population. This sentiment is seen across many papers that discussed the negative impacts or disempowerment of the communities participating in the extension processes [40, 50, 67, 81]. While not all studies measured for disempowerment, many noticed effects such as domestic violence, negative feedback from other women in the community such as seen in Case Study 2. The rate of negative effects of the extension interventions indicates that current strategies are not always successfully empowering women. This further illustrates the need to develop innovative gender-responsive extension strategies.

Conclusion – Integrating Gender within Extension Services to Empower

Agriculture has been at the forefront of the international development sector since the beginning of the 20th century, aiming to improve efficiency, resilience, and cohesion of agricultural systems. However, pressing environmental and socioeconomic challenges prove that historic approaches to agricultural development have failed and often further displace vulnerable communities, specifically

women. The immediate effects of climate change cannot be ignored and, in the future, agricultural, ecological, and social interventions will largely dictate how the Global South can mitigate the impacts of disasters. Extension institutions are crucial to adapting to climate change. In recent years, organizations and institutions have been working to mitigate the disempowerment of women in agriculture communities by including an empowerment framework in their agriculture extension programs. Many programs have added structures to improve local gender-based access to power, decision, making, and technology access. In this systematic review, I examined the impacts of agriculture extension projects on women in rural and impoverished communities. Our team was intentionally meticulous in our review and sorting process as I intended to include the most relevant papers regarding women's empowerment, or disempowerment, in agriculture extension.

This systematic review builds on work done by many large projects. The United States Agency for International Development (USAID) funded project titled Integrating Gender and Nutrition within Agricultural Extension Services (INGENAES) highlighted many ways to integrate gender into extension strategies. In INGENAES work, researchers Farnworth and Colverson [112] recommend that extension institutions think of "extension and advisory services as a facilitation *system* rather than a service and to reconfigure it" pg 20. Specifically, contemporary researchers of extension education outline the need to integrate existing services, systems, and structures, while *enhancing* the local community capitals in order to achieve mutually beneficial changes that represent community desires and facilitate local development [112]. This systematic review supports those ideas and highlights the need to tackle the underlying gender roles and power dynamics in communities alongside extension facilitation.

Key Takeaways

I found that the following extension practices had the highest success amongst women: community forums, self-help groups (SHGs), demonstrations, farmer-to-farmer training, and farm visits. Here, the

term “success” indicates those practices that have high retention, adaptability, shape to cultural contexts, and contribute to women’s empowerment. The most prevalent topics covered in extension programs included crop cultivation, pest and disease management, and technology, but found few extension programs focused on animal rearing. Employing a multidimensional empowerment framework, I found that extension services contributed to positive outcomes for women including greater access to technology and information, higher income, improved social cohesion, and decision-making power.

Only some projects worked in tandem with existing cultural structures and illustrated the ramifications of the reinforcement of Western-based gender ideologies in communities who have longstanding gender-based divisions in labor, knowledge, and power. Few studies focused on existing environmental capital, and some sought the implementation of genetically engineered food, with little mind to local or indigenous crops. Indigenous crops such as leafy greens, grains, and legumes provide micronutrients for humans and have localized adaptability to drought, temperatures tress, and disease resistance though genetic variation. While many studies showed some improvement to local cultural sentiment towards women and their abilities to contribute towards household capital, women face an uphill battle that requires community education as well as women empowerment. In some instances, women experienced disempowerment via heightened domestic abuse, or decrease in income, most likely due to men feeling threatened by women’s increasing knowledge and capabilities. This systematic review reinforced contemporary extension thinking that extensionists should consider cultural norms and gendered social divisions and work to create communal change in order to truly empower women at a local level. Community capitals must be leveraged into project design in order to avoid negative ramification for women who partake in these interventions.

It is further observed that improvements in agency, resources, or achievements were more successful when different extension methods were combined. For example, women may have earned

higher income in projects that led community forums and farm visits, rather than only one or the other. There is sufficient evidence demonstrating that improving women's resources and decision-making power may alleviate economic hardship and help families escape cyclical poverty. This may be because women are often the primary farm laborers, knowing insights often unseen by their husbands who control more household resources. Thus, when given the opportunity to make decisions related to finances or technology, women more heavily consider the interrelated complexities of their farms, and long-term return, and ultimately see greater benefits. In these cases, the improved income that results from these opportunities, for example, may be used to send children to school or apply for micro-credit, leading to an improved socioeconomic state.

In Conclusion

The insights in this systematic review demonstrate the importance of implementing empowerment frameworks in international agricultural development work that includes extension and should be used to guide future extension projects. The rice parboiling case study, in particular, serves as an exemplary reference of redesigning an extension project to fit the needs of a community and contribute to greater empowerment. While many projects seek to improve the lives of individuals, it is imperative to understand the sociocultural norms of community-based cultures. For example, the ANGeL project (Case Study 3) illustrates the ability to combine educational pathways for both members of the household in order to leverage extension and create a more equitable community. I advise future projects to avoid pitfalls by examining programs in regions other than Sub-Saharan Africa and Southeast Asia. The lack of materials available for study do not provide a comprehensive scope or allow for a prescriptive view on how to approach local projects and interventions. Each culture, community, county, or region has its own struggles and needs. Extensionists are often outsiders to a community. As outsiders, we cannot

allow our vanity nor our hubris to dictate what communities should or could look like. Community success cannot be wholly defined by outsiders and requires a great deal of communal input.

This would be further expanded by exploring unsuccessful studies, in an attempt to learn from mistakes or ill planned projects. I do however recognize the inherent challenge in this as many failed projects are not published; possibly a greater limitation to development work. The social taboo of highlighting and speaking to failures was a particular hinderance to the depth this systematic review could have provided. While an analysis could determine overall struggles and underexplored areas, the lack of explicitly stated failures decreases the overall understanding of how to improve as extensionists. As a community of partitioners, scholars, and direct service providers, we owe it to those we serve to discuss how we have failed or order to learn and create better dialogues that allow for community led successes. It should be noted that many projects in these studies are short, often being completed within a few months or years. This structure often impedes the ability to create longstanding change within each community as none of the intervention offered courses, classes, interventions for more than a few months at a time. The lack of continued support encourages a single solution method as opposed to a multifaceted and robust program which would take many years to fully achieve. Furthermore, I want to re-emphasize the importance of bottom-up and participatory extension frameworks to ensure that the community's true needs and knowledge are being considered in order to promote resilient and lasting growth. With community engagement and collaboration, sustained success and long-term community participation should be achieved in order to meet extension goals.

This systematic review offers some key insights on the nature of extension and women's empowerment. While I acknowledge biases and limitations present in this dataset, I was able to find many common trends amongst these select papers and conclude that women's empowerment is possible through extension. The structure of agricultural extension has the ability and opportunity to create gender, capital, and intellectual equity across gender groups. However, this cannot be achieved

when approaching women's empowerment through a single method. Regional and local cultural specificity will dictate the types of problems, issues, or restrictions women face. Empowerment is simultaneously a community and individual asset and, in many circumstances, the empowerment an individual gains is mirrored or accepted at the social level. Understanding social capitals, local nuances, and diverse skills across different cultures, regions, language and religions will only enhance the effectiveness of agricultural extension programs. Moreover, in order to create equity and have that change reflected across a greater region, we must work with men and women to ensure that women gain power and independence in a safe environment. We must start with the community first and create systems that can survive with a new equitable leadership.

Limitations and Opportunities

While I was able to extract useful and telling information from this review, I strongly feel that the information extracted is limited due to the nature of my sources. By virtue of the review being comprised solely of research and published material, I lost the nuances present from studies published in other languages, published as grey literature, or studies not published due to failures – all of which provide extremely useful information on the state of agricultural extension and how it affects women's empowerment.

My initial desire was to include written work in French and Spanish; however, I was unable to retrieve papers systematically through any available database. To include work written originally in French and Spanish would increase the data value of this review since many emerging economy regions use these languages – regions including Central America, South America, and parts of Northern and Western Africa. Additionally, many other countries and regions with extension services include Northern Asia, Eastern Europe, the Caribbean, and the Middle East, some of these regions are represented through languages outside the scope of mine or my research teams understanding. It is important to

acknowledge that research, extension, and development is led by experts across the globe; to truly amass a collective understanding of a topic, future studies must extend our search beyond monolingual discourse. The lack of databases containing polylingual work has affected my ability to explore the full extent of the literature on agricultural extension, acknowledging that many countries have national research and extension institutions that I was not able to access. This is a significant limitation to fully understanding the ways in which agricultural extension can impact women's empowerment.

In the early stages of this study, I attempted to extract information from “grey literature,” or non-academic published bodies of information such as agency reports, study progress notes, or government documents. While the body of published work is vast, the quantity of grey literature is incredibly prolific and requires systematic technological expertise. In early attempts to access grey literature, I encountered many problems finding platforms or standardized methods of extracting information in a systematic way. I attempted to figure out methods of web scraping to extrapolate published PDFs on websites from FAO, the UN, and USAID to no avail. The level of coding and technical analysis that is needed exceeded mine or my colleague's capacity. I would also like to mention that downloading the 33,000 abstracts and 3,000 papers for review alone was a highly technologically demanding process. Many trials and errors with different software were used, until a viable solution was found. This illustrates the technical difficulty of retrieving information in a systematic process and the barriers to remaining systematic in the way we as humans process information. As there are no standardized information platforms for grey literature of this type, it becomes increasingly difficult to search all possible bodies of work and all related aspects of agricultural extension.

The processes that I dissect and examine here are not ubiquitous and it should not be assumed that other organizations are not utilizing improved and innovative examples. My data here are largely based on published work, English communication, and Western programming. These published works were only accessed and freely available through the University of California in Davis Library, which facilitates

the access to scientific papers that are often hidden behind pay-walls. Even through our extensive library access, there were a number of papers that were inaccessible through these means, and they were excluded from the study as well. My information base being research papers and scientific communication influenced the types of methods, agriculture, and development approaches that were reported in this review. Many other organizations perform extension or extension related work in various aspects of the agricultural supply chain, these organizations or programs are not represented here. There is no standardized method of extension reporting, method sharing, or information access. In some ways this is a benefit as it allows for innovative processes to take place and encourages community-oriented extension, but it also prevents the sharing of information on an international level.

Another limitation I encountered was the lack of information regarding programs that failed. It is important to share information regarding all aspects of programming to allow for collective improvement and avoid repetitive mistakes. This is not common in scientific literature as most published studies contain successes, and very little analysis of failures. I had hoped to include this type of information in my analysis but found that there was very little to comment on in terms of what was not a helpful practice and instead spoke to aspects that were successful. While it is important to include what works it is equally as important to understand how to improve systems as they exist and work around lessons learned. One of the common themes I did notice was that many studies repeated the same findings – more community engagement is necessary. The prevalence of similar studies even across our robust initial search speaks to the nature of extension and development – the same program models are followed even across a 20-year span. Very few studies implemented novel approaches or incorporated communities in the design process, recommendations that have been made through countless research studies looking to improve extension and community improvement. The most alarming practice I saw was the attempt to take programs from one region and implement them in other

regions and places which did not share any similarities outside of residing in the Global South, a process that does not take communities in question and prevents targeted communication.

Final Remarks

One of the standing questions that I found myself trying to answer was the question of whether empowerment metrics and extension practices should be standardized, and if so, what aspects of it should be considered standard so we can build upon existing knowledge and improve services and systems. Many studies found that rural growers and communities have little faith in local governments or national systems to provide them with the resources and access that they need. There was a greater appreciation for international and foreign partners and folks were very willing to work with those organizations through more trust in the processes and procedures. Many farmers are not ready to begin investing in technologies. Value chains are not secure and inconsistencies in governments, terrain, crops, and resource access prevent farmers from amassing capital or in a position to risk investments. Little credence is given to native crops which could provide improved nutritional security, climate change resilience, and capital in a local market system. Credit lenders and microlenders are rarely trusted. Unless spearheaded by major organizations, governments, or international partners, trust in local money lenders is low and prevents people from gaining capital through means outside immediate work or agricultural production. The trust and weight in western interventions is understandable but also alarming. We have a duty to recognize the power imbalance we bring through international aid, research, extension, or development. Communities trust in Development practitioners and it is imperative that we consider long-term ramifications of our work across different regions.

Limitations of our process and of extension itself prevent me from making generalizable statements and recommending types of extension or methods that will work ubiquitously. This is one of the major commonalities I found across all studies, that each community's needs are different and require

individually catered interventions. Future studies could assess more regional approaches as each culture has its own norms and each region has its own needs. There are major differences between nutrition and crop-based interventions, and these also change by region. A huge focus that I observed revolved around genetically modified or fortified seeds to improve production for export-based crops. Very few of these interventions focused on immediate food production for local nutrition improvements or food security. The intention of these interventions is necessary to then contextualize the outcomes and impacts of each reviewed paper, effectively guiding and leading the type of intervention being implemented. Future research on impacts of extension-based work should focus on understanding the reasons for the intervention and the relevancy for each region. As practitioners of extension, development, and international aid we must be held responsible and accountable to the communities that deserve support based on locally available resources.

Papers Included in the Systematic Review (alphabetical)

Adams, T., J.-D. Gerber and M. Amacker (2019). "Constraints and opportunities in gender relations: Sugarcane outgrower schemes in Malawi." *World Development* 122: 282-294.

Akter, S., W. Erskine, L. Spyckerelle, L. V. Branco and J. Imron (2020). "The impact of women's access to agricultural extension on cropping practices in Timor-Leste." *Food Security* 12(2): 449-463.

Alam, A., W. Khatun, M. Khanam, G. Ara, A. Bokshi, M. Li and M. J. Dibley (2020). ""In the Past, the Seeds I Planted often Didn't Grow." A Mixed-Methods Feasibility Assessment of Integrating Agriculture and Nutrition Behaviour Change Interventions with Cash Transfers in Rural Bangladesh." *Int J Environ Res Public Health* 17(11).

Alemu, S. H., L. Van Kempen and R. Ruben (2018). "Women Empowerment Through Self-Help Groups: The Bittersweet Fruits of Collective Apple Cultivation in Highland Ethiopia." *Journal of Human Development and Capabilities* 19(3): 308-330.

Amare, T., G. F. John and G. Therese (2021). "Womens empowerment: A gender outcome of an improved agriculture health and nutrition project in Zambia and Malawi." *Journal of Agricultural Extension and Rural Development* 13(2): 125-137.

Bain, C., E. Ransom and I. Halimatusa'diyah (2020). "Dairy Livestock Interventions for Food Security in Uganda: What are the Implications for Women's Empowerment?*" *Rural Sociology* 85(4): 991-1020.

Balasubramanian, K. and P. Thamizoli (2003). "Social differentiation in the horizontal transfer of knowledge: A case study from South India." *The Journal of Agricultural Education and Extension* 9(2): 51-60.

Balasubramanya, S. (2019). "Effects of training duration and the role of gender on farm participation in water user associations in Southern Tajikistan: Implications for irrigation management." *Agricultural Water Management* 216: 1-11.

Bayisenge, J., S. Höjer and M. Espling (2014). "Women's land rights in the context of the land tenure reform in Rwanda – the experiences of policy implementers." *Journal of Eastern African Studies* 9(1): 74-90.

Bezner Kerr, R., S. L. Young, C. Young, M. V. Santoso, M. Magalasi, M. Entz, E. Lupafya, L. Dakishoni, V. Morrone, D. Wolfe and S. S. Snapp (2019). "Farming for change: developing a participatory curriculum on agroecology, nutrition, climate change and social equity in Malawi and Tanzania." *Agriculture and Human Values* 36(3): 549-566.

Biswas, M., M. Anwar, L. Stillman and G. Oliver (2022). Understanding Information and Communication Opportunities and Challenges for Rural Women Through the Sustainable Livelihood Framework. *Information for a Better World: Shaping the Global Future*: 175-191.

Biswas, M. K. (2014). "Oyster Mushroom Cultivation: a Women Friendly Profession for the Development of Rural West Bengal." *International Journal of Bio-resource and Stress Management* 5(3).

Bose, P. (2019). "Oil palm plantations vs. shifting cultivation for indigenous peoples: Analyzing Mizoram's New Land Use Policy." *Land Use Policy* 81: 115-123.

Cai, T., C. Steinfield, H. Chiwasa and T. Ganunga (2019). "Understanding Malawian farmers' slow adoption of composting: Stories about composting using a participatory video approach." *Land Degradation & Development* 30(11): 1336-1344.

Carnegie, M., P. S. Cornish, K. K. Htwe and N. N. Htwe (2020). "Gender, decision-making and farm practice change: An action learning intervention in Myanmar." *Journal of Rural Studies* 78: 503-515.

Chowdhury, A. H., P. Van Mele and M. Hauser (2011). "Contribution of Farmer-to-Farmer Video to Capital Assets Building: Evidence from Bangladesh." *Journal of Sustainable Agriculture* 35(4): 408-435.

Connor, M. and S. S. San (2020). "Sustainable rice farming and its impact on rural women in Myanmar." *Development in Practice* 31(1): 49-58.

Crookston, B. T., J. H. West, S. F. Davis, P. C. Hall, G. Seymour and B. L. Gray (2021). "Understanding female and male empowerment in Burkina Faso using the project-level Women's Empowerment in Agriculture Index (pro-WEAI): a longitudinal study." *BMC Womens Health* 21(1): 230.

Dar, M. H., S. A. Waza, S. Nayak, R. Chakravorty, N. W. Zaidi and M. Hossain (2020). "Gender focused training and knowledge enhances the adoption of climate resilient seeds." *Technol Soc* 63: 101388.

de Boef, W. S., S. Singh, P. Trivedi, K. S. Yadav, P. S. Mohanan, S. Kumar, J. P. Yadavendra and K. Isaacs (2021). "Unleashing the social capital of self-help groups for strengthening seed systems in Uttar Pradesh, India." *Global Food Security* 29.

Deka, R. J., A. M. M. Zakir and R. B. Kayastha (2019). "Improvement of rural livelihood through rearing of Chara-Chemballi ducks in Assam." *World's Poultry Science Journal* 70(2): 397-404.

Desai, R. M. and S. Joshi (2013). "Can Producer Associations Improve Rural Livelihoods? Evidence from Farmer Centres in India." *The Journal of Development Studies* 50(1): 64-80.

Devkota, R., H. Hambly Odame, J. Fitzsimons, R. Pudasaini and M. N. Raizada (2020). "Evaluating the Effectiveness of Picture-Based Agricultural Extension Lessons Developed Using Participatory Testing and Editing with Smallholder Women Farmers in Nepal." *Sustainability* 12(22).

Duffy, C., G. Toth, J. Cullinan, U. Murray and C. Spillane (2020). "Climate smart agriculture extension: gender disparities in agroforestry knowledge acquisition." *Climate and Development* 13(1): 21-33.

Dupuis, S., M. Hennink, A. S. Wendt, J. L. Waid, M. A. Kalam, S. Gabrysch and S. S. Sinharoy (2022). "Women's empowerment through homestead food production in rural Bangladesh." *BMC Public Health* 22(1): 134.

Esther, W. (2018). "Innovation development and transfer by agricultural development agencies: a case study of cowpea IPM in northern Ghana." *Agro-Science* 17(1).

Frings-Hessami, V. and A. Sarker (2022). *Access to Information Two Years After an ICT4D Project in Bangladesh: New Digital Skills and Traditional Practices. Information for a Better World: Shaping the Global Future: 123-135.*

Fuller-Wimbush, D. and K. Adebayo (2014). "Lessons of endogenous leadership in Nigeria: innovating to reduce waste and raise incomes in the cassava processing and goat-keeping systems." *Development in Practice* 24(5-6): 693-698.

Geleta, E. B., C. Henry and P. Elabor-Idemudia (2018). "'The pluses of pulses': haricot beans and women's empowerment in Ethiopia." *Development in Practice* 28(2): 311-317.

Gichungi, H., B. Muriithi, P. Irungu, G. Diiro and J. Busienei (2020). "Effect of Technological Innovation on Gender Roles: The Case of Fruit Fly IPM Adoption on Women's Decision-Making in Mango Production and Marketing in Kenya." *The European Journal of Development Research* 33(3): 407-426.

Gilligan, D. O., N. Kumar, S. McNiven, J. V. Meenakshi and A. Quisumbing (2020). "Bargaining power, decision making, and biofortification: The role of gender in adoption of orange sweet potato in Uganda." *Food Policy* 95: 101909.

Goldman, M. J., A. Davis and J. Little (2016). "Controlling land they call their own: access and women's empowerment in Northern Tanzania." *The Journal of Peasant Studies* 43(4): 777-797.

Goodrich, C. G., S. Justice, S. Biggs and G. Sah (2008). "Participatory technology development in agricultural mechanisation in Nepal: how it happened and lessons learned." *Development in Practice* 18(4-5): 643-649.

Gupta, S. and H. S. Rathore (2020). "Socio-Economic and political empowerment through self help groups intervention: A study from Bilaspur, Chhattisgarh, India." *Journal of Public Affairs* 21(1).

Humphries, S., L. Classen, J. Jiménez, F. Sierra, O. Gallardo and M. Gómez (2012). "Opening Cracks for the Transgression of Social Boundaries: An Evaluation of the Gender Impacts of Farmer Research Teams in Honduras." *World Development* 40(10): 2078-2095.

Kadiyala, S., E. H. Morgan, S. Cyriac, A. Margolies and T. Roopnaraine (2016). "Adapting Agriculture Platforms for Nutrition: A Case Study of a Participatory, Video-Based Agricultural Extension Platform in India." *PLoS One* 11(10): e0164002.

Kamwamba-Mtethiwa, J., R. Namara, C. De Fraiture, J. Mangisoni and E. Owusu (2012). "Treadle Pump Irrigation in Malawi: Adoption, Gender and Benefits." *Irrigation and Drainage* 61(5): 583-595.

Kinkingninhoun-Médagbé, F. M., A. Diagne, F. Simtowe, A. R. Agboh-Noameshie and P. Y. Adégbola (2008). "Gender discrimination and its impact on income, productivity, and technical efficiency: evidence from Benin." *Agriculture and Human Values* 27(1): 57-69.

Kjeldsberg, C., N. Shrestha, M. Patel, D. Davis, G. Mundy and K. Cunningham (2018). "Nutrition-sensitive agricultural interventions and gender dynamics: A qualitative study in Nepal." *Matern Child Nutr* 14(3): e12593.

Lambrecht, I., B. Vanlauwe and M. Maertens (2016). "Agricultural extension in Eastern Democratic Republic of Congo: does gender matter?" *European Review of Agricultural Economics* 43(5): 841-874.

Lamontagne, G., Dorward, Aslam and Cardey (2019). "Analysing Support Towards Inclusive and Integrated Rural Advisory Systems." *Social Sciences* 8(10).

Larson, S., A. Dray, T. Cornioley, M. Thephavanh, P. Thammavong, S. Vorlasan, J. G. Connell, M. Moglia, P. Case, K. S. Alexander and P. Perez (2020). "A Game-Based Approach to Exploring Gender Differences in Smallholder Decisions to Change Farming Practices: White Rice Production in Laos." *Sustainability* 12(16).

Lawal, A. O. (2011). "Women's benefits from agricultural technologies: evidence from poultry production among Nigerian fisherfolk." *Development in Practice* 21(3): 371-378.

Lecoutere, E. and E. Wuyts (2020). "Confronting the Wall of Patriarchy: Does Participatory Intrahousehold Decision Making Empower Women in Agricultural Households?" *The Journal of Development Studies* 57(6): 882-905.

Mancini, F., A. J. Termorshuizen, J. L. S. Jiggins and A. H. C. van Bruggen (2008). "Increasing the environmental and social sustainability of cotton farming through farmer education in Andhra Pradesh, India." *Agricultural Systems* 96(1-3): 16-25.

Mancini, F., A. H. C. Van Bruggen and J. L. S. Jiggins (2007). "Evaluating Cotton Integrated Pest Management (Ipm) Farmer Field School Outcomes Using the Sustainable Livelihoods Approach in India." *Experimental Agriculture* 43(1): 97-112.

Medendorp, J. W., N. P. Reeves, V. Celi, M. Harun-Ar-Rashid, T. J. Krupnik, A. N. Lutomia, B. Pittendrigh and J. Bello-Bravo (2022). "Large-scale rollout of extension training in Bangladesh: Challenges and opportunities for gender-inclusive participation." *PLoS One* 17(7): e0270662.

Mensah, M., G. B. Villamor, B. Y. Fosu-Mensah and P. L. G. Vlek (2021). "Exploring the Gender-Specific Adaptive Responses to Climate Variability: Application of Grazing Game in the Semi-Arid Region of Ghana." *Agriculture* 11(11).

Mercykutty, M. J. and V. K. Rashida (2020). "MKSP Scheme: An Effective Approach for Uplifting 'Kudumbashree' Farm

Women in Kerala." *Journal of Extension Education* 32(3).

Mudege, N. N., T. Nyekanyeka, E. Kapalasa, T. Chevo and P. Demo (2015). "Understanding collective action and women's empowerment in potato farmer groups in Ntcheu and Dedza in Malawi." *Journal of Rural Studies* 42: 91-101.

Murage, A. W., J. O. Pittchar, C. A. O. Midega, C. O. Onyango, J. A. Pickett and Z. R. Khan (2019). "Gender appropriateness of field days in knowledge generation and adoption of push-pull technology in eastern Africa." *East African Agricultural and Forestry Journal* 83(4): 289-306.

Nagarathinam, S., K. D. Mishra and N. Paramanatham (2022). Agricultural Drudgery Reduction Among Tribal Women Through Science and Technology Communication in Tamil Nadu. *Narratives and New Voices from India*: 283-297.

Nagwekar, N. N., V. B. Tidke and B. N. Thorat (2020). "Seasonal Nutritional Food Security to Indian Women through Community-level Implementation of Domestic Solar Conduction Dryer." *Ecol Food Nutr* 59(5): 525-551.

Naughton, C. C., Q. Zhang and J. R. Mihelcic (2017). "Modelling energy and environmental impacts of traditional and improved shea butter production in West Africa for food security." *Sci Total Environ* 576: 284-291.

O'Brien, C., N. S. Gunaratna, K. Gebreselassie, Z. M. Gitonga, M. Tsegaye and H. De Groot (2016). "Gender as a Cross-Cutting Issue in Food Security: The NuME Project and Quality Protein Maize in Ethiopia." *World Medical & Health Policy* 8(3): 263-286.

O'Brien, C., L. Leavens, C. Ndiaye and D. Traore (2022). "Women's Empowerment, Income, and Nutrition in a Food Processing Value Chain Development Project in Touba, Senegal." *Int J Environ Res Public Health* 19(15).

Olney, D. K., L. Bliznashka, A. Pedehombga, A. Dillon, M. T. Ruel and J. Heckert (2016). "A 2-Year Integrated Agriculture and Nutrition Program Targeted to Mothers of Young Children in Burkina Faso Reduces Underweight among Mothers and Increases Their Empowerment: A Cluster-Randomized Controlled Trial." *J Nutr* 146(5): 1109-1117.

Oumer, A. M., W. G. Tiruneh and C. Y. Tizale (2014). "Empowering Smallholder Women Farmers through Participatory Seed Potato Management: Lessons from Welmera District, Ethiopia." *Journal of Sustainable Development* 7(5).

Pandey, V., H. K. Nagarajan and D. Kumar (2021). "Impact of Gendered Participation in market-linked value-chains on Economic Outcomes: Evidence from India." *Food Policy* 104.

Paris, T. R., A. Singh, A. D. Cueno and V. N. Singh (2008). "Assessing the Impact of Participatory Research in Rice Breeding on Women Farmers: A Case Study in Eastern Uttar Pradesh, India." *Experimental Agriculture* 44(1): 97-112.

Quin, P., S. Joseph, O. Husson, S. Donne, D. Mitchell, P. Munroe, D. Phelan, A. Cowie and L. Van Zwieten (2015). "Lowering N₂O emissions from soils using eucalypt biochar: the importance of redox reactions." *Sci Rep* 5: 16773.

Quin, P., S. Joseph, O. Husson, S. Donne, D. Mitchell, P. Munroe, D. Phelan, A. Cowie and L. Van Zwieten (2015). "Lowering N₂O emissions from soils using eucalypt biochar: the importance of redox reactions." *Sci Rep* 5: 16773.

Quisumbing, A., A. Ahmed, J. Hoddinott, A. Pereira and S. Roy (2021). "Designing for empowerment impact in agricultural development projects: Experimental evidence from the Agriculture, Nutrition, and Gender Linkages (ANGeL) project in Bangladesh." *World Dev* 146: 105622.

Ragasa, C., N.-L. Aberman and C. Alvarez Mingote (2019). "Does providing agricultural and nutrition information to both men and women improve household food security? Evidence from Malawi." *Global Food Security* 20: 45-59.

Raghunathan, K., S. Kannan and A. R. Quisumbing (2019). "Can women's self-help groups improve access to information, decision-making, and agricultural practices? The Indian case." *Agric Econ* 50(5): 567-580.

Raman, N. L. M. and N. Dubey (2016). "Rural women empowerment: horticulture to improve the livelihoods of communities." *Acta Horticulturae*(1126): 199-204.

Rubio-Jovel, K. (2021). "Gender Empowerment in Agriculture Interventions: What Are We Still Missing? Evidence From a Randomized-Controlled Trial Among Coffee Producers in Honduras." *Frontiers in Sustainable Food Systems* 5.

Samuelsson, A. M., P. A. Matthews, E. Jansen, P. D. Taylor and L. Poston (2013). "Sucrose feeding in mouse pregnancy leads to hypertension, and sex-linked obesity and insulin resistance in female offspring." *Front Physiol* 4: 14.

Sarkar, B., P. K. Sundaram, A. P. Anurag, R. Kumar, U. Kumar, A. Rahman and A. Upadhyaya (2021). "Ergonomic Evaluation of Hand Operated Maize Sheller for Reducing Drudgery of Farm Women in Bihar." *Journal of AgriSearch* 8(01).

Suma, T. R. and K. Großmann (2016). "Exclusions in inclusive programs: state-sponsored sustainable development initiatives amongst the Kurichya in Kerala, India." *Agriculture and Human Values* 34(4): 995-1006.

Tavener, K. and T. A. Crane (2018). "Gender power in Kenyan dairy: cows, commodities, and commercialization." *Agriculture and Human Values* 35(3): 701-715.

Teklewold, H., R. I. Adam and P. Marenja (2020). "What explains the gender differences in the adoption of multiple maize varieties? Empirical evidence from Uganda and Tanzania." *World Dev Perspect* 18: 100206.

Thar, S. P., T. Ramilan, R. J. Farquharson, A. Pang and D. Chen (2020). "An empirical analysis of the use of agricultural mobile applications among smallholder farmers in Myanmar." *The Electronic Journal of Information Systems in Developing Countries* 87(2).

Tiwari, R., D. S. Tomar, A. K. Dixit and A. K. Saxena (2015). "Impact of Advanced Transport Machinery for Reducing Drudgery and Work Related Stress of Farm Women." *International Journal of Bio-resource and Stress Management* 6(2).

Tripathy, S. N. (2014). "Watershed Management and Participation of Rural Women: A Study in Nagpur District of Maharashtra." *Journal of Land and Rural Studies* 1(2): 83-97.

Uddin, M. E., A. K. M. K. Pervez and Q. Gao (2020). "Effect of voluntary cooperativisation on livelihood capital of smallholder dairy farmers in the southwest of Bangladesh." *GeoJournal* 87(1): 111-130.

Vandercasteelen, J., M. Dereje, B. Minten and A. S. Taffesse (2018). "Labour, profitability and gender impacts of adopting row planting in Ethiopia." *European Review of Agricultural Economics* 45(4): 471-503.

Vanderwal, L., R. Rautiainen, R. Kuye, C. Peek-Asa, T. Cook, M. Ramirez, K. Culp and K. Donham (2011). "Effectiveness, Safety, and Sustainability of a Hand Water Pump Among Women Vegetable Farmers in the Gambia." *Journal of Sustainable Agriculture* 35(4): 394-407.

VanLeeuwen, J. A., T. Mellish, C. Walton, A. Kaniaru, R. Gitau, K. Mellish, B. Maina and J. Wichtel (2012). "Management, productivity and livelihood effects on Kenyan smallholder dairy farms from interventions addressing animal health and nutrition and milk quality." *Trop Anim Health Prod* 44(2): 231-238.

Waid, J. L., A. S. Wendt, S. S. Sinharoy, A. Kader and S. Gabrysch (2022). "Impact of a homestead food production program on women's empowerment: Pro-WEAI results from the FAARM trial in Bangladesh." *World Dev* 158: 106001.

Yasmin, T., R. Khattak and I. Ngah (2013). "Facilitating Earthquake-Affected Rural Women Communities Toward Sustainable Livelihoods and Agriculture." *Agroecology and Sustainable Food Systems* 37(5): 592-613.

Zossou, E., P. Van Mele, J. Wanvoeke and P. Lebailly (2012). "Participatory Impact Assessment of Rice Parboiling Videos with Women in Benin." *Experimental Agriculture* 48(3): 438-447.

Zoundji, G. C., S. D. Vodouhe, F. Okry, J. W. Bentley and R. C. Tossou (2017). "Beyond Striga Management: Learning Videos Enhanced Farmers' Knowledge on Climate-Smart Agriculture in Mali." *Sustainable Agriculture Research* 7(1).

References Cited

1. INGENAES, *Extension and Advisory Services - Terminology and Glossary*. Integrating Gender and Nutrition within Agricultural Extension Services. White Paper. Creative Commons License 3.0., 2015.
2. Manfre, C., Rubin, D., Allen, A., Summerfield, G., Colverson, K., & Akeredolu, M. , *Reducing the gender gap in agricultural extension and advisory services*. Modernizing Extension and Advisory Services Discussion Paper United States Agency for International Development., 2013.
3. Saito, K.A., & Weidemann, C. J., *Agricultural extension for women farmers in Africa*. World Bank Publications., 1990(103).
4. Boserup, E., *Woman's Role in Economic Development*. 1970, London:George Allen Unwin.
5. Bank, W., *World Development Report 1983: World Economic Recession and Prospects for Recovery; Management in Development; World Development Indicators*. 1983: The World Bank.
6. Fao, F., *The state of food and agriculture: Women in agriculture*. Closing the gender gap for development, 2011.
7. Kabeer, N., *Resources, Agency, Achievements: Reflections on the Measurement of Women's Empowerment*. Development and Change, 1999. **30**(3): p. 435-464.
8. Nussbaum, M.C., *Women and human development: The capabilities approach*. Vol. 3. 2000: Cambridge university press.
9. Collins, P.H., *Intersectionality as Critical Inquiry*, in *Companion to Feminist Studies*. 2020. p. 105-128.
10. Spivak, G., *Can the subaltern speak? Speculations on widow sacrifice*, *Wedge*, 7/8. 1985, Winter–Spring.
11. Development, L.E.f.A.a., *Gender in agriculture and food systems: An Evidence Gap Map*. 2021: Chennai, India: LEAD at KREA University.

12. Cumpston, M., et al., *Updated guidance for trusted systematic reviews: a new edition of the Cochrane Handbook for Systematic Reviews of Interventions*. The Cochrane database of systematic reviews, 2019. **2019**(10).
13. Zossou, E., et al., *The power of video to trigger innovation: rice processing in central Benin*. International Journal of Agricultural Sustainability, 2011. **7**(2): p. 119-129.
14. Zossou, E., et al., *Women groups formed in response to public video screenings on rice processing in Benin*. International Journal of Agricultural Sustainability, 2011. **8**(4): p. 270-277.
15. Zossou, E., et al., *Participatory Impact Assessment of Rice Parboiling Videos with Women in Benin*. Experimental Agriculture, 2012. **48**(3): p. 438-447.
16. Balasubramanian, K. and P. Thamizoli, *Social differentiation in the horizontal transfer of knowledge: A case study from South India*. The Journal of Agricultural Education and Extension, 2003. **9**(2): p. 51-60.
17. Adams, T., J.-D. Gerber, and M. Amacker, *Constraints and opportunities in gender relations: Sugarcane outgrower schemes in Malawi*. World Development, 2019. **122**: p. 282-294.
18. Akter, S., et al., *The impact of women's access to agricultural extension on cropping practices in Timor-Leste*. Food Security, 2020. **12**(2): p. 449-463.
19. Alam, A., et al., *"In the Past, the Seeds I Planted often Didn't Grow." A Mixed-Methods Feasibility Assessment of Integrating Agriculture and Nutrition Behaviour Change Interventions with Cash Transfers in Rural Bangladesh*. Int J Environ Res Public Health, 2020. **17**(11).
20. Alemu, S.H., L. Van Kempen, and R. Ruben, *Women Empowerment Through Self-Help Groups: The Bittersweet Fruits of Collective Apple Cultivation in Highland Ethiopia*. Journal of Human Development and Capabilities, 2018. **19**(3): p. 308-330.

21. Amare, T., G.F. John, and G. Therese, *Womens empowerment: A gender outcome of an improved agriculture health and nutrition project in Zambia and Malawi*. Journal of Agricultural Extension and Rural Development, 2021. **13**(2): p. 125-137.
22. Bain, C., E. Ransom, and I. Halimatusa'diyah, *Dairy Livestock Interventions for Food Security in Uganda: What are the Implications for Women's Empowerment?**. Rural Sociology, 2020. **85**(4): p. 991-1020.
23. Balasubramanya, S., *Effects of training duration and the role of gender on farm participation in water user associations in Southern Tajikistan: Implications for irrigation management*. Agricultural Water Management, 2019. **216**: p. 1-11.
24. Bayisenge, J., S. Höjer, and M. Espling, *Women's land rights in the context of the land tenure reform in Rwanda – the experiences of policy implementers*. Journal of Eastern African Studies, 2014. **9**(1): p. 74-90.
25. Bezner Kerr, R., et al., *Farming for change: developing a participatory curriculum on agroecology, nutrition, climate change and social equity in Malawi and Tanzania*. Agriculture and Human Values, 2019. **36**(3): p. 549-566.
26. Biswas, M., et al., *Understanding Information and Communication Opportunities and Challenges for Rural Women Through the Sustainable Livelihood Framework*, in *Information for a Better World: Shaping the Global Future*. 2022. p. 175-191.
27. Biswas, M.K., *Oyster Mushroom Cultivation: a Women Friendly Profession for the Development of Rural West Bengal*. International Journal of Bio-resource and Stress Management, 2014. **5**(3).
28. Bose, P., *Oil palm plantations vs. shifting cultivation for indigenous peoples: Analyzing Mizoram's New Land Use Policy*. Land Use Policy, 2019. **81**: p. 115-123.

29. Cai, T., et al., *Understanding Malawian farmers' slow adoption of composting: Stories about composting using a participatory video approach*. *Land Degradation & Development*, 2019. **30**(11): p. 1336-1344.
30. Carnegie, M., et al., *Gender, decision-making and farm practice change: An action learning intervention in Myanmar*. *Journal of Rural Studies*, 2020. **78**: p. 503-515.
31. Chowdhury, A.H., P. Van Mele, and M. Hauser, *Contribution of Farmer-to-Farmer Video to Capital Assets Building: Evidence from Bangladesh*. *Journal of Sustainable Agriculture*, 2011. **35**(4): p. 408-435.
32. Connor, M. and S.S. San, *Sustainable rice farming and its impact on rural women in Myanmar*. *Development in Practice*, 2020. **31**(1): p. 49-58.
33. Crookston, B.T., et al., *Understanding female and male empowerment in Burkina Faso using the project-level Women's Empowerment in Agriculture Index (pro-WEAI): a longitudinal study*. *BMC Womens Health*, 2021. **21**(1): p. 230.
34. Dar, M.H., et al., *Gender focused training and knowledge enhances the adoption of climate resilient seeds*. *Technol Soc*, 2020. **63**: p. 101388.
35. de Boef, W.S., et al., *Unleashing the social capital of self-help groups for strengthening seed systems in Uttar Pradesh, India*. *Global Food Security*, 2021. **29**.
36. Deka, R.J., A.M.M. Zakir, and R.B. Kayastha, *Improvement of rural livelihood through rearing of Chara-Chemballi ducks in Assam*. *World's Poultry Science Journal*, 2019. **70**(2): p. 397-404.
37. Desai, R.M. and S. Joshi, *Can Producer Associations Improve Rural Livelihoods? Evidence from Farmer Centres in India*. *The Journal of Development Studies*, 2013. **50**(1): p. 64-80.
38. Devkota, R., et al., *Evaluating the Effectiveness of Picture-Based Agricultural Extension Lessons Developed Using Participatory Testing and Editing with Smallholder Women Farmers in Nepal*. *Sustainability*, 2020. **12**(22).

39. Duffy, C., et al., *Climate smart agriculture extension: gender disparities in agroforestry knowledge acquisition*. *Climate and Development*, 2020. **13**(1): p. 21-33.
40. Dupuis, S., et al., *Women's empowerment through homestead food production in rural Bangladesh*. *BMC Public Health*, 2022. **22**(1): p. 134.
41. Esther, W., *Innovation development and transfer by agricultural development agencies: a case study of cowpea IPM in northern Ghana*. *Agro-Science*, 2018. **17**(1).
42. Frings-Hessami, V. and A. Sarker, *Access to Information Two Years After an ICT4D Project in Bangladesh: New Digital Skills and Traditional Practices*, in *Information for a Better World: Shaping the Global Future*. 2022. p. 123-135.
43. Fuller-Wimbush, D. and K. Adebayo, *Lessons of endogenous leadership in Nigeria: innovating to reduce waste and raise incomes in the cassava processing and goat-keeping systems*. *Development in Practice*, 2014. **24**(5-6): p. 693-698.
44. Geleta, E.B., C. Henry, and P. Elabor-Idemudia, *"The pluses of pulses": haricot beans and women's empowerment in Ethiopia*. *Development in Practice*, 2018. **28**(2): p. 311-317.
45. Gichungi, H., et al., *Effect of Technological Innovation on Gender Roles: The Case of Fruit Fly IPM Adoption on Women's Decision-Making in Mango Production and Marketing in Kenya*. *The European Journal of Development Research*, 2020. **33**(3): p. 407-426.
46. Gilligan, D.O., et al., *Bargaining power, decision making, and biofortification: The role of gender in adoption of orange sweet potato in Uganda*. *Food Policy*, 2020. **95**: p. 101909.
47. Goldman, M.J., A. Davis, and J. Little, *Controlling land they call their own: access and women's empowerment in Northern Tanzania*. *The Journal of Peasant Studies*, 2016. **43**(4): p. 777-797.
48. Goodrich, C.G., et al., *Participatory technology development in agricultural mechanisation in Nepal: how it happened and lessons learned*. *Development in Practice*, 2008. **18**(4-5): p. 643-649.

49. Gupta, S. and H.S. Rathore, *Socio-Economic and political empowerment through self help groups intervention: A study from Bilaspur, Chhattisgarh, India*. Journal of Public Affairs, 2020. **21**(1).
50. Humphries, S., et al., *Opening Cracks for the Transgression of Social Boundaries: An Evaluation of the Gender Impacts of Farmer Research Teams in Honduras*. World Development, 2012. **40**(10): p. 2078-2095.
51. Kadiyala, S., et al., *Adapting Agriculture Platforms for Nutrition: A Case Study of a Participatory, Video-Based Agricultural Extension Platform in India*. PLoS One, 2016. **11**(10): p. e0164002.
52. Kamwamba-Mtethiwa, J., et al., *Treadle Pump Irrigation in Malawi: Adoption, Gender and Benefits*. Irrigation and Drainage, 2012. **61**(5): p. 583-595.
53. Kinkingninhou-Médagbé, F.M., et al., *Gender discrimination and its impact on income, productivity, and technical efficiency: evidence from Benin*. Agriculture and Human Values, 2008. **27**(1): p. 57-69.
54. Kjeldsberg, C., et al., *Nutrition-sensitive agricultural interventions and gender dynamics: A qualitative study in Nepal*. Matern Child Nutr, 2018. **14**(3): p. e12593.
55. Kuma, B., *Women Farmers in Practices: Opportunities and Challenges in Accessing Potato Production Technologies in Wolmera Etiopia*. Asian Journal of Agricultural extension, economics and sociology, 2015. **6**: p. 149-157.
56. Lambrecht, I., B. Vanlauwe, and M. Maertens, *Agricultural extension in Eastern Democratic Republic of Congo: does gender matter?* European Review of Agricultural Economics, 2016. **43**(5): p. 841-874.
57. Lamontagne, G., et al., *Analysing Support Towards Inclusive and Integrated Rural Advisory Systems*. Social Sciences, 2019. **8**(10).

58. Larson, S., et al., *A Game-Based Approach to Exploring Gender Differences in Smallholder Decisions to Change Farming Practices: White Rice Production in Laos*. Sustainability, 2020. **12**(16).
59. Lawal, A.O., *Women's benefits from agricultural technologies: evidence from poultry production among Nigerian fisherfolk*. Development in Practice, 2011. **21**(3): p. 371-378.
60. Lecoutere, E. and E. Wuyts, *Confronting the Wall of Patriarchy: Does Participatory Intra-household Decision Making Empower Women in Agricultural Households? The Journal of Development Studies*, 2020. **57**(6): p. 882-905.
61. Malabasari, R.T. and U.S. Hiremath, *Capacity Building of Rural Women through Trainings*. 2016. 2016.
62. Mancini, F., et al., *Increasing the environmental and social sustainability of cotton farming through farmer education in Andhra Pradesh, India*. Agricultural Systems, 2008. **96**(1-3): p. 16-25.
63. Mancini, F., A.H.C. Van Bruggen, and J.L.S. Jiggins, *Evaluating Cotton Integrated Pest Management (Ipm) Farmer Field School Outcomes Using the Sustainable Livelihoods Approach in India*. Experimental Agriculture, 2007. **43**(1): p. 97-112.
64. Medendorp, J.W., et al., *Large-scale rollout of extension training in Bangladesh: Challenges and opportunities for gender-inclusive participation*. PLoS One, 2022. **17**(7): p. e0270662.
65. Mensah, M., et al., *Exploring the Gender-Specific Adaptive Responses to Climate Variability: Application of Grazing Game in the Semi-Arid Region of Ghana*. Agriculture, 2021. **11**(11).
66. Mercykutty, M.J. and V.K. Rashida, *MKSP Scheme: An Effective Approach for Uplifting 'Kudumbashree' Farm Women in Kerala*. Journal of Extension Education, 2020. **32**(3).
67. Mudege, N.N., et al., *Understanding collective action and women's empowerment in potato farmer groups in Ntcheu and Dedza in Malawi*. Journal of Rural Studies, 2015. **42**: p. 91-101.

68. Murage, A.W., et al., *Gender appropriateness of field days in knowledge generation and adoption of push-pull technology in eastern Africa*. East African Agricultural and Forestry Journal, 2019. **83**(4): p. 289-306.
69. Nagarathinam, S., K.D. Mishra, and N. Paramanatham, *Agricultural Drudgery Reduction Among Tribal Women Through Science and Technology Communication in Tamil Nadu*, in *Narratives and New Voices from India*. 2022. p. 283-297.
70. Nagwekar, N.N., V.B. Tidke, and B.N. Thorat, *Seasonal Nutritional Food Security to Indian Women through Community-level Implementation of Domestic Solar Conduction Dryer*. Ecol Food Nutr, 2020. **59**(5): p. 525-551.
71. Naughton, C.C., Q. Zhang, and J.R. Mihelcic, *Modelling energy and environmental impacts of traditional and improved shea butter production in West Africa for food security*. Sci Total Environ, 2017. **576**: p. 284-291.
72. Ndenga, E., et al., *Agricultural Diversification with Indigenous Vegetables for Cash Cropping and Nutrition: Examples from Rift Valley and Central Provinces in Kenya*. Acta horticulturae, 2013. **979**: p. 549-558.
73. O'Brien, C., et al., *Gender as a Cross-Cutting Issue in Food Security: The NuME Project and Quality Protein Maize in Ethiopia*. World Medical & Health Policy, 2016. **8**(3): p. 263-286.
74. O'Brien, C., et al., *Women's Empowerment, Income, and Nutrition in a Food Processing Value Chain Development Project in Touba, Senegal*. Int J Environ Res Public Health, 2022. **19**(15).
75. Okali, C. and J. Sumberg, *Quick Money and Power: Tomatoes and Livelihood Building in Rural Brong Ahafo, Ghana**. IDS Bulletin, 2012. **43**(6): p. 44-57.
76. Olney, D.K., et al., *A 2-Year Integrated Agriculture and Nutrition Program Targeted to Mothers of Young Children in Burkina Faso Reduces Underweight among Mothers and Increases Their Empowerment: A Cluster-Randomized Controlled Trial*. J Nutr, 2016. **146**(5): p. 1109-17.

77. Oumer, A.M., W.G. Tiruneh, and C.Y. Tizale, *Empowering Smallholder Women Farmers through Participatory Seed Potato Management: Lessons from Welmera District, Ethiopia*. Journal of Sustainable Development, 2014. **7**(5).
78. Pandey, V., H.K. Nagarajan, and D. Kumar, *Impact of Gendered Participation in market-linked value-chains on Economic Outcomes: Evidence from India*. Food Policy, 2021. **104**.
79. Paris, T.R., et al., *Assessing the Impact of Participatory Research in Rice Breeding on Women Farmers: A Case Study in Eastern Uttar Pradesh, India*. Experimental Agriculture, 2008. **44**(1): p. 97-112.
80. Prayoga, K. and Y. Yuliati, *Women Farmers Respond about Rice Barn Village Program in the Pamotan Village, Dampit Subdistrict, Malang Regency*. HABITAT, 2015. **26**: p. 10-21.
81. Quisumbing, A., et al., *Designing for empowerment impact in agricultural development projects: Experimental evidence from the Agriculture, Nutrition, and Gender Linkages (ANGeL) project in Bangladesh*. World Dev, 2021. **146**: p. 105622.
82. Ragasa, C., N.-L. Aberman, and C. Alvarez Mingote, *Does providing agricultural and nutrition information to both men and women improve household food security? Evidence from Malawi*. Global Food Security, 2019. **20**: p. 45-59.
83. Raghunathan, K., S. Kannan, and A.R. Quisumbing, *Can women's self-help groups improve access to information, decision-making, and agricultural practices? The Indian case*. Agric Econ, 2019. **50**(5): p. 567-580.
84. Raghuprasad, K., N.R. Gangadharappa, and U. Ravindra, *Dynamics of Social Capital among Resource Poor Rural Women*. Tropical Agricultural Research, 2011. **22**.
85. Raman, N.L.M. and N. Dubey, *Rural women empowerment: horticulture to improve the livelihoods of communities*. Acta Horticulturae, 2016(1126): p. 199-204.

86. Ramkumar, S., S.V.N. Rao, and K. Waldie, *Dairy Cattle Rearing by Landless Rural Women in Pondicherry: A Path to Empowerment*. Indian Journal of Gender Studies, 2004. **11**(2): p. 205-222.
87. Rubio-Jovel, K., *Gender Empowerment in Agriculture Interventions: What Are We Still Missing? Evidence From a Randomized-Controlled Trial Among Coffee Producers in Honduras*. Frontiers in Sustainable Food Systems, 2021. **5**.
88. Sarkar, B., et al., *Ergonomic Evaluation of Hand Operated Maize Sheller for Reducing Drudgery of Farm Women in Bihar*. Journal of AgriSearch, 2021. **8**(01).
89. Srinath, K., et al., *Group farming for sustainable aquaculture*. Ocean & Coastal Management, 2000. **43**(7): p. 557-571.
90. Suma, T.R. and K. Großmann, *Exclusions in inclusive programs: state-sponsored sustainable development initiatives amongst the Kurichya in Kerala, India*. Agriculture and Human Values, 2016. **34**(4): p. 995-1006.
91. Tavenner, K. and T.A. Crane, *Gender power in Kenyan dairy: cows, commodities, and commercialization*. Agriculture and Human Values, 2018. **35**(3): p. 701-715.
92. Teklewold, H., R.I. Adam, and P. Marenja, *What explains the gender differences in the adoption of multiple maize varieties? Empirical evidence from Uganda and Tanzania*. World Dev Perspect, 2020. **18**: p. 100206.
93. Thar, S.P., et al., *An empirical analysis of the use of agricultural mobile applications among smallholder farmers in Myanmar*. The Electronic Journal of Information Systems in Developing Countries, 2020. **87**(2).
94. Tiwari, R., et al., *Impact of Advanced Transport Machinery for Reducing Drudgery and Work Related Stress of Farm Women*. International Journal of Bio-resource and Stress Management, 2015. **6**(2).

95. Tripathy, S.N., *Watershed Management and Participation of Rural Women: A Study in Nagpur District of Maharashtra*. Journal of Land and Rural Studies, 2014. **1**(2): p. 83-97.
96. Uddin, M.E., A.K.M.K. Pervez, and Q. Gao, *Effect of voluntary cooperativisation on livelihood capital of smallholder dairy farmers in the southwest of Bangladesh*. GeoJournal, 2020. **87**(1): p. 111-130.
97. Vandercasteelen, J., et al., *Labour, profitability and gender impacts of adopting row planting in Ethiopia*. European Review of Agricultural Economics, 2018. **45**(4): p. 471-503.
98. Vanderwal, L., et al., *Effectiveness, Safety, and Sustainability of a Hand Water Pump Among Women Vegetable Farmers in the Gambia*. Journal of Sustainable Agriculture, 2011. **35**(4): p. 394-407.
99. VanLeeuwen, J.A., et al., *Management, productivity and livelihood effects on Kenyan smallholder dairy farms from interventions addressing animal health and nutrition and milk quality*. Trop Anim Health Prod, 2012. **44**(2): p. 231-8.
100. Waid, J.L., et al., *Impact of a homestead food production program on women's empowerment: Pro-WEAI results from the FAARM trial in Bangladesh*. World Dev, 2022. **158**: p. 106001.
101. Yasmin, T., R. Khattak, and I. Ngah, *Facilitating Earthquake-Affected Rural Women Communities Toward Sustainable Livelihoods and Agriculture*. Agroecology and Sustainable Food Systems, 2013. **37**(5): p. 592-613.
102. Zoundji, G.C., et al., *Beyond Striga Management: Learning Videos Enhanced Farmers' Knowledge on Climate-Smart Agriculture in Mali*. Sustainable Agriculture Research, 2017. **7**(1).
103. Van Mele, P., J. Wanvoeke, and E. Zossou, *Enhancing rural learning, linkages, and institutions: the rice videos in Africa*. Development in Practice, 2010. **20**(3): p. 414-421.
104. D., S.B.G., *Education through cooperative extension*. 3 ed. 2012: University of Arkansas.
105. Bourdieu, P., *The forms of capital*, in *The sociology of economic life*. 2018, Routledge. p. 78-92.

106. Chambers, R. and G. Conway, *Sustainable rural livelihoods: practical concepts for the 21st century*. 1992: Institute of Development Studies (UK).
107. Polar V, Babini C, Flores P, Velasco C, & C. Fonseca (2017). Technology is not gender neutral: factors that influence the potential adoption of agricultural technology by men and women. *In: CGIAR Research Program on Roots, Tubers and Bananas*. International Potato Center, La Paz (Bolivia), 41 p. <https://hdl.handle.net/10568/90133>
108. Valente, T. W., & E.M. Rogers (1995). The Origins and Development of the Diffusion of Innovations Paradigm as an Example of Scientific Growth. *Science Communication*, 16(3), 242-273. <https://doi.org/10.1177/1075547095016003002>
109. Bernard, T., Doss, C., Hidrobo, M., Hoel, J., & C. Kieran. (2019). Ask me why: Patterns of intrahousehold decision-making. *World Development*, 125.
110. Coles, C. & J. Mitchell. (2011). Gender and Agricultural Value Chains: A Review of Current Knowledge and Practice and Their Policy Implications. *ESA Working Paper No. 11-05*. Rome: Agricultural Development Economics Division (ESA). <http://www.fao.org/3/a-am310e.pdf>
111. Palacios-Lopez, A., Christiaensen, L., & T. Kilic. (2017). How much of the labor in African agriculture is provided by women?. *Food policy*, 67, 52-63.
112. Farnworth, C. R., & Colverson, K. E. (2015). Building a gender-transformative extension and advisory facilitation system in Sub-Saharan Africa. *Journal of Gender, Agriculture and Food Security (Agri-Gender)*, 1(302-2016-4749), 20-39.
113. Mannathukkaren N. 'Enjoying life': Consumption, changing meanings, and social differentiation in Kerala, India. *Modern Asian Studies*. 2023;57(2):505-554. doi:10.1017/S0026749X22000257

Appendix A

Boolean codes and site hits sorted by database searched.

Database	Code (key terms)	Number of results
Agricola	("women" AND "agriculture" AND "extension")	239
Agricola	((wom*n" OR "gender") AND "agriculture" AND empowerment AND ("technology" OR "tech*"))	73
Agricola	("agriculture" AND "women" AND "empowerment")	189
Agricola	((("women" OR "gender") AND "agriculture" AND "extension" AND "empowerment")	37
Agricola	("agriculture" AND "extension" AND ("wom*" OR "women" OR "female" OR "girls" OR "gender"))	182
Agricola	((("women" OR "gender" OR "female") AND ("agriculture" OR "farm*" OR "crops") AND "extension" AND "empowerment")	55
Agricola	("women" OR "gender" OR "mothers") AND ("agriculture" OR "farm*" OR "crops")	6035
Agricola	((("women" OR "gender" OR "mothers" OR "female") AND "agriculture" AND ("extension" OR "Development") AND Empowerment)	130
Agricola	((("women" OR "gender" OR "mothers" OR "female") AND "agriculture" AND ("extension" OR "Development")) AND "Empowerment"	75
Agricola	(agri* AND extension AND technology AND (wom* or gender* or fem*))	72
Agricola	(agricultur* AND extension AND (wom* OR gender* OR female*))	316
Agricola	(agricultur* AND extension AND tech* AND (wom* OR gender* OR female*))	149
Agricola	("agricultur* extension" AND tech* AND (wom* OR gender*))	34
Agricola	("agricultur* extension" AND (gender AND women))	64
CABI	(women AND cash crop AND extension)	29
CABI	(farming AND extension AND vegetables AND women)	91
CABI	(farming AND extension AND vegetables AND women)	91
CABI	(((((women AND woman) OR gender) AND farms) OR growing) AND vegetables)	24485
CABI	((inputs AND technology) OR woman)	34260
CABI	(farming AND inputs AND women AND woman)	10
CABI	((gender AND farming) OR technology	1247707

CABI	(farming AND gender AND tools)	152
CABI	(farming AND gender AND tools)	542
CABI	(farming AND extension AND rural)	4548
CABI	(women AND technology AND farming)	770
CABI	("wom*" AND "agricultur*" AND "empowerment")	1453
CABI	("wom*" AND "agricult*" AND "Extension")	1385
CABI	("wom*" AND "agricult*" AND "tech*")	2891
CABI	("gender" AND "agricult*" AND "extension*")	1271
CABI	((("wom*" OR "women" OR "gender") AND "agricult*" OR "Agriculture" OR "farming" OR "husbandry") AND ("human" OR "person" OR "people"))	3934
CABI	("gender*" AND "empowerment*" AND "extension*")	140
CABI	((("agriculture" OR "agricultural technology") AND "gender" AND "development")	2315
CABI	((("women" OR "gender" OR "female") AND (agriculture" OR "farm" OR "farming systems") AND "extension")	4967
CABI	("gender*" AND "empowerment*" AND "food*")	377
SCOPUS	agriculture OR gender OR women AND technology	226
SCOPUS	agriculture AND woman AND empowerment OR gender	281
SCOPUS	women AND agriculture AND machinery AND gender AND cellphones	0
SCOPUS	women AND extension AND agriculture	271
SCOPUS	women AND agriculture AND technology	542
SCOPUS	women AND extension AND technology	428
SCOPUS	women AND agriculture AND machinery	72
SCOPUS	women AND agriculture AND inputs	156
SCOPUS	women AND technology OR agriculture	542
SCOPUS	women AND technology AND agriculture	542
SCOPUS	"agricultural extension" AND technology AND (girl* OR wom*)	2134
SCOPUS	"agricultural extension" AND tech* AND gender AND female	639
SCOPUS	agriculture AND extension AND tech* AND gender AND female	1595
SCOPUS	"agricultur* extension" AND tech* AND gender OR women	3571
SCOPUS	"agricultur* extension" AND gender OR women	4228

Appendix B

Dedoose Codes after coding papers used in systematic review of women’s empowerment in extension.

Id	Parent Id	Depth	Title	Weighted
1		0	Basic Paper Demographics	FALSE
2	1	1	Continent (regions per World Bank)	FALSE
3	2	2	East Asia and Pacific	FALSE
4	3	3	American Samoa	FALSE
5	3	3	Australia	FALSE
6	3	3	Brunei Darussalam	FALSE
7	3	3	Cambodia	FALSE
8	3	3	China	FALSE
9	3	3	Fiji	FALSE
10	3	3	French Polynesia	FALSE
11	3	3	Guam	FALSE
12	3	3	Hong Kong SAR, China	FALSE
13	3	3	Indonesia	FALSE
14	3	3	Japan	FALSE
15	3	3	Kiribati	FALSE
16	3	3	Korea, Dem. People's Rep.	FALSE
17	3	3	Korea, Rep.	FALSE
18	3	3	Lao PDR	FALSE
19	3	3	Macao SAR, China	FALSE
20	3	3	Malaysia	FALSE
21	3	3	Marshall Islands	FALSE
22	3	3	Micronesia, Fed. Sts.	FALSE
23	3	3	Mongolia	FALSE
24	3	3	Myanmar	FALSE
25	3	3	Nauru	FALSE
26	3	3	New Caledonia	FALSE
27	3	3	New Zealand	FALSE
28	3	3	Northern Mariana Islands	FALSE
29	3	3	Palau	FALSE
30	3	3	Papua New Guinea	FALSE
31	3	3	Philippines	FALSE
32	3	3	Samoa	FALSE

33	3	3	Singapore	FALSE
34	3	3	Solomon Islands	FALSE
35	3	3	Taiwan, China	FALSE
36	3	3	Thailand	FALSE
37	3	3	Timor-Leste	FALSE
38	3	3	Tonga	FALSE
39	3	3	Tuvalu	FALSE
40	3	3	Vanuatu	FALSE
41	3	3	Vietnam	FALSE
42	2	2	Europe and Central Asia	FALSE
43	42	3	Albania	FALSE
44	42	3	Andorra	FALSE
45	42	3	Armenia	FALSE
46	42	3	Austria	FALSE
47	42	3	Azerbaijan	FALSE
48	42	3	Belarus	FALSE
49	42	3	Belgium	FALSE
50	42	3	Bosnia and Herzegovina	FALSE
51	42	3	Bulgaria	FALSE
52	42	3	Channel Islands	FALSE
53	42	3	Croatia	FALSE
54	42	3	Cyprus	FALSE
55	42	3	Czech Republic	FALSE
56	42	3	Denmark	FALSE
57	42	3	Estonia	FALSE
58	42	3	Faroe Islands	FALSE
59	42	3	Finland	FALSE
60	42	3	France	FALSE
61	42	3	Georgia	FALSE
62	42	3	Germany	FALSE
63	42	3	Gibraltar	FALSE
64	42	3	Greece	FALSE
65	42	3	Greenland	FALSE
66	42	3	Hungary	FALSE
67	42	3	Iceland	FALSE
68	42	3	Ireland	FALSE
69	42	3	Isle of Man	FALSE
70	42	3	Italy	FALSE
71	42	3	Kazakhstan	FALSE
72	42	3	Kosovo	FALSE
73	42	3	Kyrgyz Republic	FALSE

74	42	3	Latvia	FALSE
75	42	3	Liechtenstein	FALSE
76	42	3	Lithuania	FALSE
77	42	3	Luxembourg	FALSE
78	42	3	Moldova	FALSE
79	42	3	Monaco	FALSE
80	42	3	Montenegro	FALSE
81	42	3	Netherlands	FALSE
82	42	3	North Macedonia	FALSE
83	42	3	Norway	FALSE
84	42	3	Poland	FALSE
85	42	3	Portugal	FALSE
86	42	3	Romania	FALSE
87	42	3	Russian Federation	FALSE
88	42	3	San Marino	FALSE
89	42	3	Serbia	FALSE
90	42	3	Slovak Republic	FALSE
91	42	3	Slovenia	FALSE
92	42	3	Spain	FALSE
93	42	3	Sweden	FALSE
94	42	3	Switzerland	FALSE
95	42	3	Tajikistan	FALSE
96	42	3	Türkiye	FALSE
97	42	3	Turkmenistan	FALSE
98	42	3	Ukraine	FALSE
99	42	3	United Kingdom	FALSE
100	42	3	Uzbekistan	FALSE
101	2	2	Latin America and the Caribbean	FALSE
102	101	3	Antigua and Barbuda	FALSE
103	101	3	Argentina	FALSE
104	101	3	Aruba	FALSE
105	101	3	Bahamas, The	FALSE
106	101	3	Barbados	FALSE
107	101	3	Belize	FALSE
108	101	3	Bolivia	FALSE
109	101	3	Brazil	FALSE
110	101	3	British Virgin Islands	FALSE
111	101	3	Cayman Islands	FALSE
112	101	3	Chile	FALSE
113	101	3	Colombia	FALSE
114	101	3	Costa Rica	FALSE

115	101	3	Cuba	FALSE
116	101	3	Curacao	FALSE
117	101	3	Dominica	FALSE
118	101	3	Dominican Republic	FALSE
119	101	3	Ecuador	FALSE
120	101	3	El Salvador	FALSE
121	101	3	Grenada	FALSE
122	101	3	Guatemala	FALSE
123	101	3	Guyana	FALSE
124	101	3	Haiti	FALSE
125	101	3	Honduras Trinidad and Tobago	FALSE
126	101	3	Jamaica	FALSE
127	101	3	Mexico	FALSE
128	101	3	Nicaragua	FALSE
129	101	3	Panama	FALSE
130	101	3	Paraguay	FALSE
131	101	3	Peru	FALSE
132	101	3	Puerto Rico	FALSE
133	101	3	Sint Maarten (Dutch part)	FALSE
134	101	3	St. Kitts and Nevis	FALSE
135	101	3	St. Lucia	FALSE
136	101	3	St. Martin (French part)	FALSE
137	101	3	St. Vincent and the Grenadines	FALSE
138	101	3	Suriname	FALSE
139	101	3	Turks and Caicos Islands	FALSE
140	101	3	Uruguay	FALSE
141	101	3	Venezuela, RB	FALSE
142	101	3	Virgin Islands (U.S)	FALSE
143	2	2	Middle East and North Africa	FALSE
144	143	3	Algeria	FALSE
145	143	3	Bahrain	FALSE
146	143	3	Djibouti	FALSE
147	143	3	Egypt, Arab Rep.	FALSE
148	143	3	Iran, Islamic Rep.	FALSE
149	143	3	Iraq	FALSE
150	143	3	Israel	FALSE
151	143	3	Jordan	FALSE
152	143	3	Kuwait	FALSE
153	143	3	Lebanon	FALSE
154	143	3	Libya	FALSE
155	143	3	Malta	FALSE

156	143	3	Morocco	FALSE
157	143	3	Oman	FALSE
158	143	3	Qatar	FALSE
159	143	3	Saudi Arabia	FALSE
160	143	3	Syrian Arab Republic	FALSE
161	143	3	Tunisia	FALSE
162	143	3	United Arab Emirates	FALSE
163	143	3	West Bank and Gaza	FALSE
164	143	3	Yemen, Rep.	FALSE
165	2	2	North America	FALSE
166	165	3	Bermuda	FALSE
167	165	3	Canada	FALSE
168	165	3	United States	FALSE
169	2	2	South Asia	FALSE
170	169	3	Afghanistan	FALSE
171	169	3	Bangladesh	FALSE
172	169	3	Bhutan Nepal	FALSE
173	169	3	India	FALSE
174	169	3	Lanka	FALSE
175	169	3	Maldives	FALSE
176	169	3	Pakistan	FALSE
177	169	3	Sri	FALSE
178	2	2	Sub-' Saharan Africa	FALSE
179	178	3	Angola	FALSE
180	178	3	Benin	FALSE
181	178	3	Botswana	FALSE
182	178	3	Burkina Faso	FALSE
183	178	3	Burundi	FALSE
184	178	3	Cabo Verde	FALSE
185	178	3	Cameroon	FALSE
186	178	3	Central African Republic	FALSE
187	178	3	Chad	FALSE
188	178	3	Comoros	FALSE
189	178	3	Congo, Dem. Rep.	FALSE
190	178	3	Congo, Rep	FALSE
191	178	3	Côte d'Ivoire	FALSE
192	178	3	Equatorial Guinea	FALSE
193	178	3	Eritrea	FALSE
194	178	3	Eswatini	FALSE
195	178	3	Ethiopia	FALSE
196	178	3	Gabon	FALSE

197	178	3	Gambia, The	FALSE
198	178	3	Ghana	FALSE
199	178	3	Guinea	FALSE
200	178	3	Guinea'-Bissau	FALSE
201	178	3	Kenya	FALSE
202	178	3	Lesotho	FALSE
203	178	3	Liberia	FALSE
204	178	3	Madagascar	FALSE
205	178	3	Malawi	FALSE
206	178	3	Mali	FALSE
207	178	3	Mauritania	FALSE
208	178	3	Mauritius	FALSE
209	178	3	Mozambique	FALSE
210	178	3	Namibia	FALSE
211	178	3	Niger	FALSE
212	178	3	Nigeria	FALSE
213	178	3	Rwanda	FALSE
214	178	3	São Tomé and Príncipe	FALSE
215	178	3	Senegal	FALSE
216	178	3	Seychelles	FALSE
217	178	3	Sierra Leone	FALSE
218	178	3	Somalia	FALSE
219	178	3	South Africa	FALSE
220	178	3	South Sudan	FALSE
221	178	3	Sudan	FALSE
222	178	3	Tanzania	FALSE
223	178	3	Togo	FALSE
224	178	3	Uganda	FALSE
225	178	3	Zambia	FALSE
226	178	3	Zimbabwe	FALSE
227	1	1	Institution	FALSE
228	227	2	International	FALSE
229	228	3	International Government	FALSE
230	228	3	International NGO	FALSE
231	228	3	International Non'-Profit	FALSE
232	228	3	International Other	FALSE
233	228	3	International University	FALSE
234	227	2	National	FALSE
235	234	3	National Government	FALSE
236	234	3	National NGO	FALSE
237	234	3	National Non'-Profit	FALSE

238	234	3	National Other	FALSE
239	234	3	National University	FALSE
240	1	1	Objectives	TRUE
241		0	Clarification Needed	FALSE
242		0	Coder	FALSE
243	242	1	Coder A	FALSE
244	242	1	Coder B	FALSE
245	242	1	Coder C	FALSE
246	242	1	Coder L	FALSE
247	242	1	Coder M	FALSE
248	242	1	Coder N	FALSE
249	242	1	Coder S	FALSE
250	242	1	Coder T	FALSE
251		0	DELETE	FALSE
252		0	Disempowering Women	FALSE
253		0	Interesting	FALSE
254		0	Sample Demographics	FALSE
255	254	1	Gender Aggregation	FALSE
256	255	2	Aggregated	FALSE
257	255	2	Disaggregated	FALSE
258	254	1	Gender Representation	FALSE
259	258	2	Men	FALSE
260	258	2	Mixed Sample	FALSE
261	258	2	Non-'Binary	FALSE
262	258	2	Women	FALSE
263	254	1	Sample Size	FALSE
264		0	Study Demographics	FALSE
265	264	1	Agricultural emphasis	FALSE
266	265	2	Agribusiness	FALSE
267	265	2	Farm Management	FALSE
268	267	3	Abiotic / Environmental	FALSE
269	267	3	Biological Response	FALSE
270	265	2	Production	FALSE
271	270	3	Animal Products	FALSE
272	270	3	Crops (Based on FAO Doc)	FALSE
273	270	3	Market/Non-'Edible goods	FALSE
274	265	2	Technology	FALSE
275	264	1	Extension Type	FALSE
276	275	2	Consulting	FALSE
277	276	3	Farm or home visits	FALSE
278	276	3	Telephone answering/advice systems	FALSE

279	276	3	Veterinary Services for livestock	FALSE
280	275	2	Development	FALSE
281	280	3	GM/Biofortification	FALSE
282	280	3	Land Tenure	FALSE
283	280	3	Micro-'credit	FALSE
284	280	3	Regionally specific policy	FALSE
285	280	3	Tool innovation	FALSE
286	275	2	Farmer-'to-'Farmer (facilitated or initiated by extension agents/agency)	FALSE
287	286	3	Clubs	FALSE
288	286	3	Debates	FALSE
289	286	3	Farm/field tours	FALSE
290	286	3	Farmer-'led demonstrations	FALSE
291	286	3	Role-'playing	FALSE
292	286	3	Self-'help groups	FALSE
293	286	3	Training of trainers	FALSE
294	275	2	Public awareness	FALSE
295	294	3	Blogs	FALSE
296	294	3	Case studies	FALSE
297	294	3	Newsletters	FALSE
298	294	3	Podcasts	FALSE
299	294	3	Radio	FALSE
300	294	3	Social Media (Instagram, Twitter, Facebook)	FALSE
301	294	3	TV	FALSE
302	294	3	YouTube	FALSE
303	275	2	Research for improving extension/figuring out what works	FALSE
304	303	3	Simulation	FALSE
305	275	2	Workshops/Meetings/Courses	FALSE
306	305	3	Camps	FALSE
307	305	3	Community forum	FALSE
308	305	3	Conferences	FALSE
309	305	3	Debates	FALSE
310	305	3	Field days	FALSE
311	305	3	Labs	FALSE
312	305	3	Lectures	FALSE
313	305	3	Online courses	FALSE
314	305	3	Panel presentations	FALSE
315	305	3	Q&A sessions	FALSE

316	305	3	Research station tours, demonstrations	FALSE
317	305	3	Role'-playing	FALSE
318	305	3	Short courses	FALSE
319	305	3	Teleconferences	FALSE
320	264	1	Target Population	FALSE
321	320	2	Differently abled	FALSE
322	320	2	Elderly	FALSE
323	320	2	Impoverished	FALSE
324	320	2	Indigenous	FALSE
325	320	2	Landless	FALSE
326	320	2	LGBTQ	FALSE
327	320	2	Racial /social / ethnic minority	FALSE
328	320	2	Rural	FALSE
329	320	2	Women	FALSE
330	320	2	Youth	FALSE
331	264	1	Type of Study	FALSE
332	331	2	Agricultural	FALSE
333	331	2	Economic	FALSE
334	331	2	Educational	FALSE
335	331	2	other	FALSE
336	331	2	Policy	FALSE
337	331	2	Research	FALSE
338	331	2	Social	FALSE
339		0	Study Results	FALSE
340	339	1	Empowerment Type	FALSE
341	340	2	Increases in Achievements for women	FALSE
342	340	2	Increases in agency for women	FALSE
343	340	2	Increases in resources for women	FALSE
344	339	1	Impacts	FALSE
345	344	2	Agricultural	FALSE
346	344	2	Economic	FALSE
347	344	2	Educational	FALSE
348	344	2	Environmental	FALSE
349	344	2	Other	FALSE
350	344	2	Social	FALSE
351	339	1	Outcomes	FALSE
352	339	1	Research Conclusion	FALSE
353		0	Well Rounded Article	FALSE

Appendix C

Complete list of participating organizations in the papers reviewed in this systematic review on women's empowerment in extension.

AFC India Limited
Agency for Aquaculture Development
Agricultural Transformation Agency
Agricultural University Beijing
Agro-biotech University Belgium
Agro-Insight-Belgium (formerly Africa Rice Center-Benin) CABI
Amity University India
Anamolbiu
Asian Vegetable Research and Development Center ADRDC
Association of Sytribai Phule Mahila Ekatma Smai Mandal- NGO of Hedgewar Hospital
Atlantic Veterinary College Canada
Banas thali Vidyapith
Bangladesh Agricultural Advisory Society
Bangladesh Agriculture Extension Programme
Bangladesh Agriculture Research Institute
Bangladesh Community Based Dairy Foundation
Bangladesh Ministry of Agriculture
Bangladesh National Government
Bill and Melinda Gates Foundation
Brackish Water Fish farmers Dev Agency
Brigham Young University (BYU)
Bunda College of Agriculture
Canadian Mennonite University of Canada
Center for Development Research Germany
Center for Plant Genetics and Breeding, University of Western Australia
Central Institute of Fisheries and Technology
CIAL (Honduran research committees)
Concern Universal
Consortium for Improving Ag- base livelihoods in Central Africa (IIAT)
Consultative Group for International Agricultural Research (CGAIR)
Cornell University
CSIR- Water Research Institute
Dawgana Sugarcane Trust
Delhi School of Economics
Department of Ag Extension Kerala Agricultural University
Department of Agriculture and Agriculture Research
Department of Global Health and Population at the Harvard T.H. Chan School of Public Health
Department of Surgery and Obstetrics, Bangladesh Agricultural University

Digital Green Foundation
District Administration
Emory University
Environment & Climate Research Center
Ethiopia Ministry of Agriculture
Ethiopian Institute of Agricultural Research
Faculty of Built Environment, Universiti Teknologi Malaysia
Farmers Helping Farmers
FREQUE- Freedom of the Queens
Fundación para la investigación participativa con Agricultores de Honduras- CIAT
Gambia National NGO
Georgetown University
Gokhale Institute of Politics
Guelph University
Haans Newman Stifung
Hawassa University
Heidelberg University
Heifer International
Hellen Keller International
Holetta Research Center
ICUN- CEEP's Theme of Governance, Equity, and Rights India
IMRB Social Research Institute
India National Government
Indian Council of Agricultural Research New Delhi
Indian Council of Agriculture
Indian Government Extension Board
Indian Institute of Management
Indian State Fisheries Department
Indonesian Regional Government
Institute de Technologie Alimentaire (ITA)
Institute of Chemical Technology- Indian OIul Odisha Campus
Institute of Chemical Technology Mumbai, India
Institute of Public Health, Berlin University
Institute of Rural Management, India
Institute of Terrestrial Ecosystems
International Center for Diarrheal Research
International Center for Insect Physiology and Ecology (ICIPE)
International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)
International Food Policy Reserch Intitute (IFPRI)
International Institute for Tropical Ag (IITA)
International Maize and Wheat Improvement Center (CIMMYT)
International Potato Center (CIP)
International Rice Reserch Intitute (IRRI)
International Water Management Institute (IWMI)
International Water Management Institute Sri Lanka

Iowa State University
IUFRO Gender and Forestry Working Group
James Cook University
JNKVV India Agricultural University
Johns Hopkins University
Kaninji Lake Project
Karnataka Health Promotion Trust
Kenya Ag Research Institute
Kenya Dairy Companies
Kenya Government Dairy Extension
Kenya Ministry of Agriculture
Kenya National Government
Kerala Agriculture University
Kissan Welfare Association Bahawalpur, Punjab Province
KVK India
Kwame Nkrumah University of Science and Technology
Landing Together Films
Lee Kuan Yew School Public Policy
Leverhulme Center for Integrative Research in Agriculture and Health
Lilongwe University of Agricultural, Natural Resources, Extension
Local Government
Local Initiatives for Biodiversity, Research, and Development
London School of Tropical Medicine
Madurai Kamaraj University
Malawi Government Extension Program
Malawi National Government
Mali Government Extension Board
Marine Products Export Development Authority
Masai Women's Development Organization
Massey University
MCRS Sagram, Skaust of Kashmir
Michigan State University
Ministry of Rural Areas and Employment
Ministry of Rural Development India
Monash University
MS Swaminathan Research Foundation
Narendra Deva University of Agricultural Technology
National Agricultural Research Center
National Agriculture and Forestry Institute- Laos / Provincial Ag and Forestry Office
National Dairy Board/Council- Indian Government
National Institute of Agriculture
National IPM Programme, Institute of Plant and Environmental Protection, national Agricultural
Research center, Pakistan agricultural research council
National University of Agriculture Benin
National University of Ireland Galway

National Watershed Development Program for Rainfed Research
Natural Resources College
Nepal Agriculture Research Council
Nigeria Government Extension
Oxfam
Pakistan National Government
Pakistan National Integrated Pest management Programme
Pennsylvania University
Plant Resources of Tropical Africa (PROTA) (retired NGO)
PolliSree
Pontifica Universidad Catolica de Peru
Potsdam Institute for Climate Impact Research
Professional Assistance for Development (PRADAN)
Program for Cotton Asia- FAO-EU Indian Govt partnership
Purdue University
Radboud University
Rajiv Gandhi College of Veterinary Sciences
Rajiv Gandhi Mahila Charitable Trust
Reserve Bank of India
Rothamsted Research UK
Rural Development Academy
San Diego State University
Savanna Ag Research Institute (CSIR Center)
School of Life and Environmental Sciences
School of Public Health, The University of Sydney
Self Employed Womens Association (SEWA)
Social Economy Department, Brawijaya University
SPRING
State Institute for Rural Development
State Women's Development Agency
Sumaq Life LLC
Swinburne University
Syarif Hidayatullah Islamic University - Jakarta
Tajikistan National Government
Thngamara Mobila Sabui Sangha (TMSS)
Ujamaa Community Resource Trust
UK Department for International Development
United Nations Educational, Scientific and Cultural Organization (UNESCO)
United States Agency for International Development (USAID)
University Illinois Urbana-Champaign
University of Abomey- Calavi
University of Adelaide
University of Agricultural Science Dharwad India
University of Agriculture Abeokuta
University of Agriculture Sciences Bangalore, India

University of Agronomy and Agricultural Extension Bangladesh
University of Antwerp
University of Bern Switzerland
University of California, Davis
University of Cape Town Africa
University of Colorado at Boulder
University of Florida
University of Ghana
University of Glasgow
University of Gothenburg Sweden
University of Guelph
University of Iowa
University of Laos
University of Leuven Belgium
University of Melbourne
University of Nairobi
University of Natural Resources and Life Sciences
University of Nebraska
University of New England
University of North Carolina
University of Passau Germany
University of Prince Edward Island
University of Professional Studies Accra
University of Reading
University of Saskatchewan
University of South Florida Peace Corps Masters Program
University of Sunshine Coast
University of the Gambia, Brikama
University of Toronto
University of West England
University of Wollongong
University of Zimbabwe
Unspecified Malawi Local NGO's
Unspecified Mali Local NGO's
Unspecified Tanzania National NGO's
Unspecified Tanzania National Partners
Varghese Jurien Policy Lab (IRMA)
Vigyan Prasar- Deep sci and tech Govt India
Voluntary Association for Rural Development
Voluntary Association for Rural Reconstruction and Appropriate Technology
Wageningen The Hauge- Netherlands
Wageningen University
Wakulima Dairy Ltd
Waolaita University
Wesflaische University, Muster Germany

Western Sydney University
Wolaita Sodo University (Ethiopia)
World Agroforestry Center
World Food Program (WFP)
World Vision Ghana
Yezin Agriculture University