



Women-Led Groups as Pathways to Women's Empowerment and One Health Practices in Cambodian Agriculture

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Abstract

Women play a vital role in Cambodian agriculture, yet their leadership, decision-making power, access to knowledge, and adoption of One Health (OH) practices remain constrained. Women-led groups (WLGs) have emerged as community-based platforms to promote women's empowerment, collective action, and knowledge sharing, but empirical evidence of their impacts remains limited. This study examines how WLG participation contributes to women farmers' empowerment, agricultural knowledge, and adoption of OH practices, while exploring the differentiated roles of WLG leaders and members. Using data from the Agricultural-based Growth and Resilience Opportunities for Women (AGROW) project impact evaluation, the study applies a mixed-methods approach combining Difference-in-Differences (DiD) analysis of baseline and endline data from 254 women—138 WLG participants and 116 non-participants—with qualitative evidence from five key informant interviews, eight focus group discussions, and nine in-depth interviews. The findings show that WLG participation significantly enhances women's empowerment and contributes to improvements in agricultural knowledge and selected OH practices. Qualitative evidence indicates that WLGs facilitate peer-to-peer learning, with leaders serving as local knowledge intermediaries. Overall, WLGs demonstrate strong potential to advance women's empowerment, knowledge diffusion, and sustainable agricultural and OH practices in rural Cambodia.

Keywords

Women's empowerment, women-led groups, One Health, agriculture, Cambodia

Introduction

The One Health (OH) concept emphasises the interconnectedness of human, animal, and environmental health, stressing that health challenges cannot be addressed in silos (Evans and Leighton 2014; Mackenzie and Jeggo 2019). The origins of OH can be traced to early recognition of the relationship between environmental conditions and human health, which was later strengthened through the integration of human and veterinary medicine (Evans and Leighton 2014). Building on this foundation, the OH approach has gained increasing global attention in response to major

zoonotic disease outbreaks such as avian influenza (H5N1), Severe Acute Respiratory Syndrome (SARS), and later Coronavirus Disease-2019 (COVID-19). At the same time, globalisation, urbanisation, and agricultural intensification have heightened risks associated with zoonotic diseases, antimicrobial resistance (AMR), and environmental degradation, prompting the formal endorsement of OH by international organisations including World Health Organisation (WHO), Food and Agriculture Organisation (FAO), World Organisation for Animal Health (OIE), and the World Bank (WHO, FAO, and OIE 2019). Empirical studies

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demonstrate how OH improves food safety, reduces zoonotic transmission, and enhances environmental resilience. Emikpe et al. (2024) showed that OH-driven sustainable agriculture reduces the risks of intensive farming by strengthening animal husbandry, promoting vaccination, improving biosecurity, and encouraging biodiversity conservation. Zhang et al. (2024) further highlighted OH's role in addressing AMR and its capacity to minimise the use of agrochemicals and antibiotics that threaten both human and animal health.

In Cambodia, the OH approach has evolved from disease-specific multisectoral responses towards broader institutional coordination across human, animal, and environmental health. Multisectoral OH collaboration emerged during the avian influenza outbreak in 2006 and was subsequently strengthened through the establishment of the Zoonotic Disease Technical Working Group (Zoo-TWG), followed by the Antimicrobial Resistance Technical Working Group (AMR-TWG) in 2017 and the Cambodia One Health University Network in 2019. More recently, representatives from the Ministry of Health (MOH), Ministry of Agriculture, Forestry and Fisheries (MAFF), Ministry of Environment (MOE), and other national and international partners jointly prioritised zoonotic diseases of national concern and developed action areas covering OH coordination, workforce development, public communication, preparedness, research, surveillance, outbreak response, and prevention and control (CDC 2025). In 2026, Cambodia further strengthened its national and international commitment to OH through the “One Health for Cambodia” initiative and its participation in the One Health Summit 2026 in Lyon, France (MFAIC 2026). The national initiative brought together high-level representatives from the MOH, MAFF, and MOE and focused on zoonotic and vector-borne diseases, AMR, sustainable food systems, integrated surveillance, and biosecurity (FAO 2026).

A key initiative is the Cambodian Applied Veterinary Epidemiology Training (CAVET) programme, which focuses on capacity building for veterinarians, medical doctors, laboratory technicians, and wildlife officers in field epidemiology, outbreak response, and zoonotic disease management (CDC 2023). OH approaches

have also been implemented through community-level agricultural and health interventions led by non-governmental organisations, where local participation plays an important role in strengthening animal health and raising awareness of food safety and sanitation (AVSF 2021). Collectively, these initiatives demonstrate Cambodia's growing commitment to applying OH principles across multiple domains.

Despite growing institutional attention to OH in Cambodia, translating OH principles into sustained practices among farmers, particularly women farmers, remains challenging. Many women farmers face constraints such as limited access to capital, low decision-making power, and insufficient knowledge. They may also lack adequate professional and extension support to strengthen their capacity and skills in implementing OH practices (AVSF 2021). These constraints directly affect women farmers' ability to implement OH practices in concrete ways. For instance, limited control over household and farming decisions may restrict their ability to invest in livestock vaccination, biosecurity improvements, or changes in production practices, while limited financial resources may constrain access to necessary inputs and services (AVSF 2021). Insufficient knowledge and weak extension support further hinder the application of integrated OH principles in farming systems. Together, these barriers suggest that technical training alone may not be sufficient and highlight the importance of women's agency, access to knowledge, and decision-making capacity in supporting the adoption of OH practices.

Given the central role of women in Cambodian agriculture, strengthening women's empowerment is not only a matter of equity but also a crucial pathway for improving productivity, food security, and resilience. Empirical evidence from other contexts, including Bangladesh (Sraboni et al. 2014), Vietnam (Nguyen et al. 2024), Ghana (Malapit and Quisumbing 2016), and Uganda (Meinzen-Dick et al. 2019), demonstrates that women's empowerment is positively associated with greater adoption of agricultural technologies, improved household food security, and better child nutrition outcomes. These findings suggest that interventions that enhance women's agency and capacity can have broad and lasting benefits for both families and communities.

Similar to self-help groups, a women-led group (WLG) refers to a voluntary gathering of female farmers who share common needs or challenges in farming activities and seek to strengthen members' skills, capacities, and socioeconomic well-being. Collective action models, such as self-help groups, are recognised for enhancing women's decision-making and income generation (Nangia 2006). However, their potential role in connecting women's empowerment with knowledge diffusion and the adoption of OH practices remains underexplored, particularly in rural agricultural contexts.

From a policy perspective, an important challenge is not only whether OH is recognised at institutional and national levels, but also how national OH priorities can be translated into sustained practices among farmers and rural communities. Existing research has largely examined women's empowerment through collective action and the implementation of OH as separate areas of inquiry. Limited empirical evidence exists on whether and how women-led community groups can connect these agendas by simultaneously strengthening women's agency, facilitating knowledge diffusion, and supporting the adoption of OH practices at farm and community levels. Moreover, little is known about the differentiated roles played by leaders and ordinary members within such groups, including whether leaders function primarily as beneficiaries or as intermediaries who facilitate the diffusion of knowledge and practices. This study addresses these gaps by examining WLGs not only as platforms for women's empowerment but also as potential community-level mechanisms for knowledge exchange and the operationalisation of selected OH practices in rural Cambodia.

Methodology

This study applied a mixed-methods approach, combining quantitative and qualitative data from the impact evaluation of the Agricultural-based Growth and Resilience Opportunities for Women (AGROW) project conducted by CDRI in Battambang province (May–June 2025). The project, implemented from January 2022 to December 2024, aimed to enhance resilience, economic security, and gender equality through sustainable agriculture under an OH framework. The

project benefited over 21,000 individuals, of whom 60 percent were women. The project's programme included agricultural training, input subsidies, animal health support, OH concepts and practices, and gender-focused capacity building. Within this approach, WLGs served as community platforms for training, knowledge sharing, peer learning, and the strengthening of women's participation in agricultural and community activities.

While drawing on this dataset, the study did not assess overall project impact but instead focused on women's empowerment, particularly the role of WLGs. The study analysed quantitative data from 254 female respondents, including 138 treatment participants (26 WLG leaders and 112 members) and 116 control participants. The DiD models were estimated separately for WLG leaders and members to examine changes in outcomes for each group relative to non-participants. Given the small number of WLG leaders, leader-specific estimates are interpreted cautiously. The qualitative component consists of five key informant interviews (KIIs), eight focus group discussions (FGDs), and nine in-depth interviews (IDIs). Male respondents were excluded to maintain a focus on women, who represented the majority of beneficiaries and were central to WLG participation. This study employed a DiD approach to estimate the impacts of participation in WLGs on women's empowerment, knowledge, and OH practices. The analysis compared changes in outcomes between treatment and control groups before (2022) and after (2024) the intervention. The DiD model included treatment, time, and interaction terms, where the interaction coefficient captured the estimated intervention effect on key outcome indicators, including the Women Empowerment Index (WEI), commodity-specific knowledge indices, and the OH Practice Index (OHI). The DiD estimator is obtained through the interaction term between treatment and post.

The empirical specification is given by:

$$Y_{it} = \beta_0 + \beta_1 Treat_i + \beta_2 Post_t + \beta_3 (Treat_i \times Post_t) + \epsilon_{it}$$

where Y_{it} represents the outcome of interest for individual i at time t , including the Women Empowerment Index (WEI), commodity-specific Knowledge Indices (chicken, cattle, and cricket),

and the OH Practice Index (OHI). $Treat_i$ is a binary variable indicating whether the individual belongs to the treatment group, and $Post_t$ indicates the post-intervention period. The coefficient β_3 captures the DiD estimate of the intervention effect¹.

The analytical sample for this study was already smaller than the original dataset due to data availability and the development of outcome indices. Further application of propensity score matching (PSM) reduced the sample by excluding observations outside the common support region, which may decrease statistical power and affect the representativeness of the findings. Therefore, DiD was maintained as the primary estimation method, while PSM was applied as a robustness check to assess the consistency of the results.

Complementing the quantitative findings, qualitative data were analysed using thematic analysis to explore changes in women's roles, decision-making power, knowledge, and OH practices in farm production. A combination of deductive and inductive coding was applied, where initial codes were developed based on the study objectives and relevant literature, while additional themes emerged from the data during analysis. The coding and theme (e.g. a sense of self-worth, behavioural changes, leadership roles) development process focused on identifying recurring patterns and perspectives across participants to better understand how WLGs contribute to women's empowerment and the adoption of OH practices. Verbatim accounts were selected to illustrate each theme and represent the respondents' voices.

Key findings

Socio-demographic of the respondents

Table 1 shows that the sample includes 254 female respondents, with 138 in the treatment group (26 leaders and 112 members of women-led groups) and 116 in the control group. Both groups of households are engaged in different livelihood activities, including chicken raising, cattle production, and cricket farming. Poverty levels are relatively comparable, with ID-Poor households accounting

for 28 percent in the treatment group and 34 percent in the control group, suggesting similar levels of economic vulnerability. The treatment group has a slightly larger average household size (5 vs 4 members) and age of respondents (45 vs 49 years). Education profiles reveal that primary education is the most common level in both groups, though lower secondary education is more prevalent in the treatment group (23.19 percent vs. 16.38 percent). This distribution reflects the generally low to moderate education levels among the treatment and control groups.

Female farmers in the treatment group operate larger landholdings compared to the control group on average (1.43 ha vs 1.14 ha) and demonstrate greater agricultural diversification (3 vs 2 crops). Greater diversification may reflect different livelihood opportunities and adaptation strategies among female respondents from both groups. Although the treatment group shows some initial advantages in education, landholding size, and diversification, these differences are addressed through Propensity Score Matching (PSM) and DiD. These methods control for observable baseline characteristics and mitigate selection bias, thereby strengthening the validity of the impact estimates.

Women's empowerment and roles of women-led groups

Table 2 presents the DiD estimates of participation in WLGs on the Women Empowerment Index (WEI), distinguishing between leaders and members. The indicators were coded and normalised on a 0–1 scale, with higher values indicating greater empowerment. The WEI was calculated as the unweighted average of the 12 indicators, with equal importance assigned to each component. The index captures women's participation in gender-related discussions, ability to influence decisions, attitudes toward gender equality and shared household responsibilities, involvement in household decision-making, and perceived influence on community and household decisions.

The results show significant positive effects for both leaders (0.230) and members (0.161), indicating that both groups experienced greater empowerment gains relative to non-participants.

¹ Details of the index construction are provided in Supplementary Appendices A and B, available upon request.

Table 1: Summary of household socio-demographics for both beneficiaries and non-beneficiaries

Socio-demographic	Treatment	Control
<i>Total Sample</i>	<i>138</i>	<i>116</i>
- Chicken	53	66
- Cattle	51	50
- Cricket	34	0
- Leader of women-led group	26	0
- Member of women-led group	112	0
<i>ID-Poor status (%)</i>		
ID-Poor	27.54	34.48
Non-ID Poor	72.46	65.52
Average HH size	5.00	4.00
Average age	45.00	49.00
<i>Education level (%)</i>		
- None	15.22	23.28
- Primary	54.35	52.59
- Secondary	23.19	16.38
- Highschool	6.52	6.03
- Vocational training	0.00	0.86
- University	0.72	0.86
<i>Farm characteristics</i>		
Average size of farming land (ha)	1.43	1.14
Agriculture diversification (average number)	2.70	1.90

Source: Authors' calculations

Table 2: The impact of participation in WLGs on women's empowerment by women as leaders and members

Variables	Leaders	Members
treat	-0.037 (0.041)	-0.051** (0.025)
post	0.074*** (0.011)	0.074*** (0.011)
DiD	0.230*** (0.047)	0.161*** (0.023)
Constant	0.578*** (0.016)	0.578*** (0.016)
Observations	284	456
R-squared	0.219	0.230

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Source: Authors' calculations

The larger effect on leaders suggests that leadership roles further enhance empowerment. The negative baseline coefficient (significant for members) indicates lower initial empowerment among participants, supporting the notion that the observed gains are programme-driven.

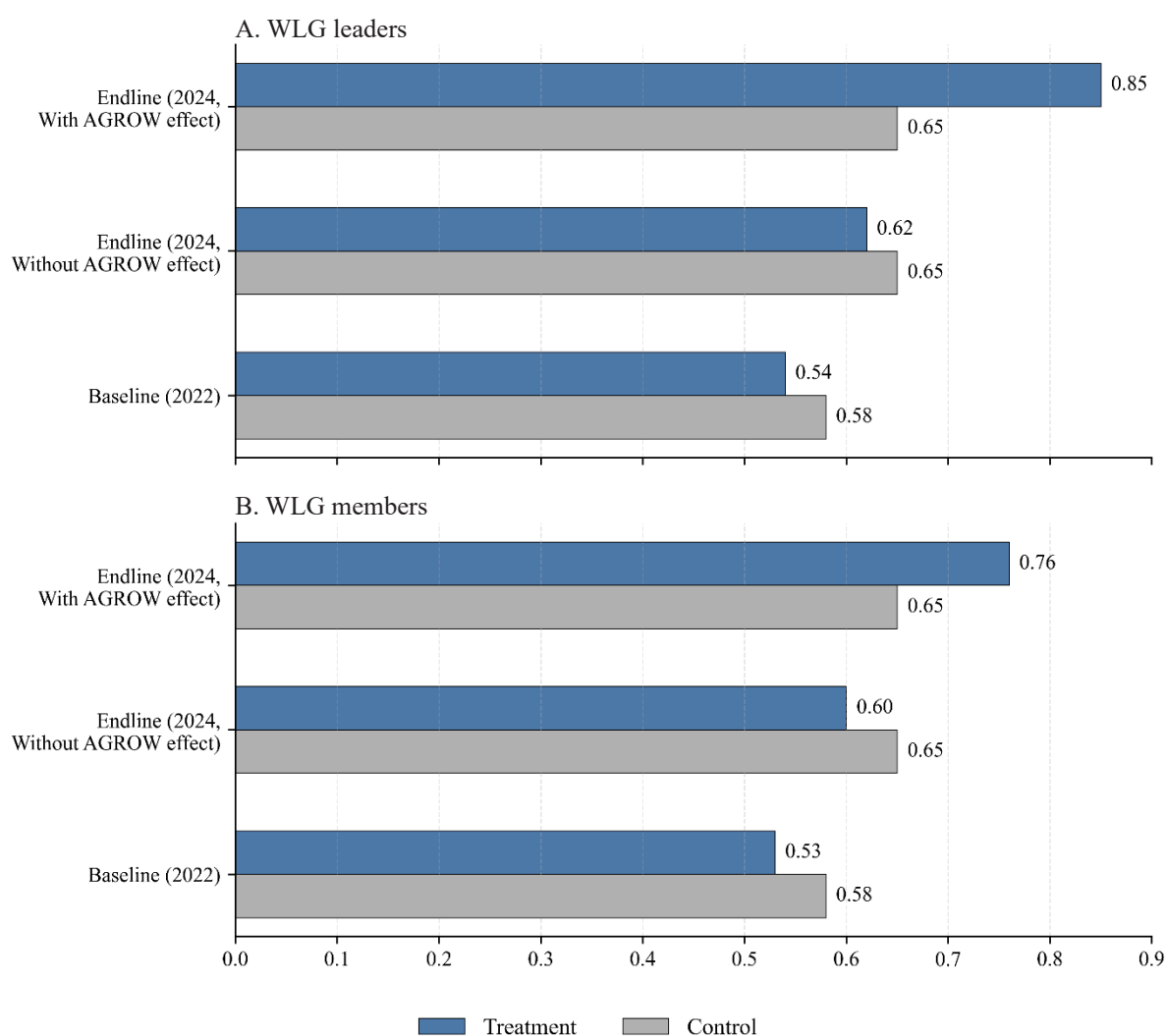
Although empowerment improved over time in both models (post = 0.074), the positive and significant DiD estimates indicate additional empowerment gains among both WLG leaders and members relative to non-participants. The predicted values show substantial increases, particularly among leaders (0.541 to 0.845), as indicated in Figure 1, compared to the smaller gains in the control group.

The findings from the KIIs and FGDs showed that WLGs serve as important community-based platforms for advancing women's empowerment,

particularly among women farmers. These groups create spaces for knowledge exchange, collective problem-solving, and peer support in agriculture, gender, and environmental practices. Women farmers as leaders play critical roles in strengthening agency, expanding access to resources, facilitating peer-to-peer learning, and building capacity. They function not only as farmers but also as key resource persons and supportive influence within their communities.

As leaders, women applied new skills to improve farming and increase household income, while also gaining social recognition, confidence, and greater mobility beyond the household. One woman leader expressed that *“My involvement as leader of the women-led group enabled me to engage more actively outside the home and become a well-known figure in my village.”* Peer-to-peer learning further

Figure 1: Women's empowerment index among WLG leaders and members



Source: Authors' calculations

amplified these outcomes by enabling women to share knowledge and support others, creating a ripple effect of empowerment. Additionally, women's leadership contributed to more equitable household decision-making, reflecting a positive shift in intra-household power dynamics, where women's voices are increasingly valued.

Regarding WLG members, the study showed that they experienced significantly greater benefits than non-members, particularly in terms of access to knowledge, learning opportunities, and positive changes in gender roles and household decision-making. These benefits form a strong foundation for women's empowerment in agriculture. Notably, WLG participation enhances the confidence and personal capacity of their members, helping them overcome reluctance and fear in communication and economic activities. Beyond technical knowledge, WLGs provide an enabling environment that encourages self-expression, business engagement, and active participation in communities, leading to increased self-worth among women.

At the household level, women as members reported more collaborative relationships with their spouses, including shared responsibilities and joint decision-making. A respondent expressed that *"My husband now helps me to complete the work fast when I am busy."* Increased confidence enables women to negotiate more effectively and play a greater role in decisions, particularly in agricultural activities.

Knowledge improvement through women-led groups

Table 3 presents the DiD estimates of the impact of participation in WLGs on knowledge improvement across key agricultural activities, distinguishing between the leaders and members. The knowledge indices capture respondents' technical understanding of livestock production and farm management practices, which are measured on a 0–1 scale.

The results show positive and statistically significant effects in several cases, particularly for members engaged in chicken production (0.168***) and for both leaders (0.157***) and members (0.126***) engaged in cattle production. These findings indicate that WLG participation contributed to improved agricultural knowledge among both leaders and members, although the pattern of effects varied by commodity and group. In contrast, the effect for leaders engaged in chicken production (0.031) is positive but not statistically significant, indicating no statistically detectable additional knowledge gain for this group.

The positive post coefficient for chicken (0.055***) indicates an overall improvement in chicken-related knowledge over time in both models, while the negative post coefficient for cattle (−0.161***) indicates an overall decline in cattle-related knowledge over time. Importantly, the positive and significant DiD estimates for cattle indicate that WLG leaders and members

Table 3: Impact of participation in women-led groups on knowledge improvement by women as leaders and members

Variables	Chicken		Cow	
	Leaders	Members	Leaders	Members
treat	0.053 (0.047)	0.003 (0.033)	0.091 (0.060)	0.024 (0.032)
post	0.055*** (0.019)	0.055*** (0.019)	−0.161*** (0.020)	−0.161*** (0.019)
did	0.031 (0.047)	0.168*** (0.032)	0.157*** (0.053)	0.126*** (0.036)
Constant	0.3355*** (0.020)	0.336*** (0.019)	0.441*** (0.021)	0.441*** (0.021)
Observations	158	212	116	186
R-squared	0.068	0.229	0.333	0.224

Note: Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: Authors' calculations

experienced more favourable changes in knowledge relative to non-participants despite this overall declining time trend. Cricket-related knowledge was assessed descriptively because data were available for only one survey period and no comparable control group was available, precluding DiD estimation. The mean cricket knowledge index was 0.793 among WLG leaders and 0.661 among WLG members.

Smaller or non-significant effects among leaders may reflect differences in their prior experience and capacity. Qualitative findings suggest that leaders were often selected based on their existing experience and capacity, which may have left less scope for measurable improvement. This potential “ceiling effect” may help explain why some leader-specific estimates were smaller or not statistically significant.

The findings from FGDs showed that leaders of WLGs act as key knowledge intermediaries, translating technical training into practical, locally relevant guidance for members and the wider community. Through capacity-building activities, they developed expertise in areas such as animal vaccination, environmental management, food safety, gender, and OH. They shared this knowledge through peer learning and community engagement. Beyond simple information transfer, they adapt and contextualise knowledge to local needs, while also facilitating dialogue, demonstrations, and collective problem-solving. This highlights their role as crucial catalysts bridging external knowledge and local practice, promoting sustained learning and behavioural change.

Compared to non-members, WLG members demonstrate improved knowledge and skills, particularly in agriculture, OH, environmental management, food safety, and gender knowledge. In contrast, non-members showed limited awareness and more adherence to unequal gender norms and decision-making patterns than members. Learning among WLG members is further strengthened through peer-to-peer and experiential approaches, where knowledge is continuously shared, reinforced, and adapted within the community. This dynamic learning environment enhances practical application and enables knowledge to be spread more effectively among farmers. One respondent

recalled, “*The women-led group visited my place. We shared knowledge with each other, especially about making chicken feed. Others saw how fast my chickens grew and asked for advice.*”

Adoption of OH practices through women-led groups

Table 4 presents the DiD estimates of the impact of participation in women-led groups on the adoption of OH practices, distinguishing between leaders and members of the group. The OH index was constructed using six indicators representing key OH dimensions: animal health (livestock vaccination), environmental management (manure utilisation and proper waste disposal), hygiene (clean animal housing), agricultural production (feed preparation/use), and farming systems (farm diversification). Each indicator was coded as a binary variable (1 = practice adopted, 0 = otherwise), normalised, and assigned an equal weight. The OHI was calculated as the unweighted average of the six indicators, with higher values indicating greater adoption of OH practices.

The results show a positive and statistically significant impact for members (0.042**), indicating that participation in women-led groups contributed to improved adoption of OH practices among members. In contrast, the DiD coefficient for leaders (0.015) is positive but not statistically significant, suggesting more limited additional gains beyond the general trends for this group. The study also noted that many women leaders may have already possessed relatively higher levels of empowerment, decision-making capacity, and community engagement prior to the intervention through other support (e.g., Accelerating Inclusive Markets for Smallholders project, Life With Dignity project), leaving less room for measurable improvement.

The positive treatment coefficients indicate that both WLG leaders and members had higher baseline levels of OH practice relative to non-participants in their respective models. The larger baseline difference observed in the leader model may reflect the prior experience or early adoption of OH-related practices among some leaders. While the DiD estimate for leaders is positive but not statistically significant, members experienced a

positive and statistically significant additional gain in OH practice adoption relative to non-participants. Qualitative findings further suggest that knowledge sharing and peer-to-peer learning within WLGs may have supported the diffusion of OH practices among members.

The positive and significant post coefficient (0.088***) in both models indicates that OH practices improved over time, likely reflecting broader external influences or increased awareness. However, the positive and significant DiD effect for members indicates additional gains associated with WLG participation beyond this general time trend.

Qualitative insights showed that WLG leaders acted as key change agents in promoting OH practices by disseminating knowledge on hygiene, sanitation, and safe livestock management. Through project-supported trainings, they gained practical understanding of OH concepts and shared this knowledge within their groups and communities, influencing behavioural change in areas such as waste management, animal care, and disease prevention. By demonstrating and modelling safe and sustainable practices, leaders encouraged adoption among members and non-members, creating a ripple effect of improved practices.

The study also found that WLG members demonstrated significant behavioural changes compared to non-members in applying OH principles in their daily farming and household practices. Through peer-to-peer learning, members

adopted improved practices, such as cleaner and more distant animal shelters, regular sanitation, safe waste disposal, composting, and protective measures when handling animals. One member expressed that *“I now collect chicken manure every few days to use in the fields. I also built a chicken cage further from my house and cleaned it more often, reducing bad smells and improving hygiene.”* These changes illustrate how participation in WLGs helped translate technical knowledge into concrete actions that enhanced human, animal, and environmental health.

Despite these improvements, the translation of knowledge into practice among WLG members remains uneven and varies by context. This indicates that while knowledge gains are achieved, behavioural change requires more time and sustained support from the project. It also underscores the need for continuous follow-up, reinforcement, and context-specific interventions to ensure the effective adoption of practices.

Discussion

This study demonstrates the important role of WLGs as effective pathways for promoting women’s empowerment in agriculture, particularly in OH practices. Several OH practices were found among WLG members, such as cleaner and more distant animal shelters, regular sanitation, safe waste disposal, composting, and protective measures when handling animals. WLGs created spaces for women to interact, exchange knowledge, and

Table 4: Impact of participation in women-led groups on OH practice by women as leaders and members

Variables	(1) Leaders	(2) Members
treat	0.127*** (0.041)	0.046* (0.024)
post	0.088*** (0.010)	0.088*** (0.010)
did	0.015 (0.037)	0.042** (0.017)
Constant	0.168*** (0.016)	0.168*** (0.016)
Observations	284	456
R-squared	0.140	0.110

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Source: Authors’ calculations

collectively address agricultural, environmental, and gender-related challenges. Beyond their functional role, these groups also contributed to women's psychosocial well-being by fostering self-confidence, self-esteem, and a sense of belonging. This supports the argument by Badejo et al. (2017) that the "act of associating" itself is a valuable resource that strengthens women's "power within." In this study, such internal transformations translated into greater agency, as women became more confident in expressing their views, participating in community activities, and gradually challenging existing gender norms.

The study's findings further indicate that WLGs play a critical role in advancing the social dimensions of women's empowerment. In line with existing evidence on self-help groups (SHGs) (Chakravarty and Jha 2012; Nangia 2006), participation in WLGs strengthened women's leadership capacities and expanded their roles within the community structures. Women leaders, in particular, demonstrated an enhanced ability to apply acquired knowledge and skills, reinforcing their positions as local facilitators and sources of support for other farmers. Their increased visibility also contributed to greater social recognition and legitimacy as leaders. These dynamics suggest that empowerment is not solely an individual outcome but a relational process, where strengthened capacities translate into increased influence and more active participation in decision-making at both the household and community levels.

Another finding is that women leaders are knowledge intermediaries and change agents in promoting OH practices. Through training and engagement in WLG activities, leaders acquired technical knowledge of hygiene, sanitation, livestock management, and environmental practices, which they translated into locally relevant and practical information for other farmers. Their role extended beyond information dissemination to facilitating behavioural change through demonstration, peer-to-peer learning, and community awareness. This finding aligns with Nangia (2006), who emphasises that women-led spaces are effective in building capacity, strengthening networks, and supporting community development. In this context, women leaders helped bridge external knowledge and

local practices, enhancing the sustainability of interventions.

The peer-to-peer learning approach within WLGs further strengthened these outcomes by fostering knowledge sharing among members. Through observation, discussion, and the exchange of practical experiences, members engaged in a dynamic learning process that supported the application of improved livestock management, household hygiene, and environmental practices in the community. The role of women as leaders not only goes beyond information dissemination but also the facilitation of behavioural change through demonstrations, peer-to-peer learning, and community engagement, consistent with evidence from farmer field school and extension initiatives across Africa and Asia (Davis et al. 2012; Waddington et al. 2012). Compared to non-members, WLG participants demonstrated stronger adoption of OH principles in their daily lives. Thus, it reflects that participatory and socially embedded learning processes are effective in translating knowledge into practice, while also contributing to increased participation in household and community decision-making.

Despite these positive outcomes, the study found that the translation of knowledge into practice remained uneven and context-dependent among some WLG members. While cognitive learning was widely achieved, behavioural change varied across individuals due to differences in resources, motivation, and local conditions. This suggests that knowledge acquisition alone is insufficient to ensure the reinforcement of new practice changes. Continuous support, such as follow-up activities and interventions tailored to local conditions (e.g., financial support, input resource, market, and labour availability), is essential to achieve long-term and inclusive impacts.

Limitations of the study

The study has several limitations. First, the leader-specific subgroup analysis is based on 26 treated WLG leaders and therefore has more limited statistical power than the full-sample and member analyses. The subgroup estimates should consequently be interpreted cautiously as exploratory evidence of heterogeneity rather

than definitive evidence of differences in impacts between leaders and members. This caution is particularly important for commodity-specific analyses, where subgroup sample sizes are smaller. Second, the estimated effects capture WLG participation within the broader context of AGROW project interventions and therefore may also reflect complementary support received through other programme activities.

Conclusion and policy implications

WLGs are effective pathways for advancing women's empowerment in agriculture while promoting the adoption of OH practices among Cambodian farmers. By creating inclusive spaces, WLGs enable women—both leaders and members—to strengthen their leadership, agency, and knowledge. Women leaders emerge not only as farmers but also as key resource persons and change agents who translate technical knowledge into locally relevant practices for sustainable agriculture. In addition, WLGs contribute to economic and social empowerment by improving agricultural productivity, personal confidence (as leaders), social recognition, and participation in household and community decision-making.

Peer-to-peer learning within WLGs further amplifies these outcomes. Through mutual exchange and observation, women reinforce and adapt their knowledge, leading to improved practices in livestock management, hygiene, and environmental management compared to non-members. These processes support the practical application of OH principles and contribute to more balanced household decision-making, where women's voices are increasingly recognised.

Overall, the study suggests that community-based, women-led group approaches hold significant potential as scalable and sustainable pathways for promoting inclusive agricultural development and operationalising OH at the local level. Therefore, this study offers important policy insights for strengthening women's empowerment and supporting the operationalisation of OH approaches in Cambodia as follows:

- *Recognise women-led groups as effective community-based platforms:* The study found that women participating in WLGs reported

higher levels of empowerment, particularly in decision-making, leadership, and access to knowledge, compared with non-members. WLGs have created safe spaces for women to exchange experiences, build confidence, and collectively address agricultural and household challenges. Based on these findings, government agencies and development partners should formally integrate WLGs into agricultural extension and rural development programmes. To sustain their effectiveness, dedicated financial and technical support should be provided for demonstration activities, community outreach, facilitation of skills development, and group management. This support would enable WLGs to continue serving as effective platforms for empowerment and knowledge dissemination at the community level.

- *Support women's leadership as a driver of local change:* The study showed that women leaders experienced stronger empowerment outcomes than ordinary members, while qualitative interviews indicated that women leaders played a critical role in mobilising participation, facilitating knowledge sharing, and encouraging the adoption of improved agricultural OH practices. These findings suggest that leadership development is a key mechanism through which WLGs have a broader community impact. To strengthen these outcomes, development programmes should invest in leadership training, mentoring schemes, and peer-learning networks for women leaders. Technical support should be provided and focused on strengthening facilitation, communication, and community mobilisation skills to enhance their effectiveness as local change agents.
- *Strengthen community-level implementation of OH through sustained peer-to-peer learning systems:* The study found that WLG members demonstrated greater knowledge and adoption of OH-related practices than non-members. The study further showed that regular group meetings, peer-to-peer learning, and practical demonstrations were important pathways through which women translated technical knowledge into their everyday farming and household practices. These findings suggest that behavioural

change is more likely to be sustained through continuous community engagement rather than through one-off training events. Therefore, governments and development partners should invest in long-term, community-based learning systems that utilise WLGs as local platforms for OH promotion. Financial and technical support should be further invested in some activities such as demonstration farms; peer-learning activities; coaching and follow-up from agricultural, livestock, health, and environmental extension officers; and community monitoring initiatives. These investments would help sustain knowledge exchange, strengthen long-term adoption of OH practices, and enhance the resilience of farming systems among rural households.

Acknowledgements

We extend our profound thanks to the reviewers whose insightful comments and constructive feedback have significantly improved the quality of this paper. We also express our sincere appreciation to Mr Soy Kimsan, who is our mentor under CDRI's Female Researcher Mentorship Programme, for his valuable comments, guidance, and contributions to improving the quality of this paper. This paper is based on data collection under the project "Impact evaluation of the AGROW project in Battambang province," conducted by the Centre for Policy Research in Agriculture and Rural Development, CDRI, and funded by the Partnership for Economic Policy. Through CDRI's Female Researcher Mentorship Programme, this study is supported by the Australian Government through the Ponlok Chomnes II: Data and Dialogue for Development in Cambodia programme. The views expressed in this paper are the authors' alone and are not necessarily the views of the Australian Government.

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