Evaluation of the Water-to-Market Activity in Armenia

March 8, 2013

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All of the above organizations and individuals have contributed tremendously to this report and to the project more generally, but any remaining errors are the fault of the authors alone.

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LIST OF ACRONYMS

ACDI: **ACDI/VOCA** nonprofit organization

AMD: **Arm**enian **D**rams

AREG: **AREG** Scientific Cultural Youth Association Nongovernmental Organization

ARMIS: **A**utomated **R**eporting **M**anagement **I**nformation **S**ystem

ARSP: **A**rmenia **A**griculture **R**eform **S**upport **P**roject

AVAG: **AVAG** Solutions, Ltd

CCR: **C**ompact **C**loseout **R**eport

CPL: **C**omplete **P**overty **L**ine

DAP: **D**etailed **A**ction **P**lan

DRC: **D**ispute **R**esolution **C**ommittee

EAS: **E**nterprise **A**doption **S**urvey

FAA: **F**ederation of **A**griculture **A**ssociations

FAO: **F**ood and **A**griculture **O**rganization

FPS: **F**arming **P**ractices **S**urvey

GIS: **G**eographic **I**nformation **S**ystem

HVA: **H**igh-**v**alue **A**griculture

IFAD: **I**nternational **F**und for **A**gricultural **D**evelopment

ILCS: **I**ntegrated **L**iving **C**onditions **S**urvey

ISSA: **I**nstitutional **S**trengthening **S**ub**a**ctivity

MCA: **M**illennium **C**hallenge **A**ccount

MCC: **M**illennium **C**hallenge **C**orporation

MIP: **M**anagement **I**mprovement **P**lan

NSS: **N**ational **S**tatistical **S**ervice of Armenia

OFWM: **O**n-**f**arm **W**ater **M**anagement

PPM: **P**ost-harvest **P**rocessing and **M**arketing

QPA: **Q**ualitative **P**rocess **A**nalysis Report

RA: **R**epublic of **A**rmenia

RFF: **R**ural **F**inance **F**acility

UCO: **U**niversal **C**redit **O**rganization

USD: **U**nited **S**tates **D**ollars

VISTAA: **VISTAA** Plus LLC

WtM: **W**ater-**t**o-**M**arket Activity

WUA: **W**ater **U**sers **A**ssociation

WSA: **W**ater **S**upply **A**gency

EXECUTIVE SUMMARY

Armenia was left with the legacy of a centrally planned economy when it declared independence from the Soviet Union in 1991. The Armenian economy was highly dependent on its Soviet trading partners and poorly equipped to function with the lack of infrastructure investment and support after Soviet withdrawal. In 1994, the Armenian government adopted a comprehensive stabilization and reform program in which farmland was privatized and redistributed as small plots. However, many of the beneficiaries of this redistribution had little expertise in farming or had mainly worked on collective farms before the reform and as a result did not have the knowledge required to effectively manage their own farms. Further, much of the irrigation infrastructure continued to deteriorate, falling into disrepair and disuse.

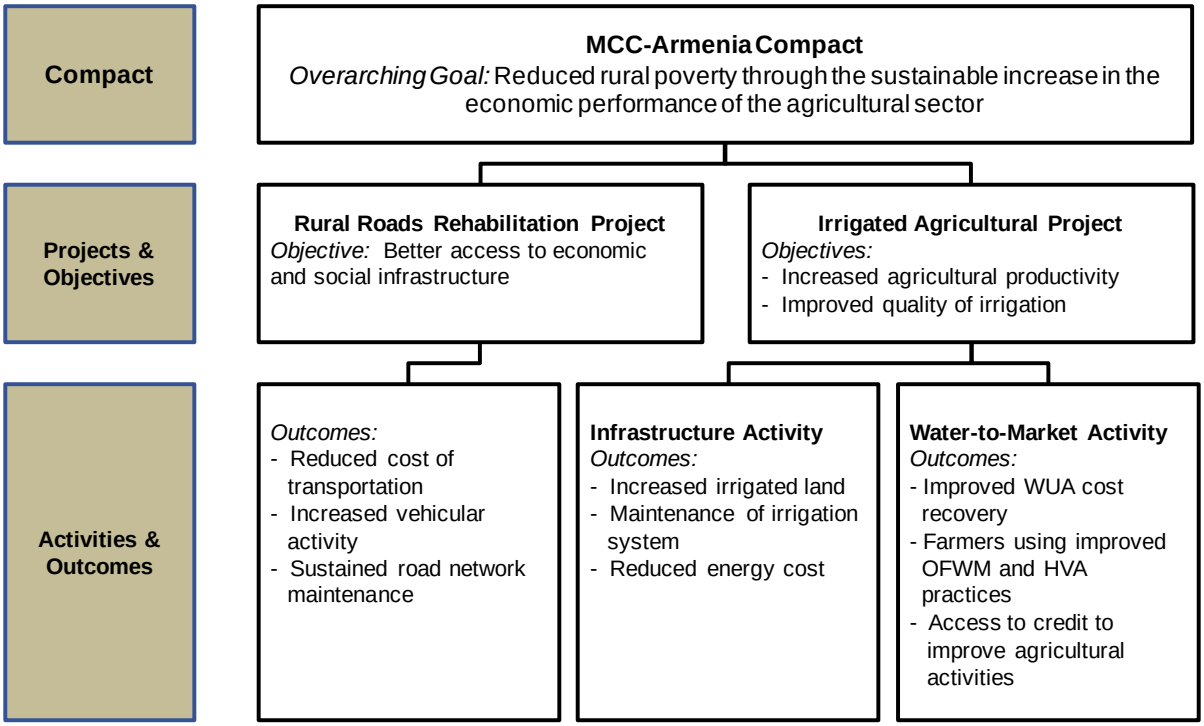
The aim of the Millennium Challenge Corporation's Compact with Armenia ("the Compact"), a five-year agreement signed in March 2006, was to increase household income and reduce poverty in rural Armenia through improved performance of the country's agricultural sector. The Compact, managed by the Millennium Challenge Account with Armenia (MCA-Armenia), was originally designed to include two projects: (1) the Rehabilitation of Rural Roads Project and (2) the Irrigated Agriculture Project.[1] The Irrigated Agriculture Project comprised two complementary activities, the Infrastructure Activity through which irrigation infrastructure would be rehabilitated, and the Water-to-Market Activity (hereafter WtM), which would provide training, technical assistance, and access to credit for farms and agribusiness. WtM was intended to help farmers harness the improvements in irrigation to introduce new technologies and shift to production of high-value agricultural crops, both of which would increase their annual income.[2] By improving living standards among rural residents, these investments were designed to lead to future economic growth in rural areas and throughout the country. Figure 1 summarizes the overall goal of the Compact and how each activity was designed to help accomplish the overall goal.

The Millennium Challenge Corporation (MCC) has commissioned evaluations to examine the Rehabilitation of Rural Roads Project, the Infrastructure Activity, and the WtM Activity. This report focuses on the evaluation of the WtM Activity. This activity comprises several components, as described in the next section, and each of these components is evaluated separately in this report.

[1] At the June 2009 MCC Board meeting, the decision was made not to continue funding any further road construction and rehabilitation under the $236 million Compact due to concerns about democratic governance. Approximately 25 km of pilot roads had been completed prior to this decision. As of July 2012, 150 km of MCC-funded road designs are now being funded by the World Bank.

[2] According to a 2005 World Bank paper (Gulati et al. 2005), high-value crops are defined as crops that have relatively high economic value per kilogram, per hectare, or per calorie, such as fruits and vegetables. In Armenia, high-value agriculture consists of all crops that are not grain or grass.

Figure 1. Overview of the Compact with Armenia



A. Overview of WtM Activities

As noted, the WtM Activity included multiple elements designed to work in concert with each other and with the Infrastructure Activity to improve agricultural profitability and household well-being. The WtM Activity is divided into two subactivities, the Improved Profitability of Water User Association Members Subactivity and the Institutional Strengthening Subactivity. The first subactivity is further subdivided into three sub-subactivities, which in short include farmer training, agricultural credit, and technical assistance to agricultural enterprises. For ease of exposition, we hereafter refer to each of the subactivities and sub-subactivities as a "component." The present report evaluates four components, each of which is summarized below.

- The first and largest component, **WtM training**, includes two types of training:

  - **On-Farm Water Management (OFWM) training,** implemented by ACDI/VOCA and its partners VISTAA and Euroconsult, included both classroom and practical components and the establishment of demonstration plots to demonstrate irrigation technologies in practice. The goal of this training was for farmers to adopt new and more efficient irrigation techniques, which would lead to increased and more cost-effective agricultural production and higher sales.
  - **High-Value Agriculture (HVA) training**, implemented by ACDI/VOCA and its partners, consisted of establishing demonstration plots and conducting training sessions for farmers on high-value crop substitution and cropping intensity. The goal of HVA training was for farmers to adopt new cropping techniques and high-value crops, which would lead to increased and more diverse agricultural production, as well as increased sales.

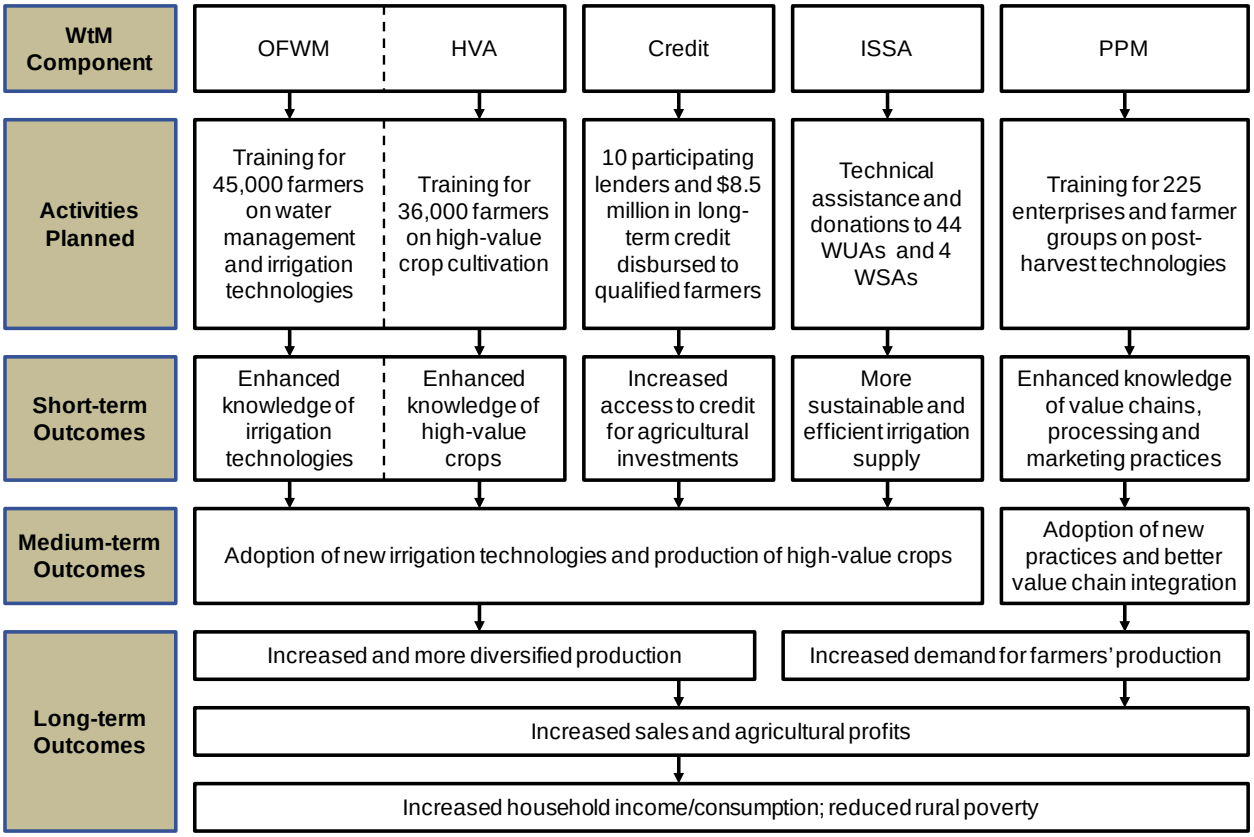
- The **WtM credit** component made long-term credit available to qualified farmers who participated in WtM training and met other selection criteria. Access to credit would allow farmers who participated in HVA and OFWM training to adopt new irrigation and production technologies, and thus generate higher output and sales. MCA contracted with the Rural Finance Facility (RFF) to implement the WtM credit component, and participating financial institutions developed loan applications and submitted them to RFF for approval.
- The **Institutional Strengthening Subactivity (ISSA),** implemented by Mott MacDonald and VISTAA, provided general technical support to water user associations (WUAs), the regional organizations that manage the distribution of and payment for irrigation water in Armenia. ISSA also provided assistance to three Water Supply Agencies (WSAs) that operate and maintain irrigation dams and pumping stations. The general aim of ISSA was to strengthen WUAs' and WSAs' managerial, technical, structural, and financial capacity and self-sufficiency. The intent of these improvements was to create more efficient and consistent irrigation supply for WUA members. ISSA also included an irrigation policy reform component, in which a reform strategy was developed through a participatory process with stakeholders such as WUA and government officials.
- Under the **Post-Harvest, Processing, and Marketing (PPM)** component, implemented by ACDI/VOCA, enterprises and producer groups were to be trained in processing technologies, food safety, quality standards, financial analysis, and developing commercial linkages. The objective of PPM was to improve post-harvest preservation procedures, strengthen processing enterprises, and provide WtM beneficiary farmers with increased opportunities to sell their products.

A high degree of interaction was envisioned between all of these components. Because new water management and production technologies introduced in OFWM and HVA training—such as drip irrigation systems and greenhouses—required investment capital, training beneficiaries could apply for WtM credit to finance these investments.[3] In addition, many water users who benefited from ISSA could participate in WtM training and were eligible to apply for WtM credit. Thus, the short-term goal of ISSA, more sustainable and efficient irrigation water supply, could feasibly facilitate farmers' transition to new water management techniques, new crops, and new production technologies financed with WtM credit. The synergy created by these components, along with improved irrigation infrastructure financed under the Compact's Infrastructure Activity of the Irrigated Agriculture Project, could lead to increased and more diversified production.

MCA also planned substantive interaction between PPM and other components, as processing enterprises strengthened by PPM assistance could form stronger linkages with WtM beneficiary farmers and create greater demand for farmers' production. Through these interactions among components, all WtM components were designed to result in increased sales and agricultural profits, as well as improved household well-being among beneficiary farmers (Figure 2).

[3] Participating in OFWM or HVA training was a prerequisite for WtM credit.

Figure 2. Logic Model for the WtM Activity



B. Research Questions and Evaluation Approach

The WtM impact evaluation originally focused on WtM training, using a random assignment design to evaluate this WtM component. Initially, evaluations of the other three WtM components were not planned. However, MCC subsequently decided to conduct analyses of the effects of the other components to the extent possible using existing quantitative data sources. Although the analyses of WtM credit, ISSA, and PPM have important limitations, these additional analyses can still help document these components' implementation and provide suggestive evidence of whether they generated their intended effects.

For each of the four components of the WtM Activity, we examine the following two broad sets of questions:

1. ***How was the component implemented?*** What were the characteristics of each component's participants, and how were these participants identified and recruited? What assistance was provided to participants through the component?
2. ***What were the impacts of the component?*** What were the impacts on practices or use of new technologies as a result of the component? What were the impacts on key outcomes such as household income and poverty?

We used a combination of quantitative and qualitative data to answer these research questions. To answer questions regarding components' implementation, we used qualitative data sources, including qualitative process analysis reports completed by Socioscope (Socioscope 2010 and Socioscope 2011), MCA-Armenia's draft Compact Completion Report (2011), and our

own observations from field visits and interviews. We also used quantitative data sources to document implementation, including RFF administrative data on WtM loans. To answer questions regarding components' impacts, we used quantitative data from baseline and follow-up household surveys as well as WUAs' administrative cost and revenue data.

The quantitative analyses, especially for the evaluations of the training and credit components, examine estimated program effects on many outcomes. When examining many estimates, it is likely that some of the estimates will be statistically significant—either positively or negatively—by chance, even if the program had no true effects. For this reason, we consider the pattern of findings rather than only individual estimates when we interpret results to assess whether each component was effective so that we can distinguish true program effects (positive or negative) from chance differences.

Before turning to the findings from the evaluation of each component, we summarize the overall achievements accomplished by MCA and its implementers under the WtM Activity. In Sections D through G, we present findings from our analyses of the training, credit, ISSA, and PPM components, respectively. In Section H, we conclude this summary with some lessons learned based on our findings.

C. WtM Targets and Outputs

Each component of WtM was designed to achieve specific implementation targets set out at the outset of the Compact, and in some cases, revised as implementation got under way. As shown in Table 1, all components met or surpassed their revised service delivery targets. OFWM and HVA training had revised targets of 45,000 and 36,000 farmers trained, respectively.[4] By mid-2011, ACDI had surpassed the revised OFWM target by 600 farmers and met the revised HVA target. For WtM credit, MCC and MCA-Armenia planned to disburse a total of at least $8.5 million in loans to farmers who completed WtM training. From 2008 to 2011, approximately $13.3 million in loans was disbursed (through use of original and revolving loan funds), thus surpassing the component's original target by nearly $5 million.

Regarding ISSA, by the end of this component's implementation in late 2010, all 44 participating WUAs (as well as all three participating WSAs) had completed needs assessments and management improvement plans (MIPs), meeting the goals for the subactivity. In addition, all 44 WUAs received computers, geographic information systems (GIS), and furniture in exchange for completing the first five ISSA milestones, which included establishing an MIP working group and a detailed work plan, installing information boards, and holding representative meetings. Similarly, 227 enterprises and farmer groups were assisted under the PPM, thus slightly surpassing the component's revised target of 225 assisted groups.

Particularly notable regarding these achievements is implementers' ability to meet very high targets for the number of famers trained in HVA and OFWM techniques. In addition, the discrepancy between the number of WtM loans granted and the number of farmers trained is noteworthy. We will discuss these issues in greater depth in the next four sections, which detail

[4] Original delivery targets were 60,000 and 30,000 farmers trained in OFWM and HVA, respectively.

each component's objectives, evaluation approach, implementation findings, and evidence of impacts.

Table 1. Comparison of WtM Targets and Outputs

	Target	Final Output
OFWM and HVA Training		
Farmers Trained in OFWM	Modified to 45,000 (from 60,000)	45,639
Farmers Trained in HVA	Modified to 36,000 (from 30,000)	36,070
Access to Credit		
Total Amount Disbursed (USD)	$8.5 million	$13.3 million[a]
Total Number of Loans	NA	1,109[a]
ISSA		
Technical Consultations Provided	452	452
Needs Assessments Completed	47[b]	47[b]
Management Improvement Plans (MIPs) Completed with WUAs	44	44
Computers with Budgeting and Accounting Software Donated to WUAs and WSAs	NA	180
Geographic Information Systems (GIS) Improved or Provided	47[b]	47[b]
WUAs and WSAs That Received Equipment and Furniture	47[b]	47[b]
PPM		
Enterprises Assisted	Modified to 225 (from 300)	227
Farmer Groups Formed	NA	94
Collection Centers Created	20	21
Consolidation Centers Created	NA	3

Source: "The Program Is Over: All About Results" Report, MCA-Armenia, September 2011.

USD = United States dollars.

[a]As of 2011. Additional lending will occur under the WtM credit revolving loan fund.

[b]Includes 44 WUAs and 3 WSAs.

D. OFWM and HVA Training

1. Summary of Training Activities

The objective of WtM training, which included both OFWM and HVA training, was to educate farmers on techniques intended to improve farm profitability by using agricultural inputs more efficiently, thus increasing production and the value of crops cultivated. The trainings were targeted to members of WUAs, and farmers who participated in training also became eligible to apply for MCA loans in the WtM credit component.

The OFWM training covered region-specific water management techniques to conserve water by emphasizing low-cost irrigation technologies such as modified furrow sizes and soil moisture meters. HVA training focused on growing new crops or on ways to cultivate high-value crop varieties by using higher-quality seeds, establishing greenhouses, or other methods. HVA

practices can be divided into industrial-economical improvements, which emphasize increases in farmers' own production or profits, and social-environmental improvements, which promote safe and environmentally friendly practices. Each type of training comprised 3 to 4 days of theoretical lessons in classrooms supplemented with practical lessons at a nearby demonstration farm. Each training session included 20 to 25 farmers from one or more neighboring communities and was led by an agricultural expert from the same region. The two types of training were offered separately, but many farmers attended both types.

Classroom Training on OFWM

A critical part of WtM training was to establish and maintain a number of farms as demonstration farms for training purposes. These farms were outfitted with irrigation technologies discussed in training and had demonstration plots of high-value crops. Each demonstration farm was carefully selected to serve one to five communities, and farmers who received training were encouraged to revisit the farms after the official training to see OFWM and HVA practices in use. ACDI also operated tours of the demonstration farms for trained farmers during key months of the agricultural year. A primary factor in designating demonstration farms was whether the farmer was willing to set up and operate a demonstration farm and to promote other farmers' understanding of the demonstrated technologies. Other selection criteria included the site's proximity to other farms in the community, topography, and soil characteristics.

HVA Demonstration Farms

2. Evaluation Approach

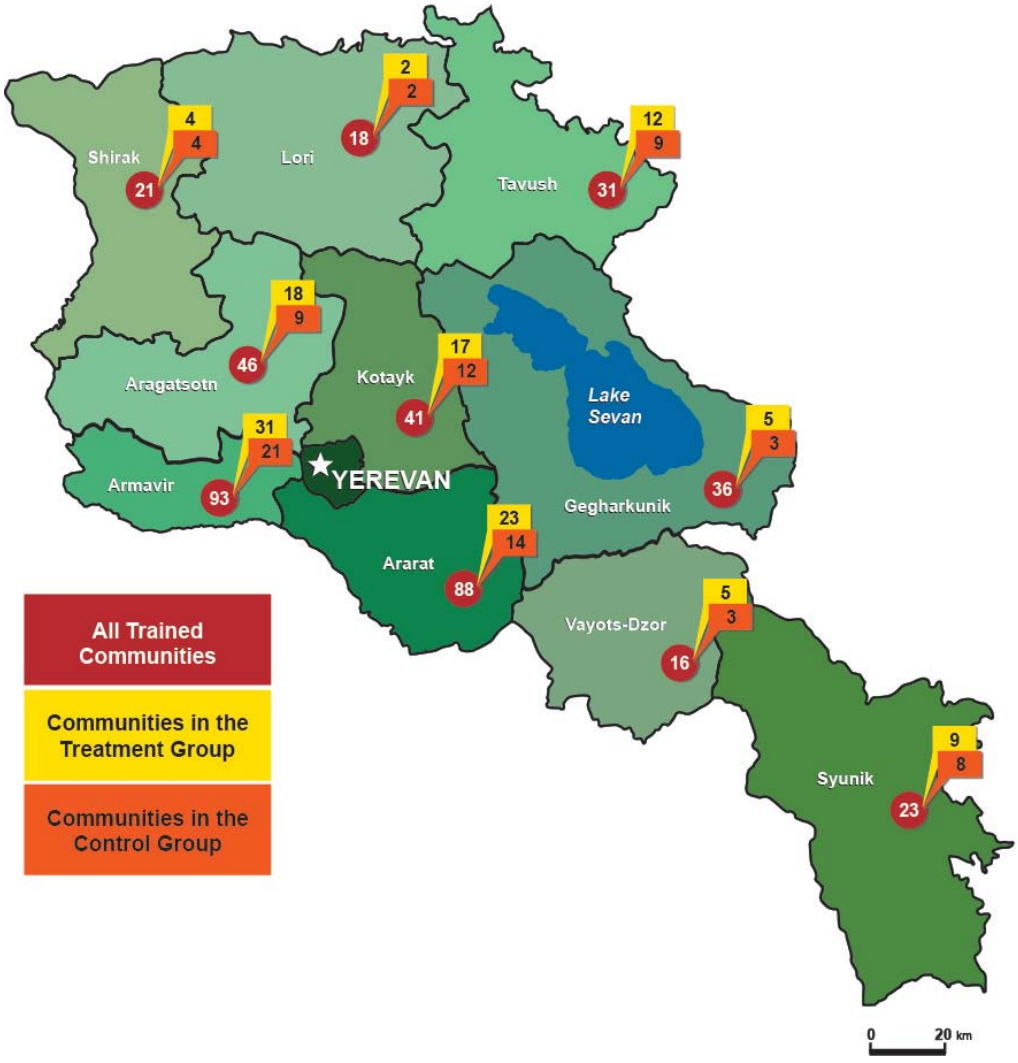
To assess the impacts of WtM training, we used a phase-in random assignment design, whereby communities were randomly assigned into a treatment group and a control group. Farmers in treatment communities were offered training, whereas farmers in control communities were not offered training during the evaluation period. Nearly 300 communities (out of over 400 eventually provided training) that were determined to have adequate access to irrigation water in 2007 were randomly assigned to one of three groups: the treatment group (eligible to receive training starting in Compact Year 2), the control group (eligible to receive training in Compact Year 5), and a nonresearch sample of communities (which could receive training in Compact Years 3 or 4). For transparency, we developed a computer program to conduct the random assignment, and the assignment was run in public. Our sample for the evaluation includes 189 community clusters covering 211 communities; 112 of these clusters were in the treatment group, and 77 were in the control group. Figure 3 illustrates how the communities in the treatment and control groups are distributed among all trained communities. The impacts of the training component were estimated by comparing outcomes of the treatment group with outcomes of the control group over time. Since only members of the treatment group had access to WtM credit, the impact estimates encapsulate the effects of access to WtM credit.

The Farming Practices Survey (FPS) was developed for the impact evaluation of the WtM training activity. Fielded by a consortium of AREG, an Armenia-based NGO, and Jen Consult, the FPS is a longitudinal survey of farming households interviewed at three points in time: at baseline in 2007 (before the program was implemented), one year after training began, and three years after training began (the final follow-up in 2010). The evaluation includes 3,547 farming households in the treatment and control communities that were interviewed at baseline and again in the final round of surveys. Households were selected for FPS interviews at baseline based on their likelihood of participating in training, as assessed by mayors using criteria provided by the survey team and based on the criteria used to recruit training participants. As a result, the sampled households are not representative of all households in the treatment and control areas. Rather, the sample is designed to represent households that are likely to have participated in training if training were offered in their communities. The FPS asked each household about their cropping patterns, irrigation and agricultural practices, crop yields, agricultural revenues and costs, other household expenditures, household employment, and other sources of household income.

According to FPS data, surveyed treatment and control group farmers had similar demographic characteristics and land holdings at baseline. At the time of the follow-up survey, the average respondent was 55 years old and households averaged just under 2 hectares of farm land at baseline. These similarities between treatment and control group farmers provide evidence that randomization produced similar treatment and control groups. In addition, about three-fifths of the treatment group farmers reported having completed training at follow-up, and

only about 10 percent of control group farmers reported completing training.[5] These different participation rates suggest that project implementers largely adhered to the randomized phase-in design.

Figure 3. Distribution of Trained Communities and Communities in the Research Sample, by Marz



Sources: Administrative data and 2010-2011 Farming Practices Survey.

[5] The FPS asked households if they or someone else in their household attended agricultural training (WtM or otherwise). It also asked farmers if they received a certificate for attending training. Certificates were given to farmers who completed WtM training but are not usually given to other training participants. This helped us to distinguish participation in WtM training from other training that may have been offered without relying on respondents to know who provided the training.

3. Implementation of Training Activities

Communities were selected for training eligibility based on availability of adequate sources of irrigation or the expectation of reliable water after infrastructure rehabilitation. Training was provided in over 400 communities over the life of the Compact. The communities considered for training early in the Compact period were those whose irrigation status was assessed as already favorable when implementation began, based on assessments by ACDI in consultation with Armenia's Irrigation Project Implementing Unit. According to initial plans, several additional communities without adequate irrigation systems would receive training at a later date, when the irrigation infrastructure activity was expected to be underway, so these communities were included in WtM training with the expectation that they would soon have improved irrigation infrastructure. Due to delays in infrastructure rehabilitation, however, many of these additional communities still did not have reliable irrigation systems by the time training was complete—over half of the treatment communities were served by at least one irrigation project that was rehabilitated later in the Compact.[6] Moreover, some communities that were initially assessed as having adequate irrigation were later found to not have reliable irrigation in actuality.

Within targeted communities, recruiting focused on individuals who were members of WUAs. This focus was based on the idea that the greatest benefits from training would accrue to farmers with access to irrigation water. Training coordinators used posters and additional advertisements at village centers to raise awareness of the training among farmers. Village mayors further assisted coordinators by encouraging participation and identifying WUA members most likely to participate.[7] While the criterion of being a WUA member guided recruitment, it was not a requirement for training. Over the course of implementation, a small portion of individuals were trained who were not active farmers or WUA members.

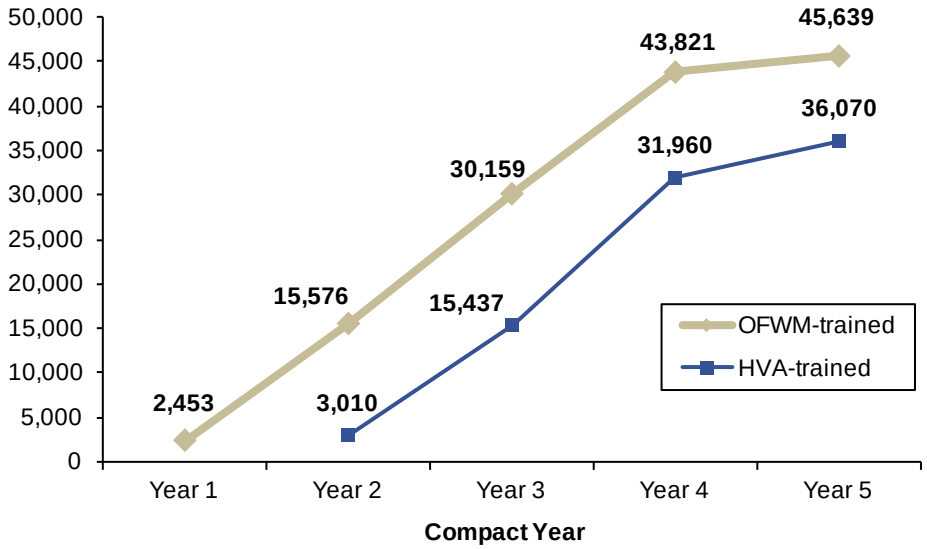
The implementers were successful in meeting program targets. Initial implementation targets were to train 60,000 farmers in OFWM and then train half of these farmers in HVA as well. When the complementarities from offering both trainings became apparent, the OFWM target was lowered to 45,000 to allow the HVA target to be raised to 36,000. Figure 4 shows that implementers were successful in meeting their revised targets, and they served a large portion of trained farmers in Years 2, 3, and 4 of the Compact.

Training participants valued the trainers' knowledge about agriculture, particularly regional agricultural conditions. During in-person interviews, farmers who had been trained recalled key OFWM and HVA concepts and appreciated that trainings were led by regional agricultural experts (Socioscope 2010). These regional experts had a strong understanding of local climatic and soil conditions, which were highly relevant to transitioning to high-value crops. Training was also highly desired in some communities. In these areas, community members organized up to 5 additional trainings because the initial training schedule did not have sufficient slots (MCA-Armenia 2011c).

[6] Some communities in which irrigation infrastructure was rehabilitated were added to WtM training later in the Compact at the request of the community and approval of MCA, but these communities were provided training too late to be included in the impact evaluation.

[7] Mass media were avoided to limit potential spillovers to control communities.

Figure 4. Number of Farmers that Participated in OFWM or HVA Training, by Compact Year



Source: MCA-Armenia Indicator Tracking Table (2011).

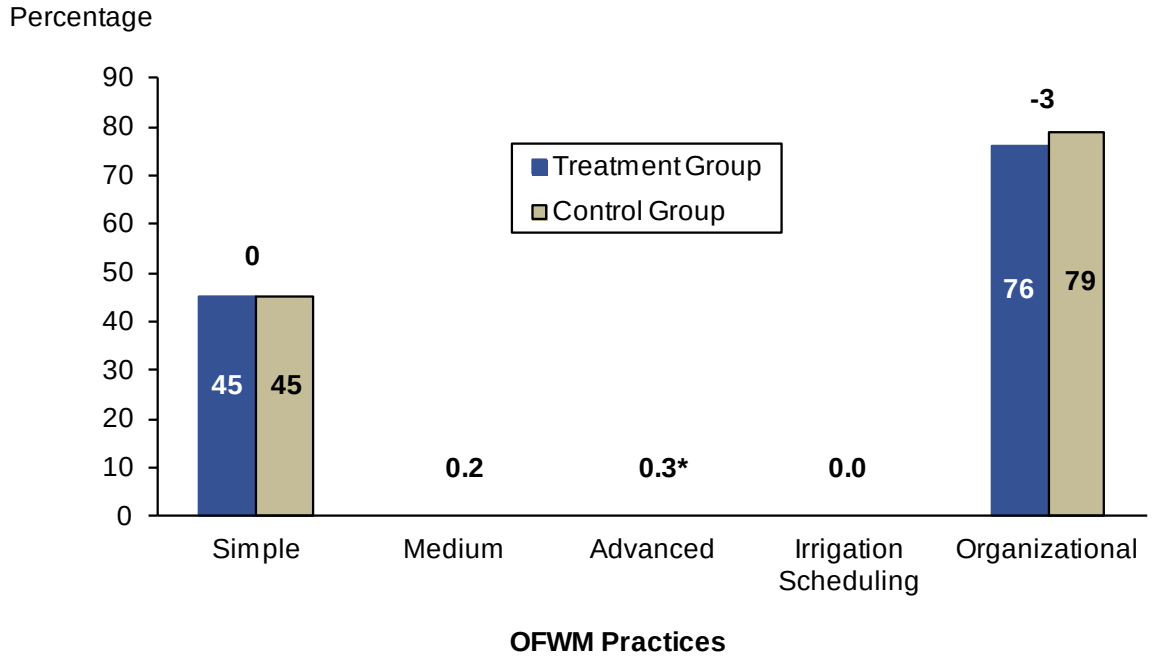
However, high training targets made it difficult to concentrate resources on farmers who were most likely to benefit from trainings. According to Socioscope, some of the training sessions included participants who were not actively farming, such as the elderly (though we note that, within the FPS sample used in the impact analysis, few respondents were not actively farming). Furthermore, some field staff and village mayors overemphasized the credit component to potential training participants, believing that insufficient numbers of farmers would attend training without the incentive of credit. As a result, many farmers who were not interested in OFWM and HVA practices attended the sessions, primarily because they believed that doing so would qualify them to receive credit. In this sense, trainers' time and attention was somewhat diverted from teaching those farmers who were interested in the subject matter being taught.

4. Impacts of HVA and OFWM Training

Farmers generally adopted only simple and organizational OFWM practices, and training did not appear to affect the adoption of these practices. At baseline, few farmers used any OFWM practices, and nearly all farmers' such practices that were reported were simple improvements such as modified furrow spacing. At the time of the follow-up, nearly half the farmers reported using simple practices, but few farmers adopted medium improvements (such as gated pipes) or advanced improvements (such as drip irrigation). As many control group farmers reported using simple OFWM practices as treatment group farmers. The increase in use of simple OFWM practices observed for both the treatment and control group appears to have been due to a difference in reporting from baseline and final follow-up rather than a change in

the practices used by control group farmers.[8] Organizational improvements, such as the preparation of irrigated land or having a copy of the farm's WUA water contract, were used by most farmers, but there were no significant impacts on adoption rates. Finally, we saw no evidence that training increased the area of land irrigated.

Figure 5. Impacts of WtM Training on OFWM Practices Used by Respondent Households at Follow- up (percentages)



Sources: 2007–2008 and 2010–2011 Farming Practices Surveys.

Note: Impact estimate for advanced technologies was statistically significant at the 10-percent level but adoption rates were low for both the treatment and control groups. Measured at follow-up, treatment and control group percentages were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impacts may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

Costs of improved techniques and a lack of irrigation infrastructure may have deterred many targeted farmers from adopting the techniques presented in training. Although the OFWM training focused on water conservation, farmers in Armenia pay for water based on the amount of land they intend to irrigate and type of crop they will produce; as a result, there is no private incentive to conserve water. While farmers believed drip irrigation to

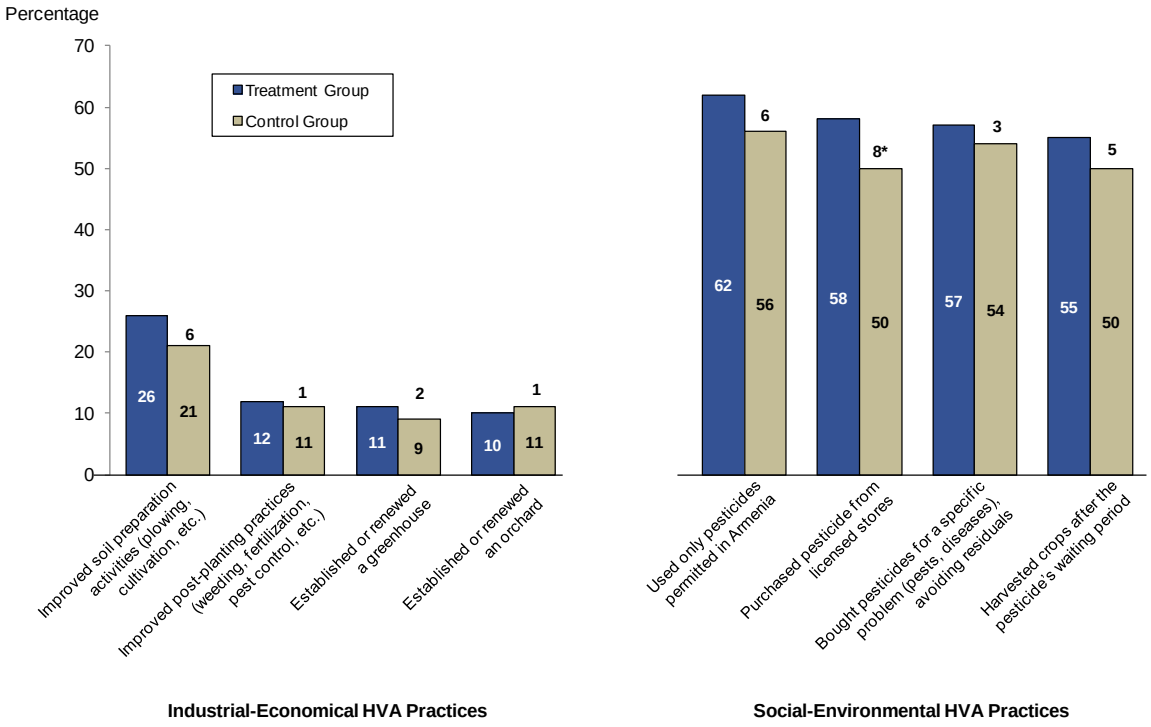
[8] The baseline survey asked farmers whether they had used furrow row spacing but the explanation interviewers provided to respondents was vague ("verifying/modifying furrow row spacing"); as a result, few farmers reported using furrow row spacing. At follow-up, farmers answered a more precisely worded question, whether they had used "modification of furrow sizes (length, width, depth, and inter-furrow area)." Subsequent informal conversations with farmers confirmed that the farmers had not actually changed their behaviors relating to this practice.

be the best OFWM technique, it is a relatively expensive improvement. During in-person interviews, the most common reason given by farmers for not using OFWM and HVA practices was financial constraints (Socioscope 2010; ACDI 2011; MCA-Armenia 2011c). Another common barrier to adopting OFWM and HVA practices was a lack of irrigation infrastructure. While training was intended to complement irrigation rehabilitation, rehabilitation projects were not completed in most communities until near the end of the Compact period. Moreover, many communities identified as having good irrigation water prior to irrigation rehabilitation were later re-categorized as having poor irrigation water. As a result, the ability of treatment farmers to implement OFWM and HVA techniques may have been stymied by a lack of reliable access to irrigation water.

There were small, positive impacts on the adoption of HVA practices. A variety of HVA practices were covered in the trainings. These include industrial-economical practices such as fertilization or establishing a greenhouse, which emphasized gains in efficiency or the value of production. HVA practices also included social-environmental practices, which focused on environmentally friendly, socially responsible practices that may not translate directly into gains in productivity or profits but could have long-term effects on farmers' health, consumers' health, or the environment. As seen in Figure 6, improved soil preparation was the most widely used industrial-economical HVA practice; it was employed by 26 percent of the treatment group and 21 percent of the control group (p-value of 0.11). Among social-environmental practices, farmers in the treatment group were 8 percentage points more likely to report purchasing pesticides from licensed stores, and this impact estimate is statistically significant at the 0.10 level (p-value: 0.08). No other statistically significant impacts were observed for the use of either industrial-economical practices or social-environmental HVA practices.

The small but positive impacts on select HVA practices were not accompanied by any statistically significant impacts on the types of crops being cultivated or total production. High proportions (over 90 percent) of treatment and control farmers reported cultivating HVA crops, but there were no statistically significant treatment-control differences in the proportion of farmers cultivating individual crops or crop types (not shown). Similarly, we found no statistically significant impacts on total production, production of HVA crops, production of non-HVA crops, or land area used to cultivate HVA or non-HVA crops (Table 2). When we examined impacts by zone, we found some evidence of impacts on agricultural production in the Mountainous Zone, where production of non-HVA crops and revenues and value from HVA crops increased significantly (not shown). When we examined production of specific types of crops, we found impacts for two major categories of HVA crops (grapes and potatoes), but they are a mix of negative and positive impacts. Given the large number of statistical tests that were conducted and the lack of systematic impacts on agricultural practices, these findings may be due to chance.

Figure 6. Impacts of WtM Training on Industrial- Economical and Social- Environmental HVA Practices of Respondent Households



Sources: 2007–2008 and 2010–2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group percentages were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

HVA = High-Value Agriculture.

The effect of training on crop sales and values was also statistically insignificant. There were no significant impacts on sales of HVA or non-HVA crops as a result of WtM training. The estimated impact of $165 for market value of all crops is not statistically significant. Treatment farmers' non-HVA crops were also valued about $42 more than control farmers' HVA production but was on the margin of statistical significance at the 10 percent level (*p*-value: 0.10).

Table 2. Impacts of WtM Training on Production, Land Cultivated, and Market Value of Harvests

	Treatment Group Mean	Control Group Mean	Impact	*p*-value
Agricultural Production (metric tons)				
Total	6.0	5.8	0.2	0.63
HVA crops	3.8	3.8	0.0	0.97
Non-HVA crops	1.9	1.7	0.1	0.39
Land under Cultivation (hectares)				
Total	1.2	1.2	0.0	0.78
HVA crops	0.4	0.4	0.0	0.50
Non-HVA crops	0.7	0.7	0.0	0.57
Market Value of Harvest (USD)				
Total	1,874	1,709	165	0.21
HVA crops	1,487	1,391	96	0.43
Non-HVA crops	323	281	42	0.10
Sample Size	**2,133**	**1,414**		

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group means were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

USD = United States dollars. HVA = High-Value Agriculture.

We observed positive differences in agricultural income and profit, but the differences were not statistically significant. We measured agricultural income as the total value of all produced crops, including those that are sold or consumed by the household. Next, we calculated agricultural profit as the difference between the total value of the harvest and all agricultural costs.[9] In addition, we defined economic income as the sum of agricultural profit and nonagricultural income. As seen in Table 3, at final follow-up, households in the treatment group had an average of $166 more agricultural profit (*p*-value: 0.13) and $206 more economic income (*p*-value: 0.17) than households in the control group. The differences are almost entirely attributable to the previously reported differences in the average market value of farmers' harvests, with similar significance levels. Our findings of positive but statistically insignificant impacts on economic income were present within three agricultural zones, the exception being Ararat Valley (not shown). In Ararat Valley, a positive and statistically significant impact of $185 on nonagricultural income contributed to a statistically significant impact of $515 on economic income. Finally, we observed no differences between the poverty rates of treatment and control group members overall, although a statistically significant increase in poverty was observed in the Mountainous zone (not shown).

[9] Agricultural costs were computed as the simple sum of expenditures during the last agricultural season on fertilizers and pesticides, irrigation, hired labor, equipment, tools, taxes and duties, seeds and seedlings, cellophanes, and any other major agricultural expenses. Amortization of large investments and payments for agricultural credit were not included, but few farmers reported large amounts of other major expenses, so this would not materially affect the estimate.

In 2009 and 2010, Armenia experienced two events that could influence the estimated impact on household income: adverse agricultural conditions and the global financial crisis. The weather conditions in 2010 caused agricultural production to decrease nationally, and the global financial crisis may have affected the behavior of lenders. If the events equally affected farmers in the treatment and control groups, then the impacts would be the same in the absence of these events. On the other hand, the estimated impacts on household income could have been muted if, for example, farmers who participated in training were unable to obtain loans to invest in new technologies or invested in new technologies that did not reap benefits because of the agricultural conditions. Conversely, estimated impacts could have been larger than normal if trained farmers adopted technologies that allowed them to weather the agricultural conditions better. However, the 2010 agricultural conditions should not have affected farmers' adoption of new technologies, as those decisions would have been made before the year's weather conditions would have been known. Because there is little evidence that many farmers adopted new technologies in 2010, it is unlikely that the weather conditions muted the estimated impacts on household income. Survey data were not collected for the 2009 agricultural season, but there was also little evidence of impacts on adoption in data from the 2008 agricultural season (not reported), before the global financial crisis, so it is not likely that the global financial crisis reduced adoption of practices in 2009 or 2010.

Table 3. Impacts of WtM Training on Respondents' Annual Household Income (USD)

	Treatment Group Mean	Control Group Mean	Impact	*p*-value
Nonagricultural Income	2,275	2,276	-2	0.98
Agricultural Income				
Total value of harvest	1,874	1,709	165	0.21
Agricultural profit (value – costs)	1,006	841	166	0.13
Total Economic Income	3,386	3,180	206	0.17
Sample Size	**2,133**	**1,414**		

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group means were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

USD = United States dollars.

E. WtM Credit

1. Summary

The strategic goal of WtM credit was to provide long-term credit to individuals who were trained in HVA and OFWM. This credit was intended to provide beneficiaries with the necessary resources to finance new irrigation and production technologies introduced in WtM training. For instance, WtM loans could be used to strengthen agricultural production, modernize equipment, build greenhouses, expand orchards and vineyards, and purchase root

stock, as well as for post-harvest agribusiness activities like marketing, processing, establishing consolidation centers, and developing and expanding processing factories. WtM credit was administered by ten providers—six universal credit organizations (UCOs)[10] and four banks. These organizations identified viable borrowers, RFF and MCA-Armenia approved loan applications, and RFF provided in-person monitoring of investments made with loans.

WtM loans had a maximum interest rate of 12 percent and a loan term of between 2 and 7 years, with a maximum loan amount of 10.5 million Armenian drams (about $28,500). WtM credit was implemented under a similar structure to previous and existing loan programs for rural Armenian borrowers designed by the World Bank and the International Fund for Agricultural Development (IFAD). These programs also featured loans for similar agricultural purposes, comparable interest rates, as well as similar maturities. However, the WtM loans were provided in Armenian drams as opposed to U.S. dollars, unlike these other programs that provided loans in U.S. dollars. This protected WtM loan recipients from currency market fluctuations like the devaluation of the U.S. dollar vis-à-vis the Armenian dram in 2009. WtM loans also featured in-person monitoring on the part of RFF staff to verify that investments were used for their designated purpose, which did not occur with the World Bank or IFAD loans.

2. Evaluation Approach

The evaluation of WtM credit relied on the WtM loan program data from RFF, as well as FPS data. We used the RFF data to summarize loan characteristics, and we used FPS data to describe WtM loan recipients and assess the relationship between receiving WtM credit and key outcomes including investment, production, sales, and income. As originally designed, the FPS was not intended to be used to determine the impact of WtM credit on farmers' agricultural and economic outcomes. However, in the final round of the FPS, we attempted to include an additional sub-sample of WtM and recipients of credit from other sources who had not been interviewed in earlier rounds to facilitate some analysis of the credit component. We interviewed 1,106 farmers in the final round of the FPS who reported receiving credit in the previous year, of whom 64 reported receiving WtM credit (around 6 percent of all credit recipients that were interviewed).

Our analysis of the WtM credit component compared outcomes for WtM credit recipients against other farmers in the FPS (regardless of whether or not they received any non-MCA credit). This group provided our estimate of the counterfactual, that is, what farmers' outcomes would have been in the absence of WtM credit. Given the nonexperimental nature of the credit evaluation, it is critical to use regression modeling to control for preexisting differences in the characteristics of WtM borrowers and other farmers who did not receive WtM loans. Because many of the WtM loan recipients were not sampled at baseline, our sample size of WtM loan recipients drops to only 27 individuals for our impact analysis.

[10] Under Armenian legislation passed in 2002, UCOs are financial organizations that can operate as credit and savings unions, leasing and factoring companies, and universal nonbank financial institutions. As of January 1, 2009, there were 25 licensed UCOs in Armenia. Their assets comprised about 61 billion Armenian drams (AMD), 15 percent of which were directed to agricultural sectors (Urutyan 2009).

The quantitative analysis of WtM credit has two important limitations. Because of these two limitations, we consider the estimates we present as suggestive but not conclusive; follow-up differences between WtM borrowers and non-borrowers are not defined as impacts, but as potential effects of WtM credit. First, the sample size was small. As a consequence, the estimates of program impacts were imprecisely estimated, meaning that the true effects of the program may not be well-measured. Second, we could not fully account for all differences between WtM loan recipients and the comparison group. The nonexperimental evaluation design assumes that all relevant differences between the two groups were observed, but important factors—such as farmers' motivation and predisposition to invest in new technologies or crops—were not completely captured by the baseline survey data. Failing to account for these factors likely caused upward bias in the impact estimates because the farmers whose unobserved characteristics make them most likely to apply for WtM credit are also most likely to invest in new technologies or crops and may already have higher incomes, even without a WtM loan.

3. Implementation of WtM Credit

Overall, the project was successful in administering credit to farmers. Under WtM credit, MCA initially planned to disburse at least $8.5 million USD to WtM training participants through intermediary credit organizations, and over $13.3 million was ultimately disbursed from 2008 until 2011. By 2011, the component was operating in 10 Armenian marzes (all except Yerevan). In addition, lending under the program's revolving fund will continue until 2020 by using repayments from earlier loans to fund subsequent loans. According to stakeholder interviews and summary reports on WtM credit, the primary factors that allowed the component to meet its lending targets were the high demand for the loan product given its low interest rates and relatively long repayment term, the program's well-defined administrative structure and target population, and a strong alignment of incentives among MCA, RFF, several UCOs, and at least one participating bank.

Participating UCOs were more active lenders than participating banks. Each participating financial institution had a unique approach to targeting WtM loan recipients, but overall UCOs were more active than banks in actively recruiting potential borrowers and making WtM loans. UCO lending accounted for 79 percent of the WtM loan portfolio of over $12.1 million by July 2011. The higher participation of UCOs relative to banks was partly attributable to UCOs' limited credit supply compared to banks. In contrast to banks, which can get funds through regular customer deposits, UCOs do not have alternate sources of investment capital.

WtM lending was low in proportion to the number of farmers trained through WtM. The scale of WtM lending—around 1,109 loans as of December 2011—was small in proportion to the 47,800 households trained in either OFWM or HVA through WtM. According to nearly all farmers who were interviewed, a large portion of trainees' demand for credit went unmet. This unmet demand resulted in a high level of dissatisfaction among farmers who participated in training for access to credit but did not secure a loan. Many of these farmers thought that participating in WtM training would lead to WtM credit. Participation in training was required, but loan applicants also had to demonstrate that they would use the loan for approved agricultural purposes and were likely to be able to repay the loan. According to participating lenders, only a few trained farmers were rejected for loans on these grounds. However, a substantial portion of trained farmers reported that they did not apply for credit due to the program's stringent application requirements and a general mistrust that they would be considered fairly in the loan approval process.

WtM credit recipients' loan features and uses were fundamentally different from non-WtM credit recipients' loans. According to FPS follow-up data, WtM credit recipients reported lower interest rates, higher loan amounts, and longer repayment terms than other credit recipients: an interest rate of 12 percent versus 21 percent among other credit recipients, an average loan size of over $13,500 versus around $2,600 for other credit recipients, and a repayment term of nearly five years versus less than two years for other credit recipients (Table 4). Compared to other credit recipients, WtM credit recipients were also more likely to report using credit for greenhouses and orchards and less likely to use credit to finance new seeds and seedlings or livestock investments.

Table 4. WtM Credit Characteristics, by Type of Credit Received (percentages unless otherwise indicated)

	WtM Credit Recipients	Other Credit Recipients
Source of Credit:		
Universal credit organization (UCO)	53	18
Bank	53	83
Purpose of Credit		
Greenhouse	44	15
Orchards	27	19
Equipment (tractor)	14	16
Seeds, seedlings, sprouts	11	35
Livestock	11	27
Cold storage	9	1
Other	8	26
Average Loan Amount (USD)	13,509	2,628
Average Annual Interest Rate (points)	12	21
Average Loan Period (months)	57	20
Sample Size	**64**	**1,042**

Source: 2010-2011 Farming Practices Survey.

Note: Percentages of respondents reporting credit from banks and UCOs sum to over 100 points due to a small proportion of respondents who reported more than one loan.

Up to two purposes could be provided for each loan. For this reason, percentages for the purpose of credit do not sum to 100 percent.

USD = United States dollars.

WtM credit recipients had more resources and agricultural investments than other credit recipients and non-credit recipients. In general, WtM credit recipients had higher education levels and were older than other credit recipients or non-credit recipients (Table 5). They cultivated 3 hectares of land, on average, at baseline, compared to 1.9 hectares among other credit recipients and 1.3 hectares among nonrecipients. In addition, WtM borrowers reported higher average farming expenditures and crop sales than the other two groups. Given WtM borrowers' higher average crop sales as well as nonagricultural income, their annual total economic income—or household income after accounting for the value of their non-sold agricultural production—of around $7,000 was over two times higher than that reported by other credit recipients and nearly three times higher than incomes reported by noncredit recipients. These findings underscore the importance of controlling for baseline differences between WtM credit recipients and other respondents in our analysis of the impact of WtM credit on agricultural and economic outcomes.

Table 5. Baseline Farmer Characteristics Prior to WtM Implementation, by Type of Credit Received (means unless otherwise indicated)

	WtM Credit Recipients	Other Credit Recipients	Credit Nonrecipients
Demographic Characteristics			
Respondent's Age (years)	51	46	50
Female Respondent (percent)	4	12	12
Education Beyond a Secondary Level (percent)	41	15	14
Land Holdings and Agricultural Expenditures			
Total Land (hectares)	3.0	1.9	1.3
Total Farm Expenditures (USD)	2,262	1,364	967
Agricultural Production and Sales			
HVA crops (metric tons)	18.6	11.4	6.3
Non-HVA crops (metric tons)	4.4	3.4	2.1
Revenue from HVA Crop Sales (USD)	5,142	2,639	1,549
Revenue from Non-HVA Crop Sales (USD)	540	179	70
Annual Income and Profit (USD)			
Nonagricultural Income	1,856	1,290	1,275
Agricultural profit (value – costs)	4,814	2,176	1,094
Total Economic Income	7,249	3,526	2,417
Sample Size	**27**	**370**	**892**

Source: 2007-2008 Farming Practices Survey.

USD = United States Dollars. HVA = High-Value Agriculture.

4. Differences in Outcomes of WtM Credit Recipients and Other Farmers

There were some differences in the farming practices of WtM credit farmers relative to other farmers. According to FPS data, WtM loan recipients were much more likely than those who did not receive WtM loans to report establishing or renewing a greenhouse (30 percent versus 15 percent in the comparison group, *p*-value of 0.01, Table 6). Also, WtM credit recipients were more likely than comparison group farmers to make at least one organizational improvement, although the differences were not significant for separate organizational improvements (not shown; significant at the 1 percent level). Notably, investments in greenhouses are capital-intensive and would thus imply a need for long-term credit. However, implementing organization improvements such as preparing irrigated land would not likely require loans to implement. The higher adoption of these practices among WtM credit recipients may be an indication that these individuals were predisposed to adopt these practices more than nonrecipients of WtM credit, regardless of access to capital.

New greenhouses under construction

Table 6. Potential Effects of WtM Credit on Industrial- Economical HVA Practices (percentages)

	WtM Credit Recipients	Nonrecipients of WtM credit	Difference	*p*-value
Produced High-Value Crops for Budget Reasons	4	4	0	1.00
Changed Crop or Variety Based on Demand	8	9	-1	0.81
Established or Renewed an Orchard	11	11	0	0.97
Established or Renewed a Greenhouse	30	15	15**	0.01
Improved Soil Preparation Activities (plowing, cultivation, etc.)	36	32	4	0.53
Used High-Quality, Disease-Resistant Seeds or Planting Material	7	8	-1	0.83
Improved Post-Planting Practices (weeding, fertilization, pest control, etc.)	22	16	7	0.35
Shifted Time of Harvest by Using Plastic Tunnels or Planting Seedlings	4	4	0	1.00
Sample Size	**27**	**1,262**		

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Impact estimate on the practice of mixed cropping was statistically significant at the 5-percent level but had very low rates of adoption for both the treatment and control groups. Measured at follow-up, treatment and control group percentages were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

There was some evidence that WtM credit had an impact on crop production and household income. There were statistically significant impacts of credit on production, revenues (not shown), and values of HVA crops produced (Table 7). WtM credit recipients produced 6 more tons of HVA crops and had over $2,000 (or 50 percent) more in total harvest value (including HVA and non-HVA crops) than nonrecipients of WtM credit, after accounting for baseline differences. When we aggregated all sources of income, WtM credit recipients had

total income that was more than $2,300 (or 45 percent) greater than nonrecipients' income.[11] This difference was also statistically significant (*p*-value: 0.00). As discussed previously, these estimates are vulnerable to upward bias. Due to this potential bias, WtM borrowers' higher agricultural production, sales, and income cannot be conclusively attributed to WtM credit.

We also conducted interviews with credit recipients to assess whether it was MCA credit that contributed to their higher production and income or if they would have made the same investments without MCA credit. Their responses were mixed; in one case, the household reported that they would not have been able to invest in new technologies without MCA's credit program. In another example, a farmer reported that he would have self-funded a greenhouse without the program but would not have been able to finance his cooling facility without MCA credit. In both cases, our perception was that the farmers were more entrepreneurial than typical Armenian farmers. Together with the quantitative findings, we believe the credit program possibly had a positive impact on participants' profits and income, but it is unlikely that the entire difference between MCA credit recipients and nonrecipients is attributable to MCA credit.

Table 7. Potential Effects of WtM Credit on Respondents' Agricultural Production, Market Value of Harvests, and Annual Economic Household Income

	WtM Credit Recipients	Nonrecipients of WtM credit	Difference	*p*-value
Agricultural Production (metric tons)				
HVA Crops	15.5	9.5	6.0***	0.01
Non-HVA Crops	2.1	2.4	-0.3	0.75
Market Value of Harvest (USD)				
HVA Crops	5,539	3,521	2,017**	0.01
Non-HVA Crops	324	438	-114	0.32
Income (USD)				
Nonagricultural Income	3,178	2,709	469	0.15
Agricultural Income				
Total value of harvest	6,079	4,059	2,020**	0.03
Agricultural profit (value – costs)	4,110	2,164	1,946**	0.01
Total Economic Income	7,523	5,190	2,333***	0.00
Sample Size	**27**	**1,262**		

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group means were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods.

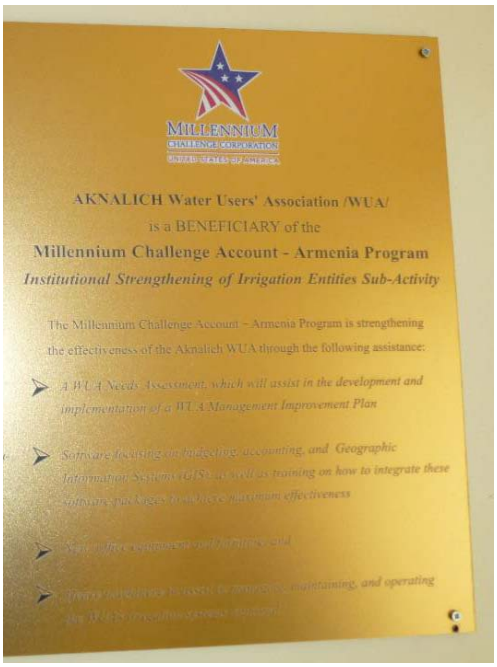
*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

USD = United States dollars. HVA = high-value agriculture.

[11] Due to the limited sample size of WtM credit recipients, sensitivity analyses such as those conducted for the training evaluation were not informative in the present context. However, our inspection of the data indicated that the WtM credit recipients' reported values were logically consistent with other item responses.

F. Institutional Strengthening Subactivity

1. Summary



Plaque listing the assistance provided to the Aknalich Water User Association

The primary objective of the Institutional Strengthening of Irrigation Management Entities Subactivity (ISSA) was to improve the managerial, technical, structural, and financial capacity of WUAs operating in rural Armenia. According to the ISSA design, WUAs' enhanced capacity should allow them to manage irrigation systems more efficiently and autonomously and eventually reach financial sustainability. In addition, strengthened WUAs should be able to more effectively operate and maintain Armenia's rural irrigation infrastructure, thus ensuring reliable water supply and supporting long-term rural agricultural development. To meet these multiple objectives, ISSA's implementing organizations provided technical assistance to staff from 44 WUAs (and 3 WSAs) on irrigation water delivery services, water service fee collection practices, budgeting and accounting processes, irrigation infrastructure maintenance, and participatory management principles. Of the 44 WUAs receiving assistance under ISSA, MCC and MCA-Armenia selected 8 WUAs for intensive assistance. The intention of this added assistance was to create a federation of these 8 WUAs. Consultations with the targeted WUAs started in late 2008 and were conducted twice a month in 2009, as compared to one consultation every three months for nontargeted WUAs. ISSA's implementing organizations also provided material assistance to WUAs and WSAs in the form of office equipment, computer software, and heavy machinery. With a budget of approximately $4.9 million, ISSA was launched in September 2008 and completed in October 2011.

2. Evaluation Approach

For the ISSA evaluation, we used WUA administrative data and Water User Surveys to compare WUA and water-user outcomes before ISSA to analogous outcomes after ISSA. This before-after design does not allow us to isolate the effect of ISSA from other factors that could have influenced WUAs' and water users' outcomes over this same time period, but it was the only viable option given the absence of a comparison group for the 44 WUAs assisted under the project.

Collected by AVAG Solutions for the 2007, 2008, 2009, and 2010 fiscal years, WUA administrative data provided annual estimates of service fee collection rates, WUA income and expenditures, and other important performance metrics. Water User Surveys were conducted by AVAG Solutions in 2009 and 2010 among households in the geographic service area of WUAs served by ISSA and covered the following domains: WUA membership and contracts, dispute resolution among water users, irrigation service fee collection, and WUA representative elections. The total number of surveyed households in 2009 and 2010 was 1,420 (480 for the 8 targeted WUAs and 940 for 36 nontargeted WUAs). Although the same households were not

surveyed in 2009 and 2010, the same number of households in each community were surveyed in both years. As such, we can compare the sample of surveyed households before ISSA to the sample of surveyed households after ISSA.

3. Implementation

Management improvement plans (MIPs) served as the basis for each WUA's strengthening efforts. Developed with the help of ISSA implementers, MIPs outlined each WUA's strengths and weaknesses and listed concrete milestones the WUA must complete to achieve technical, managerial, and financial self-sustainability. With consultants' help, MIPs were further distilled into detailed action plans (DAPs), which prioritized the twelve most important follow-up issues identified by MIPs. Beginning in late 2008, VISTAA technical consultations were structured around WUAs' efforts to meet MIP milestones. Of the 44 WUAs receiving assistance under ISSA, MCC and MCA-Armenia selected 8 WUAs for more intensive assistance in the form of more regular consultations and additional assistance with meeting goals outlined in MIPs. The intention of this intensive assistance was to prepare these 8 WUAs for the creation of a WUA federation.

Although ISSA implementation faced a number of obstacles, according to qualitative reports and additional interviews, stakeholders believed that ISSA consultations were generally well implemented. The implementers conducted all scheduled consultations and distributed donations equitably. An independent consultant hired by MCC concluded that the WUA consultations had indeed been effective in providing WUA leadership with technical and moral support, and helping WUA staff better understand their roles and long-term goals (Merkley 2010). In addition, stakeholders praised the decision on the part of MCC, MCA, and ISSA implementers to make computer and equipment donations conditional on the completion of key milestones. However, implementation was hindered by an initial lack of clarity in consultations about WUAs' goals as well as a general lack of willingness on the part of most WUA staff to take ownership of ISSA initiatives. In general, WUAs' management decisions were not based on consultations for MIPs, and even midway through implementation, some WUA staff lacked a basic understanding of ISSA program logic.

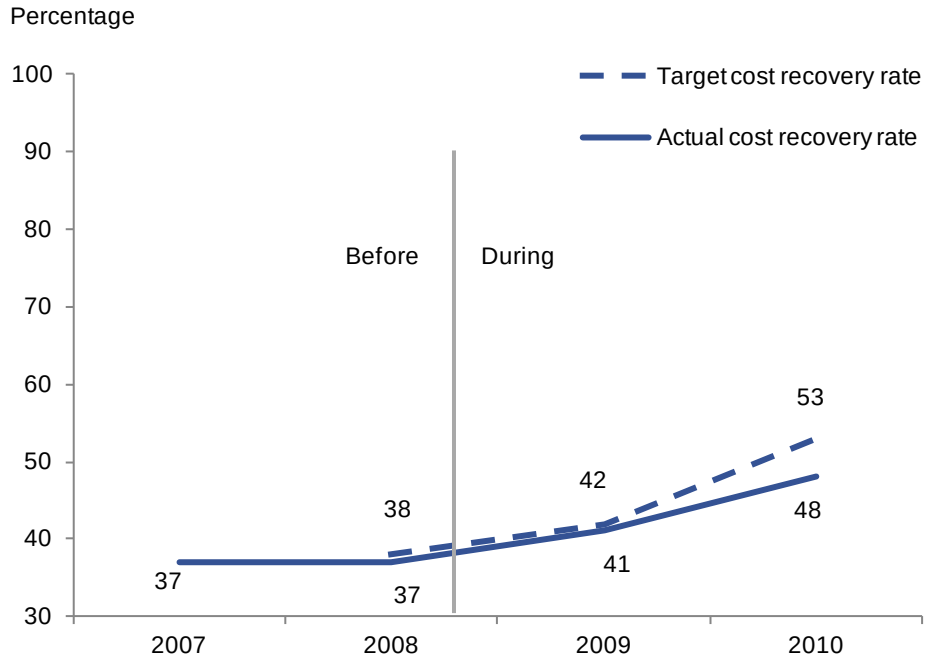
Beneficiary perceptions were mixed regarding the usefulness of consultations and MIPs. Out of several WUAs interviewed by Socioscope for the QPA report, only a few had a high assessment of MIPs' practical value. Most interviewed WUA personnel saw MIPs merely as documentation of their current operations, rather than a program document that could assist their management decisions. The 8 targeted WUAs, which received intensive assistance, spoke more highly of the usefulness of consultations than the 36 nontargeted WUAs. While WUAs identified some aspects of the consultations as important, particularly sessions related to new technologies and to accounting issues, WUA staff generally did not consider the consultations particularly helpful or relevant to their daily operations. In contrast, equipment support—including furniture, computers, and GIS software—was considered very useful by WUA staff.

4. ISSA Effects

WUAs appear to have improved their financial standing and increased membership during ISSA implementation. WUA water intake and delivery decreased between 2007 and 2010, likely due to the poor agricultural seasons in 2009 and 2010 and unfavorable global economic conditions. On average, WUA expenditures decreased by $72,000 during this period, largely as a result of decreased water payments to WSAs. Also during this period, WUAs'

revenues increased slightly by $16,000, leading to increased net annual revenues of over $87,000, on average (not shown). Related to these increased revenues, WUA cost recovery improved from 37 percent in 2008 to 48 percent in 2010 (Figure 7). Although notable, this improvement fell short of the 2010 target cost recovery rate of 53 percent. These moderate changes from 2008 to 2010 cannot necessarily be attributed in full or in part to ISSA, as climatic conditions, changes in cropping patterns, national irrigation policy reforms outside of the scope of ISSA, and other assistance programs could have had an effect on irrigation outcomes and WUA expenditures and revenues. Despite these moderate improvements, WUAs do not yet appear to be approaching financial self-sufficiency in the short- or medium-term.

Figure 7. WUA Cost Recovery Rates, 2007–2010 (percentages)



Sources: 2007, 2008, 2009 and 2010 WUA administrative data. Sample size = 44 WUAs.

Note: Cost recovery rates are defined as the percentage of operations and maintenance costs recovered with revenues from water charges.

Membership rates, membership fee payment rates, and WUA representation appear to have improved. Data from the Water User Survey showed that while irrigation practices in areas served by WUAs did not change, WUA membership rates and membership fee payment rates both increased moderately (Table 8). From 2009 to 2010, WUA membership increased from 38 to 48 percent, and membership fee payment among WUA members increased from 75 to 92 percent. The number of respondents who reported having village WUA representatives also increased from 27 percent in 2009 to 52 percent in 2010. Interestingly, the reported average water payment amount also increased from $76 to $98 from 2009 to 2010, but the percentage reporting that they fully paid for irrigation did not change.

Again, these changes cannot be attributed solely to ISSA, given the confluence of environmental, economic, and political developments from 2008 to 2010 that could have also influenced these outcomes. However, it is likely that ISSA had some role in improving WUA membership fee payment rates and increasing awareness of WUA operations, as these were the

primary activities and outcomes outlined in ISSA milestones, and WUAs were rewarded with a wide array of donations upon completion of these milestones.

Table 8. Reported Irrigation and WUA- Related Outcomes of Farmers in the ISSA Assistance Area in 2009 and 2010 (percentages unless otherwise indicated)

	2009	2010	2009-2010 Change
WUA Membership, Contracts, and Representation			
WUA Membership	38	48	10
Currently paying a WUA membership fee	75	92	16
Signed a Contract with the WUA Last Year	74	69	-5
Has a Village WUA Representative	27	52	24
In Last Year, Respondent Fully Paid for Irrigation Water	60	60	0
Total Amount Paid in USD (conditional on making water payments)	76	98	22
Sample Size	**1,420**	**1,420**	

Sources: 2009 and 2010 Water User Surveys.

Note: Reported 2009-2010 change may not equal the difference in reported values for 2009 and 2010 due to rounding.

USD = United States dollars.

ISSA's national irrigation policy efforts may result in some long-term changes in the role of the irrigation sector in supporting sustainable development of agriculture. The goal of ISSA's irrigation policy component was to prepare and adopt a national irrigation policy for the Armenian irrigation sector and to secure legislative reforms outlined by the policy. Mott MacDonald developed a draft irrigation policy and strategy document, which was approved by the Armenian government in December 2009. Next, AVAG Solutions developed a strategic plan for legislative reforms related to the new irrigation policy. The most important policy reforms resulting from these documents and reform efforts were legislative modifications related to taxes and subsidies. Stakeholders viewed the completion and adoption of the policy by the Armenian government, as well as legislative modifications achieved under the component, as a fulfillment of the component's primary objectives. However, stakeholders agreed that additional legislative reforms were still necessary to successfully regulate the Armenian irrigation sector.

G. Post- Harvest Processing and Marketing

1. Summary of PPM

The objective of PPM was to improve post-harvest handling, enhance processing enterprises' operations, and link Armenian producers to international and domestic markets. Implemented by ACDI from 2008 to 2011, PPM assistance was provided at both the enterprise level and the industry level. At the enterprise level, ACDI specialists trained beneficiary organizations on food safety; processing technologies and practices; sorting, packaging, and storing principles; quality management systems; and business and financial analysis. In addition, ACDI specialists provided technical assistance to improve enterprises' day-to-day operations and develop long-term business plans. ACDI staff primarily targeted small- and medium-sized agribusiness processing companies for technical assistance, as these companies formed the primary link between producers and consumers. PPM implementers also organized informal

groups of farmers, provided these groups with donated seeds, fertilizer, and technical assistance, and assisted them in establishing agreements and contracts with agricultural buyers.

At the industry level, ACDI specialists facilitated a "Buy Armenian" campaign and helped develop the Armenian Automated Reporting Marketing Information System (ARMIS). Another primary PPM activity was the establishment of collection centers—small locations where several producers could store and cool their agricultural products—and consolidation centers—larger locations where large numbers of producers could store, aggregate, and package their production for sale.

2. Evaluation Approach

For the PPM component, we focused on descriptive analyses of enterprises' characteristics and the adoption of post-harvest practices, profitability, and sustainability using the Enterprise Adoption Survey (EAS). EAS respondents were enterprises that received services through PPM by September 2010. Unlike the analyses of the other components, we did not have any estimate of the counterfactual—what would have happened with those enterprises in the absence of PPM. The EAS did not survey enterprises that did not receive services, nor were the enterprises surveyed prior to the provision of services. As a result, we could only analyze the potential effects of PPM assistance using participants' reported changes in outcomes following this assistance and their perceptions of the contribution of PPM to these changes.

3. Implementation of the PPM Component

Identification of PPM participants was difficult. To target beneficiaries for PPM assistance, ACDI compiled a list of registered small businesses operating in food production, processing, or marketing. Through this method, they found fewer than 200 possible beneficiary groups. After program implementers determined that there were likely far fewer than the original target of 300 registered enterprises that could benefit from PPM assistance, the target number of participants was reduced to 225 over the entire implementation period.

To meet implementation targets, program implementers also targeted farmers' groups for assistance. Given the dearth of registered production and processing enterprises in Armenia, MCC and MCA-Armenia decided that ACDI specialists should also organize and assist informal groups of farmers. The objective of this assistance was to strengthen farmer groups' ability to work directly with newly established consolidation centers and recently trained fruit processors, thus strengthening new links in key value chains. By September 2011, ACDI had assisted 94 farmer groups (in addition to 133 enterprises), thus meeting its revised target of 225 assisted beneficiary groups.

PPM assistance largely varied according to beneficiary group. EAS respondents within each beneficiary group—commercial organizations, nongovernmental organizations, individual business owners, and farmers' groups—reported receiving a different mix of PPM assistance. The most commonly reported types of assistance among commercial organizations were food safety training and activities to facilitate value chain linkages. Among nongovernmental organizations, the most commonly reported assistance was post-harvest technology training and assistance with establishing collection centers. In contrast, farmer groups largely reported receiving help with production inputs as well as assistance with organizing the group itself. Individual business owners largely reported receiving production inputs and participating in trainings on dried fruit production and post-harvest technologies.

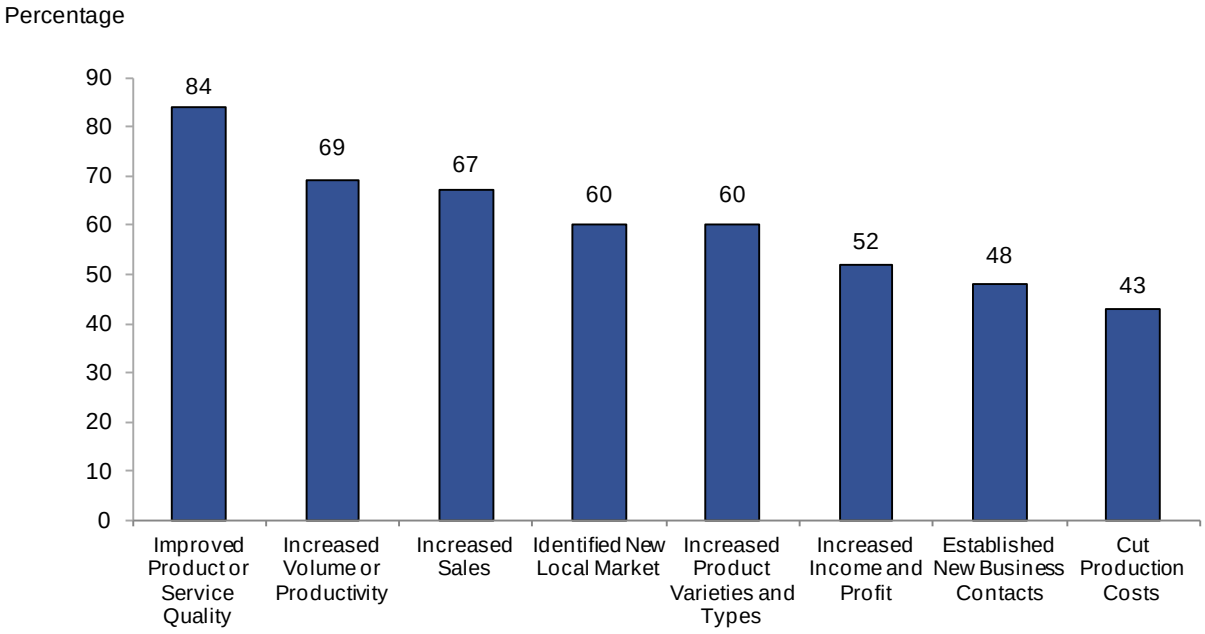
Qualitative reports and interviews with PPM participants revealed mixed findings regarding the usefulness of PPM assistance. Assisted fruit processors particularly valued training or assistance on dried fruit production and food safety. In addition, informal dried fruit producers rated training on production technologies and raw materials as quite useful. Technical assistance in brand development was also considered useful by several interviewed beneficiaries. However, participation in local expositions and agricultural events was unanimously unpopular because such events did not directly help beneficiaries expand their access to markets and relationships with local and foreign partners. In interviews, beneficiaries stressed their continued need for assistance with local and external market access and stated that PPM assistance in this area had been deficient.

The establishment of collection and consolidation centers was viewed favorably by many stakeholders, but some centers performed better than others. Following the program's midterm review, MCA-Armenia and ACDI prioritized the establishment of 20 collection centers as a primary implementation target. MCA-Armenia introduced a cost-sharing mechanism in which MCA-Armenia would share up to 20 percent of beneficiary groups' investment costs for consolidation centers, and finance up to $10,000 for investments in collection centers. Consolidation centers were established after the implementer conducted informal analysis of retailers, including where they bought their produce and what price they paid. Cooperatives and individual entrepreneurs were then identified and informed of the costs and benefits of establishing collection and consolidation centers. As a result of these efforts, several collection and consolidation centers were functional by mid-2011, including a consolidation center built and operated by the Federation of Agricultural Associations (FAA).

According to the QPA report, the FAA's consolidation center and collection points had the most potential to continue operations in the future because these initiatives had strong beneficiary ownership and directly serve producers and buyers' incentives and information needs. By late 2011, however, ACDI and other stakeholders had mixed opinions concerning the value of ACDI's collaboration with FAA. By the end of the compact period, ACDI had determined that the federation was not managing its consolidation center in an effective manner, despite ACDI's continued marketing support. In contrast, at least one consolidation center established by a private entrepreneur appeared to operate very efficiently and profitably by mid-2011.

There was conflicting evidence about whether PPM had a positive effect on enterprises' outcomes. According to the EAS, the majority of PPM beneficiaries reported improvements in outcomes following PPM assistance. The most common positive outcomes reported were improved product and service quality, increased productivity, and increased sales (Figure 8). About half of all beneficiaries reported higher income and profit. There was some heterogeneity among beneficiary groups regarding increased sales, with only around half of individual business owners and nongovernmental organizations reporting such an improvement, compared to around three-quarters of commercial organizations and farmer groups (not shown). Overall, enterprises largely reported that PPM assistance contributed to these positive outcomes. Over 70 percent of enterprises that reported improved quality, sales, profits, and productivity stated that PPM assistance contributed (at least in part) to these positive outcomes (not shown). While the EAS showed highly positive outcomes, these findings are at odds with Socioscope's qualitative findings, which suggested that PPM assistance generally did not lead to measured improvements in production or sales.[12]

Figure 8. Self- Reported Business Outcomes of PPM Beneficiaries (percentages)



Source: 2010–2011 Enterprise Adoption Survey.

[12] These differences may reflect different data collection methods and timeframes of the two efforts. For example, the QPA featured interviews with individual PPM participants, whereas the EAS often featured interviews with more than one PPM participant in each assisted organization or group. The EAS's group administration approach may reflect the positive outcomes experienced by any members of participant groups, as opposed to positive outcomes experienced by one interviewed individual, as is the case with the QPA report. It is also possible that PPM assistance improved from the period covered in the QPA (2008 and 2009) to the period covered in the EAS (2010 and 2011). These improvements may reflect midcourse adjustments to PPM assistance, partly resulting from the earlier findings.

H. Conclusions and Lessons Learned

MCC and MCA-Armenia had envisioned an integrated and complementary set of activities designed to improve agricultural production and reduce rural poverty in Armenia, with ambitious service delivery targets for each of the four components. Implementers were able to meet or surpass all of these ambitious targets, which is especially notable for training, in which over 45,000 and 36,000 farmers were trained in OFWM and HVA, respectively.

For the most rigorous evaluation, WtM training, we did not find evidence that training substantially improved measures of farmers' well-being such as income, avoidance of poverty, or consumption. We also did not find evidence of impacts on adoption of new OFWM practices that might suggest that longer-term impacts could develop over time. Perhaps such practices were not adopted due to institutional factors such as lack of monetary incentives to conserve water or lack of credit to invest in technologies to increase cultivation of higher-value crops.

As described earlier, we attempted to evaluate each of the other WtM components but cannot conclusively assess their impacts. Despite the methodological challenges associated with the nonrigorous research designs for these components, the evaluation provides suggestive evidence that WtM credit may have led to greater production, revenue, and income for beneficiaries, although only a very small fraction of trained farmers received WtM credit. In addition, qualitative evidence and observations suggest that some PPM efforts (like collection centers) may be sustained, while others—particularly support to farmer groups and processors—may not have much of an effect. Finally, while we see improvements in WUA cost recovery rates and net revenue, we cannot attribute these changes solely to the ISSA component of WtM. Furthermore, WUAs' apparent lack of commitment to strengthening activities will pose a challenge to the sustainability of the results to the extent they can be attributed to ISSA. However, legislation secured by the irrigation reform component will likely have some impact on WUAs' long-term cost recovery, as WUAs now face a reduced tax burden as result of recent reforms.

Because the evaluations of WtM credit, ISSA, and PPM were introduced after WtM was already underway, it was not possible to design a quantitative evaluation that could rigorously examine the overall effects of the combined WtM Activity. However, we can attempt to gauge the magnitude of the possible overall effect of WtM by considering the evidence available. Unfortunately, as has been discussed, the WtM components were not well integrated with each other, so there is little chance that the planned complementarities were realized. For this reason, when assessing the overall effect of WtM, we assess the possible effect of each component on its target population. WtM training was the largest and most visible component of WtM, but it had little impact on the overall WtM goals of increasing agricultural production, agricultural profits, and household income. Thus, any overall effects of WtM could only be through direct effects of the other components. There is suggestive evidence that WtM credit and PPM may have had effects on the beneficiaries who participated in these components, but little evidence to suggest that these components had broader effects beyond the direct beneficiaries. Although some participants may have benefited from these components, the overall effect of WtM on the full set of targeted beneficiaries was probably small, at least as of the end of the Compact. We note, however, that many of the potential effects of ISSA on farmers were designed to provide benefits beyond the Compact period in the form of sustained irrigation infrastructure investments and more effective WUAs; if ISSA is successful in these goals, it would affect many farmers.

Our study suggests some lessons for future programs considering similar activities similar to those of WtM:

More modest training targets and better selection of training beneficiaries may help ensure that more farmers adopt practices. The findings from the evaluation of the training component suggest that inducing farmers to change their behaviors is challenging, particularly when there are numerous constraints to adopting new practices. In addition, because the implementer had high targets to meet in a prescribed timeframe, the recruitment of farmers may not have targeted those most likely to benefit. With smaller training targets, more time could have been spent identifying and selecting farmers and then following up with trained farmers to identify and resolve issues precluding them from adopting new practices. This could lead to a higher net total benefit even if the footprint of the program is smaller. We note that the training targets (as well as the PPM targets) were revised following interim review of the program. The findings of this evaluation suggest that those revised targets probably were not enough, but we do not believe there was sufficient evidence at the time to dramatically overhaul the program.

Training could have been better aligned with the needs of beneficiary farmers. The implementers tailored training sessions to match the agricultural conditions and needs of the different zones in Armenia. However, the training sessions in each area provided all farmers who attended training with the same type of information and followed a similar format of classroom and practical instruction. While these trainings included some simple practices, they also included many costly practices (which may have better long-term results if adopted). However, it is unlikely that many trained farmers would be able to invest in these more costly practices. An alternate training strategy would be to tailor the content of training more directly to farmers' ability to invest in the practices of irrigation and cultivation being taught in the training. For example, small-scale farmers who lack investment capital could have received training that focused only on simple and inexpensive OFWM practices. Lessons on demonstration farms could have been structured accordingly. Trainings could also have taken into account whether farmers had access to reliable water or when their irrigation infrastructure was scheduled for rehabilitation. Such an approach could have used farmers' and trainers' time more efficiently and placed emphasis on practices that had a higher probability of being adopted. In other cases, all farmers may have benefitted more from training being better-aligned with the Armenian context. For example, although the OFWM training focused on water conservation, farmers in Armenia pay for water based on the amount of land and crops they intend to irrigate rather than the volume of water used; as a result, there is no private incentive to conserve water.

Programs may consider a more targeted approach to selecting farmers for training as well as credit that would facilitate better linkages between the two components. Levels of WtM lending were disproportionately low compared to levels of WtM training, and only a very small proportion of trained farmers received WtM credit. This produced dissatisfaction among farmers who participated in training with the expectation of receiving credit and also probably resulted in inefficiencies in that farmers were trained in technologies they could not afford to adopt. Future agricultural assistance programs may consider a more targeted (and perhaps joint) selection of farmers for training as well as credit. For example, if only creditworthy farmers were selected for training in more advanced methods—and credit was provided upon the successful completion of training—farmers' expectations of credit would be more realistic and a greater proportion of trained farmers would have sufficient capital to invest in technologies featured in training. This combination of advanced training and credit could be offered to one segment of the target population, whereas another segment of small-scale (and presumably not creditworthy) farmers could receive training in simple and inexpensive practices.

WUA staff may need stronger incentives to strengthen WUA operations. Throughout ISSA implementation, WUAs took a passive role in consultations and in developing and applying MIPs. Implementers were more successful in inducing participants to implement changes once they brought in the incentives of equipment. To ensure more ownership among participants, future interventions with WUAs—including consultations, training sessions, and donations—should be designed to provide WUA staff with strong incentives to take ownership of strengthening efforts at the initial stages of implementation.

Future post-harvest and marketing assistance programs may benefit from providing more targeted assistance. Rather than serving all producer groups and creating new farmer groups to meet targets, PPM implementers could have provided more intensive assistance to fewer individuals or groups that have a strong commitment to taking advantage of assistance and a high potential to generate positive business outcomes.

Synchronizing implementation of training and post-harvest and marketing assistance programs could strengthen both components. PPM could have helped to identify broken links in agricultural value chains or the needs of Armenia's agricultural enterprises and the steps required to meet those needs. This information could have fed into the training program to help farmers change their practices and the crops they cultivate to meet market needs. The original vision for the WtM activity was for these activities to be complementary in ways such as these. However, WtM training and PPM were implemented in isolation from one another. A contributing factor to that separation was that training began well before PPM, which was necessary in order to meet the high training targets. Also, the provision of PPM services to farmer groups was not tied to WtM training, nor was the formation of farmer groups who could receive PPM services encouraged as part of the training component.

I. INTRODUCTION

A. Overview of the Compact and the Water-to-Market Activity

Armenia was left with the legacy of a centrally planned economy when it declared independence from the Soviet Union in 1991. The Armenian economy was highly dependent on its Soviet trading partners and poorly equipped to function with the lack of infrastructure investment and support after Soviet withdrawal. In 1994, the Armenian government adopted a comprehensive stabilization and reform program that dramatically lowered inflation and led to steady economic growth beginning in 1995. Evidence from the Integrated Living Conditions Survey, however, suggests that this growth occurred primarily in urban areas. As of 2004, the poverty rate in rural areas was 32 percent (National Statistical Service, 2010).

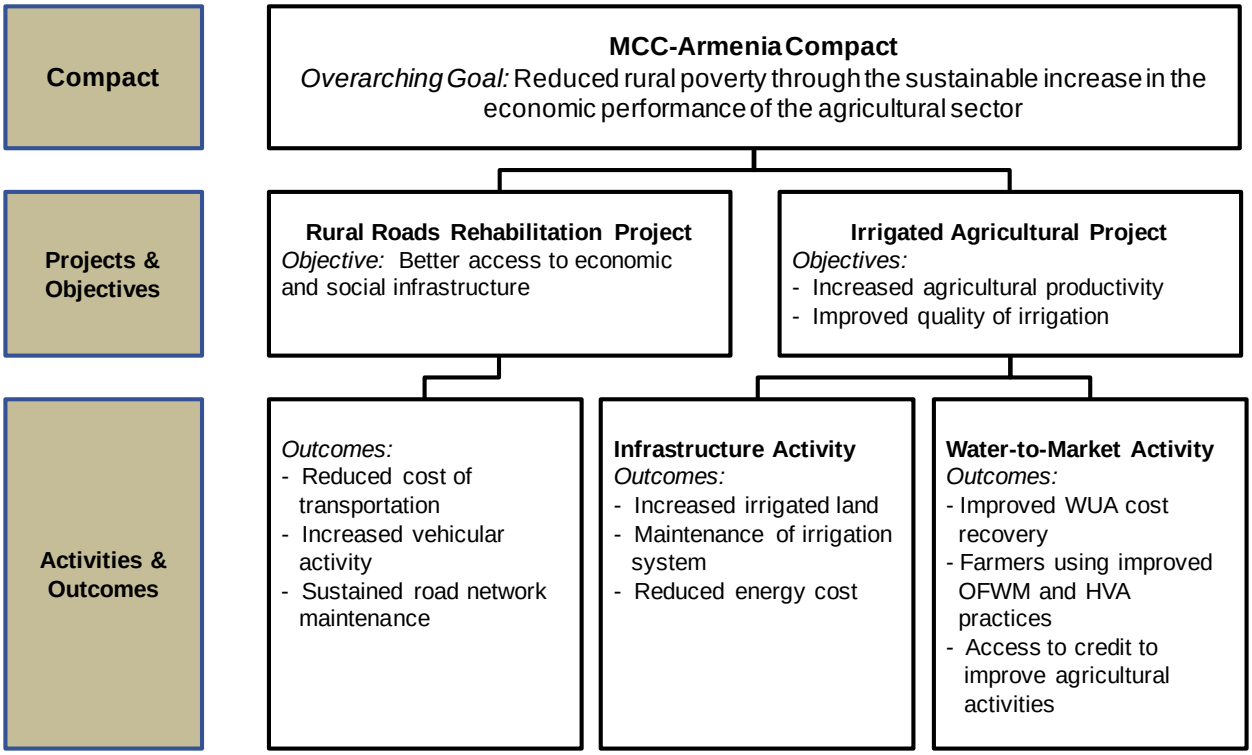
As part of the aforementioned reforms in the early 1990s, farm lands were privatized and redistributed as small plots. However, many of the beneficiaries of this redistribution had little expertise in farming or had mainly worked on collective farms and as a result did not have the knowledge they required to effectively manage their own farms. Many farming households cultivate high-value agriculture (HVA) crops such as fruits and vegetables, but they grow them only in small amounts and for household consumption. [13] Grains such as wheat constitute most of the crops produced, but grains have limited commercial viability in Armenia and are not considered HVA crops (Fortson, Player, Blair, and Rangarajan, 2008).

The aim of the Millennium Challenge Corporation's Compact with Armenia ("the Compact"), a five-year agreement signed in March 2006, was to increase household income and reduce poverty in rural Armenia through improved performance of the country's agricultural sector. The Compact, managed by the Millennium Challenge Account with Armenia (MCA-Armenia), was originally designed to include two projects: (1) the Rehabilitation of Rural Roads Project and (2) the Irrigated Agriculture Project. [14] The Irrigated Agriculture Project comprised two complementary activities, the Infrastructure Activity through which irrigation infrastructure would be rehabilitated, and the Water-to-Market Activity (hereafter WtM), which would provide training, technical assistance, and access to credit for farms and agribusiness. WtM was intended to help farmers harness the improvements in irrigation to introduce new technologies and shift to production of high-value agricultural crops, both of which would increase their annual income. By improving living standards among rural residents, these investments were designed to lead to future economic growth in rural areas and throughout the country. Figure I.1 summarizes the overall goal of the Compact and how each activity was designed to help accomplish the overall goal.

[13] According to a 2005 World Bank paper (Gulati et al. 2005), high-value crops are defined as crops that have relatively high economic value per kilogram, per hectare, or per calorie, such as fruits and vegetables. In Armenia, high-value agriculture consists of all crops that are not grain or grass.

[14] At the June 2009 MCC Board meeting, the decision was made not to continue funding any further road construction and rehabilitation under the $236 million Compact due to concerns about democratic governance. Approximately 25 km of pilot roads had been completed prior to this decision. As of July 2012, 150 km of MCC-funded road designs are now being funded by the World Bank.

Figure I.1. Overview of the Compact with Armenia



The Millennium Challenge Corporation (MCC) has commissioned evaluations to examine the Rehabilitation of Rural Roads Project, the Infrastructure Activity, and the WtM Activity. This report focuses on the evaluation of the WtM Activity. As noted, the WtM Activity included multiple elements designed to work in concert with each other and with the Infrastructure Activity to improve agricultural profitability and household well-being. The WtM Activity is divided into two subactivities, the Improved Profitability of Water User Association Members Subactivity and the Institutional Strengthening Subactivity. The first subactivity is further subdivided into three sub-subactivities, which in short include farmer training, agricultural credit, and technical assistance to agricultural enterprises. For ease of exposition, we hereafter refer to each of the subactivities and sub-subactivities as a "component." The present report evaluates four components, each of which is summarized below.

The first and largest component, **WtM training**, included two types of training. **On-Farm Water Management (OFWM) training** consisted of sessions aimed at helping farmers learn to use new irrigation technologies. As part of this component, demonstration plots were also established to demonstrate the irrigation technologies in practice. According to original plans, a total of 60,000 farmers in 350 communities were scheduled to be trained in water management practices from 2007 to 2010. This was later revised to 45,000 farmers. MCA contracted with ACDI/VOCA and its partners, VISTAA and Euroconsult, (hereafter referred to collectively as ACDI) to implement the training. The goal of this training was for farmers to adopt new and more efficient irrigation techniques, which would lead to increased and more cost-effective agricultural production and higher sales. **High-Value Agriculture (HVA) training** consisted of establishing demonstration plots and conducting training sessions for farmers on high-value crop substitution and cropping intensity. A total of 30,000 farmers who also received OFWM training were scheduled to be trained by ACDI in HVA from 2007 to 2011. This was later increased to 36,000 farmers when program implementers concluded that there were benefits and synergies from offering farmers both OFWM

and HVA training and consequently agreed with MCA and MCC to revise the targets for both sets of training to better align them. The goal of HVA training was for farmers to adopt new cropping techniques and high-value crops, which would lead to increased and more diverse agricultural production, as well as increased sales.

Through the **Access to Credit ("WtM credit") component,** $8.5 million in long-term credit was scheduled to be disbursed by ten lending institutions to qualified farmers who participated in WtM training and met other criteria. MCA contracted the Rural Finance Facility (RFF) to implement WtM credit from 2008 to 2011. The objective of this component was to provide long-term credit to individuals who were trained under WtM training. Access to credit would also allow farmers who participated in HVA and OFWM training to adopt new irrigation and production technologies, and thus generate higher output and sales.

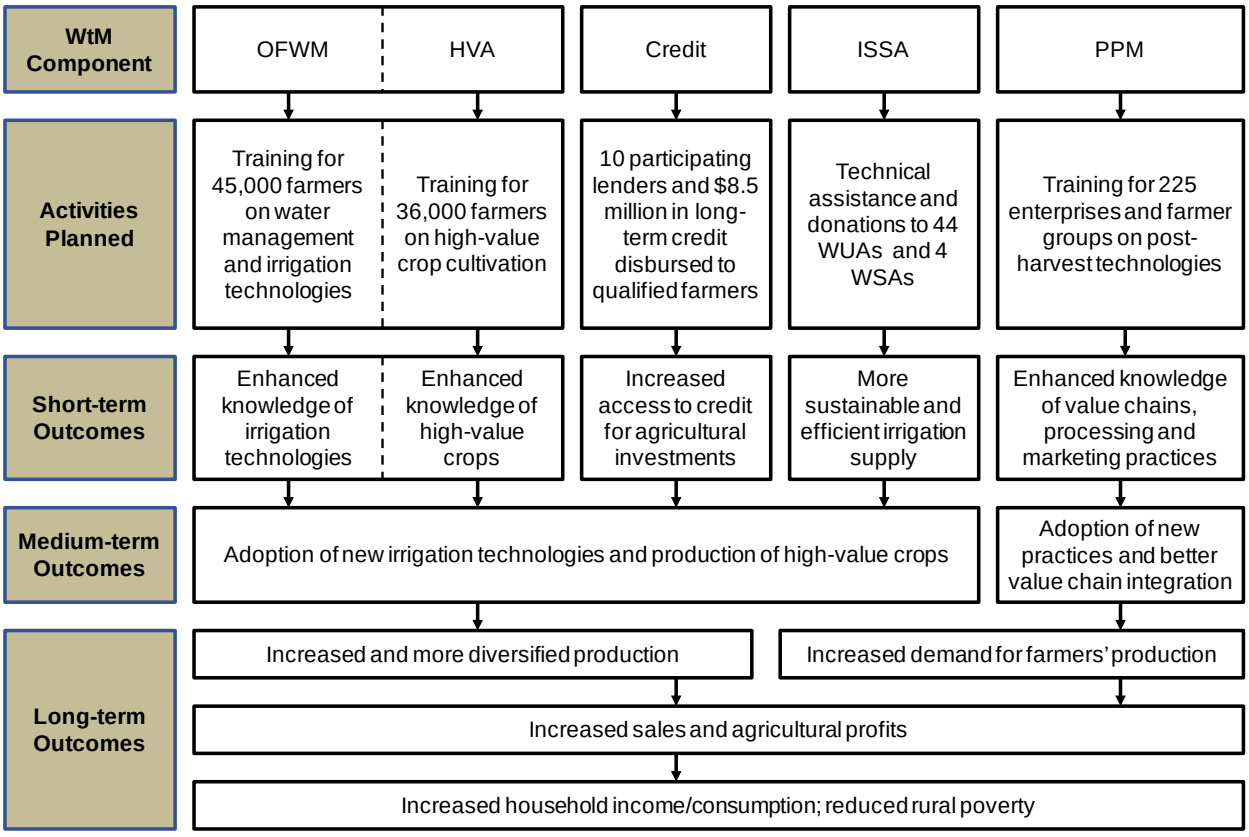
The **Institutional Strengthening Subactivity (ISSA)** provided general technical support to 44 Water User Associations (WUAs) operating in Armenia—and intensive technical support to 8 of them. WUAs are regional organizations that manage the distribution of and payment for irrigation water service. ISSA's aim was strengthening WUAs' managerial, technical, structural, and financial capacity and self-sufficiency. ISSA's primary implementing partners, Mott MacDonald and VISTAA, provided technical assistance to WUAs on irrigation water delivery services, water fee collection and accounting, irrigation infrastructure maintenance, and reporting tasks. The intent of these improvements was to create more efficient and consistent irrigation supply for WUA members. ISSA also provided technical and material assistance to 3 Water Supply Agencies (WSAs) that operate and maintain irrigation dams and pumping stations. The subactivity also included an irrigation policy reform component, in which a reform strategy was developed through a participatory process with WUA and government officials, among others. All ISSA activities took place from August 2008 to September 2011.

Under the **Post-Harvest, Processing, and Marketing (PPM)** component**,** 300 enterprises and producer groups were originally scheduled to be trained by ACDI in processing technologies, food safety, quality standards, financial analysis, and developing commercial linkages. This was later revised to 225 agribusiness enterprises and farmer groups when it was determined that original targets exceeded the numbers of such groups in Armenia. The project was implemented from 2008 to 2011. The objective of PPM was to improve post-harvest preservation procedures, strengthen processing enterprises, and provide WtM beneficiary farmers with increased opportunities to sell their products.

The synergy created by these components could lead to increased and more diversified production (Figure I.2). A high degree of interaction was envisioned between all of these components. Because new water management and production technologies introduced in OFWM and HVA training—such as drip irrigation systems and greenhouses—required investment capital, training beneficiaries could apply for WtM credit to finance these investments. In addition, many water users who benefited from ISSA could participate in WtM training and were eligible to apply for WtM credit. Thus, the short-term goal of ISSA, more sustainable and efficient irrigation water supply, could feasibly facilitate farmers' transition to new water management techniques, new crops, and new production technologies financed with WtM credit. WtM training also embedded additional possible synergies with ISSA in that training featured modules on farmers' rights and responsibilities as water users and WUA members. The synergy created by these components, along with improved irrigation infrastructure financed under the Compact's Infrastructure Activity of the Irrigated Agriculture Project, could lead to increased and more diversified production.

MCA also planned substantive interaction between PPM and other components, as processing enterprises strengthened by PPM assistance could form stronger linkages with WtM beneficiary farmers and create greater demand for farmers' production. Through these interactions among components, all WtM components were designed to result in increased sales and agricultural profits, as well as improved household well-being among beneficiary farmers.

Figure I.2. Logic Model for the WtM Activity



B. Summary of the Evaluation Approaches

The WtM impact evaluation originally focused on WtM training. The evaluation of training used a phase-in random assignment design, whereby communities were randomly assigned into a treatment group, whose farmers were offered training, and a control group, whose farmers were not offered training during the evaluation period.[15] The impacts of WtM training were estimated by comparing outcomes of the treatment group with outcomes of the control group based on the 2010 agricultural season, which came three years after the treatment group was first offered training but before the control group farmers were offered similar training. Random assignment is considered the gold standard of evaluation designs because the treatment and control group are expected to be no different, on average, except for the treatment group's receipt of the treatment, which in this case

[15] To ensure geographic balance of the treatment and control groups, random assignment was stratified by WUA. Some of the smaller, neighboring communities were grouped into clusters of communities and randomly assigned together.

is access to training. Consequently, any differences between the outcomes of the two groups can be credibly attributed to the training program.

The Farming Practices Survey (FPS) was developed specifically for the impact evaluation of WtM training. The FPS is a longitudinal survey of farming households interviewed at three points in time: at baseline (before the program was implemented), one year after training began, and three years after training began. The FPS includes 3,547 households who were interviewed at baseline and again in the final round; these households span 211 communities. The FPS asks each household about their cropping patterns, irrigation and agricultural practices, crop yields, agricultural revenues and costs, other household expenditures, household employment, and other sources of household income.

Rigorous evaluations of the other three WtM components (WtM credit, ISSA, PPM) were not initially planned. However, it was subsequently decided to conduct analyses of the effects of the other components to the extent possible using existing quantitative data sources. Although the analyses of WtM credit, ISSA, and PPM have important limitations discussed further in later chapters of this report, these additional analyses can still help determine whether the components had the intended effects.

The analysis of WtM credit used baseline and final follow-up FPS data to summarize beneficiary and loan characteristics, as well as to estimate the impact of MCA credit on the key outcomes of investment, production, sales, and income. To construct these estimates, we used regression modeling that allowed us to compare farmers who did and did not receive MCA credit. We supplemented this quantitative analysis with qualitative information on program implementation and intended results based on interviews with MCA staff, RFF personnel, lending organizations participating in the program, and representatives from other donor organizations in Armenia.

The ISSA analysis primarily used data from the WUA (administrative) Survey and Water User Survey of households. Using these data, we examined how key outcomes—such as WUA cost recovery, WUA expenditures, and farmers' interactions with WUAs—have changed over time. The ISSA analysis was also supplemented with qualitative information on implementation and intended effects of ISSA based on interviews with MCA staff, VISTAA staff, and a representative of AVAG Solutions who contributed to the irrigation policy reform strategy.

For PPM, we focused on descriptive analyses of enterprises' characteristics, adoption of post-harvest practices, profitability, and sustainability using the Enterprise Adoption Survey (EAS). The EAS respondents were all enterprises that received services through PPM by September 2010. Thus, unlike the analyses of the other components, we do not have an estimate of the counterfactual—what would have happened with those enterprises in the absence of PPM—because enterprises that did not receive services were not surveyed. We supplemented the descriptive analysis with qualitative information on program implementation, intended results, mid-course corrections, and outcomes based on interviews with MCA staff, implementing staff at ACDI/VOCA, and beneficiary enterprises.

The quantitative analyses, especially for the evaluations of WtM training and WtM credit, examine estimated program effects on many outcomes. When examining many estimates, it is likely that some of the estimates will be statistically significant—either positively or negatively—by chance, even if the program had no true effects. For this reason, we consider the pattern of findings rather than only individual estimates when we interpret results to assess whether each component was effective so that we can distinguish true program effects (positive or negative) from chance differences.

The remainder of the report is structured as follows. Chapters II to V present findings from our analyses of WtM training, credit, ISSA, and PPM components, respectively. Chapter VI provides conclusions based on our analyses.

II. EVALUATION OF WTM TRAINING

A. Overview of WtM Training

The objective of WtM training was to educate farmers on techniques intended to improve farm profitability by increasing agricultural production, increasing the value of crops cultivated, and using agricultural inputs more efficiently. Farmers who participated in training also became eligible to apply for MCA loans in the WtM credit component.

Training topics were organized and presented to farmers in two parts: On-Farm Water Management (OFWM) training and High-Value Agriculture (HVA) training. Both types of training were targeted to members of Water User Associations (WUAs), the regional organizations that manage the distribution of and payment for irrigation water. OFWM training covered region-specific water management practices and technologies to conserve water. HVA training focused on growing new crops or on ways to cultivate higher-value crop varieties by using higher-quality seeds, establishing greenhouses, or other methods. HVA practices can be divided into industrial-economical improvements, which emphasize increases in farmers' own production or profits, and social-environmental improvements, which promote safe and environmentally friendly practices.

The initial implementation targets were to train 60,000 farmers in OFWM and then train half of them in HVA as well. When the complementarities from offering both trainings became apparent (and the devaluation of the dollar relative to the Armenian dram caused a reassessment of program resources), the OFWM target was lowered to 45,000 to allow the HVA target to be raised to 36,000. All training was implemented by ACDI/VOCA and its partners, VISTAA and Euroconsult, which we refer to collectively as ACDI. A typical training session included 20 to 25 farmers from one or more neighboring communities and was led by a local agricultural expert or irrigation engineer. Table II.1 presents a summary of WtM training.

A key theme in implementing training was tailoring sessions to the climatic and agricultural conditions of the region. Each session was led by an agricultural expert from the same region, and the content of the training was customized to each region. Participants were all from the same region, so concerns and experiences were based on a shared context. The training also supplemented three to four days of theoretical lessons in classrooms with practical lessons at a nearby demonstration farm. Each demonstration farm was carefully selected to serve one to five communities, and farmers who received training were encouraged to revisit the demonstration farms after the official training to see OFWM and HVA practices in use. ACDI also operated tours of the demonstration farms for trained farmers during key months of the agricultural season. A primary factor in designating demonstration farms was whether the farmer was willing to set up and operate a demonstration farm and to promote other farmers' understanding of the demonstrated technologies. In return for farmers' willingness to operate a demonstration farm, ACDI provided the farmer with the needed equipment. Other selection criteria included the site's proximity to other farms in the community, topography, and soil characteristics.

Table II.1. Summary of WtM Training

Objective	Provide training for farmers to transition to more profitable, market-oriented agricultural activities.
Target Population	Farmers in rural areas of Armenia who are members of Water User Associations (WUAs). WUA members were targeted because they are likely to be active farmers with access to irrigation water, but membership was not strictly required to receive training.
Funding	$14.3 million (USD), approximately $310 per participating household
Implementing Parties	ACDI/VOCA in partnership with VISTAA and Euroconsult
Time Frame	2007 to 2011
Activities/Assistance	Each training involved 20-25 farmers from one or more neighboring communities and was led by an agricultural expert from the farmers' region. Training involved • Three or four days of in-class lessons. • Practical lessons on a demonstration farm set up and maintained for OFWM or HVA training. Each demonstration farm served one to five communities. Demo farm lessons were typically held after the classroom lessons. • Optional tours of demonstration farms for trained farmers during key months of the agricultural cycle. These tours were intended to help farmers remember practices covered in training. OFWM training emphasized low-cost irrigation for small-scale farming operations. HVA training emphasized cultivation of new, higher-revenue crops and higher-value varieties of common crops, such as organic varieties.
Implementation Targets	
OFWM Training	The initial target was to train 60,000 farmers. The plan was revised to provide OFWM training to fewer farmers (45,000) and provide HVA training to more of these farmers.
HVA Training	The initial target was to train 30,000 farmers. The revised plan provided HVA training to 36,000 farmers. Seventy-eight percent of these farmers also participated in OFWM training.

1. Activities and Outputs

a. Beneficiary Population

A key factor in determining whether a community would benefit from training was whether it had adequate, reliable sources of irrigation or would have such a source when its irrigation infrastructure was rehabilitated as part of the Compact, as assessed by ACDI in consultation with Armenia's Irrigation Project Implementing Unit. The communities considered for training early in the Compact were those whose irrigation status was assessed as already favorable. Additional communities were considered later in the Compact, by which point the irrigation infrastructure activity was expected to be underway. Due to delays in infrastructure rehabilitation, however, many of the trained communities still did not have reliable irrigation systems after training was complete—over half of the treatment communities were served by at least one irrigation project that was

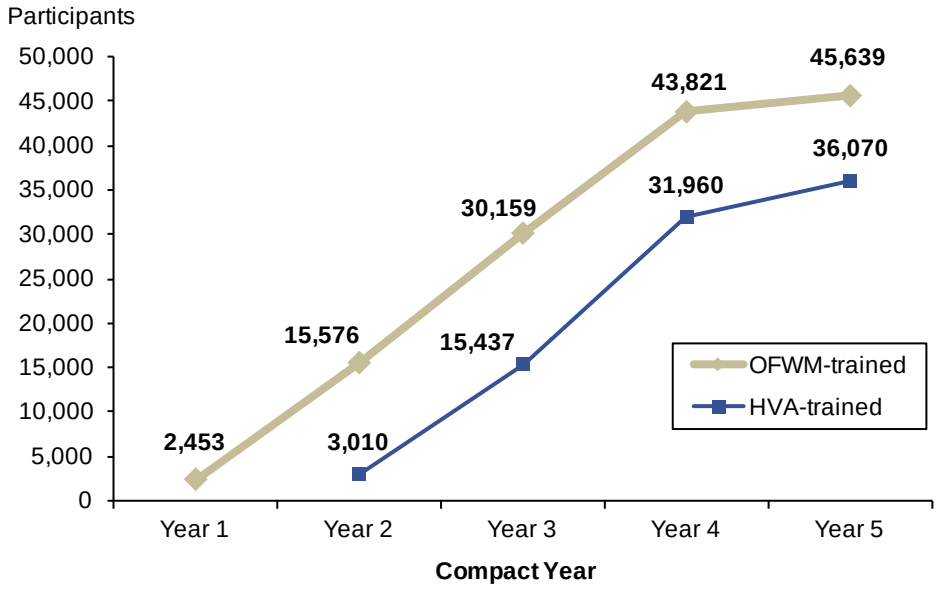
rehabilitated later in the Compact.[16] Training was provided in over 400 communities over the life of the Compact.

Within targeted communities, ACDI focused recruiting efforts on individuals who were members of WUAs. This focus was based on the idea that the greatest benefits from training would accrue to farmers with access to irrigation water. However, these criteria were not requirements for training. Training coordinators from ACDI used posters and additional advertisements at village centers to raise awareness of the training. Village mayors further assisted coordinators by encouraging participation and identifying WUA members most likely to participate. These members were targeted by ACDI for more intensive recruitment efforts.

b. Final Outputs

ACDI trained a total of 45,639 farmers in OFWM practices and 36,070 farmers in HVA practices (Figure II.1). The exact amount of overlap is not known, but we estimate that about 78 percent of farmers trained in HVA had also participated in OFWM training, and that about 47,800 households participated in at least one training session. (See Appendix E for details.) OFWM training started first and HVA began one year later. In most communities where both were offered, HVA training was offered one year after OFWM training.

Figure II.1. Cumulative Numbers of Farmers Who Participated in OFWM or HVA Training by the End of Each Compact Year



Source: MCA-Armenia Indicator Tracking Table (2011).

[16] Some communities in which irrigation infrastructure was rehabilitated were added to WtM training later in the Compact at the request of the community and approval of MCA, but these communities were provided training too late to be included in the impact evaluation.

2. Research Questions and Methods

The evaluation answers the following research questions, informed by the structure and content of OFWM and HVA trainings:

1. What were the characteristics of farmers served by the program? (See Section II.B.)
2. How was WtM training implemented? (Section II.C.)
3. What were the impacts of WtM training on OFWM and HVA agricultural practices? (Section II.D.)
4. What were the impacts of WtM training on agricultural production of HVA and non-HVA crops? Did these impacts vary across agricultural zones? (Section II.E.)
5. What were the impacts of WtM training on household income? (Section II.F.) What were the impacts of WtM training on the poverty rate? (Section II.G.)

To describe farmers in communities that received WtM training and to estimate impacts of WtM training, we use the Farming Practices Survey (FPS). The FPS was administered at baseline (2007-2008), interim follow-up (2008-2009) and final follow-up (2010-2011). The FPS is a longitudinal survey designed specifically for this impact evaluation, and it was fielded by a consortium of AREG, an Armenia-based NGO, and Jen Consulting (hereafter referred to collectively as AREG). The final (round 3) follow-up survey instrument is included as Appendix C.

We executed a phase-in random assignment design to estimate impacts of WtM training. Random assignment was used because, when implemented carefully, it is the most rigorous way to measure a program's impact. This method allows the creation of two groups at baseline that are statistically comparable and differ only in their receipt of the intervention. Consequently, any changes observed in the outcomes of these groups over time can be attributed to the intervention. We summarize our primary research questions and the data sources and research design used to answer each of them in Table II.2.

Table II.2. Data Sources and Research Design Used to Answer Primary Research Questions for WtM Training

Primary Research Questions	Data Sources	Research Design
How was WtM training implemented?	WtM Qualitative Process Analysis Report; Compact Completion Report	Mixed methods, with a focus on qualitative data
What were the impacts of WtM training on OFWM and HVA agricultural practices, agricultural production, and household well-being?	2007-2008 and 2010-2011 Farming Practices Surveys	Phase-in random assignment

Our evaluation design began with a set of nearly 300 communities determined to have adequate access to irrigation water in 2007. We randomly assigned these communities to three groups, each of which would receive training in one of three phases: (1) Year 2 of the Compact, (2) Years 3 or 4 of the Compact, or (3) Year 5 of the Compact.[17] Some smaller, neighboring communities were grouped together and randomly assigned together as one cluster. Clusters could include as many as five communities, but most communities were assigned individually.[18]

This phase-in random assignment design was used to estimate the impacts of training by comparing outcomes of communities assigned to receive training in Year 2 of the Compact (hereafter called the treatment group) with outcomes of communities assigned to receive training in Year 5 of the Compact (hereafter called the control group). By measuring outcomes in Year 5, we can compare outcomes for communities that had at least two years to implement new techniques (the treatment group) with those for communities that would not have benefited from training to that point (the control group). Communities that were randomly assigned to receive training in Years 3 or 4 of the Compact were excluded from this analysis because the timing of training was not sufficiently different from Year 2 to detect differences from the treatment group's outcomes. For transparency, we developed a computer program to conduct the random assignment, and the assignment was run in public.

The random assignment process ensured regional balance by randomly assigning communities separately within each WUA. Each WUA serves several communities that are in the same region and share water sources, irrigation systems, and climate conditions. On average, our sample contains about four communities from each WUA. Stratified random assignment was necessary because farmers across Armenia's agricultural regions face distinct agricultural conditions. For example, Ararat Valley is considered the most fertile region for crops and had the best-maintained irrigation infrastructure before the Compact. The mountainous area of Armenia ("Mountainous Zone"), in contrast, has poorer quality soil and harsher weather, so farmers in this region tend to have larger farm sizes and more livestock than farmers in Ararat Valley. Randomly assigning communities separately within each WUA also ensured that each WUA had some trained communities and no WUA would have an unusually bad draw. The probability of being assigned to the treatment group was approximately the same for almost all WUAs. The exceptions were the WUAs in the Mountainous Zone, which had a smaller proportion of communities and clusters selected to be in the research sample, as described in the Baseline Report on the Farming Practices Survey (Fortson, Player, Blair, and Rangarajan 2008).

[17] Our randomization excluded communities that received training during WtM's pilot phase (Year 1 of the Compact) or already had demonstration farms set up by ACDI (Fortson, Player, Blair, and Rangarajan 2008).

[18] Communities instead of individuals were assigned to receive trainings because the training sessions are community-level interventions. Had assignment been based on individuals, it would not have been feasible to bar individuals assigned to the control group from attending training in their communities; in addition, any individuals who received training could possibly share the information with other farmers in the same community. Communities and clusters were generally far enough apart that farmers in the control group would be unlikely to participate in trainings or interact frequently with trained farmers.

Our analysis sample included 189 community clusters.[19] One-hundred and twelve of these clusters are in the treatment group, and 77 are in the control group (Table II.3). These 189 community clusters cover 211 communities.[20] Because the Subtropical Zone has only 8 community clusters, we do not present estimates specific to households in that zone in this report, but many estimates are reported separately for the Ararat Valley, Pre-Mountainous, and Mountainous zones. The geographic distribution of communities in our research sample was similar to the geographic distribution of all communities that were trained (Figure II.2). In this discussion of the evaluation design, it was important to distinguish between communities and clusters; beyond this point, we refer to communities and all clusters that contain multiple communities as "communities" to simplify our discussion of the findings.

Table II.3. Distribution of Training in Community Clusters in the Research Sample, by Zone

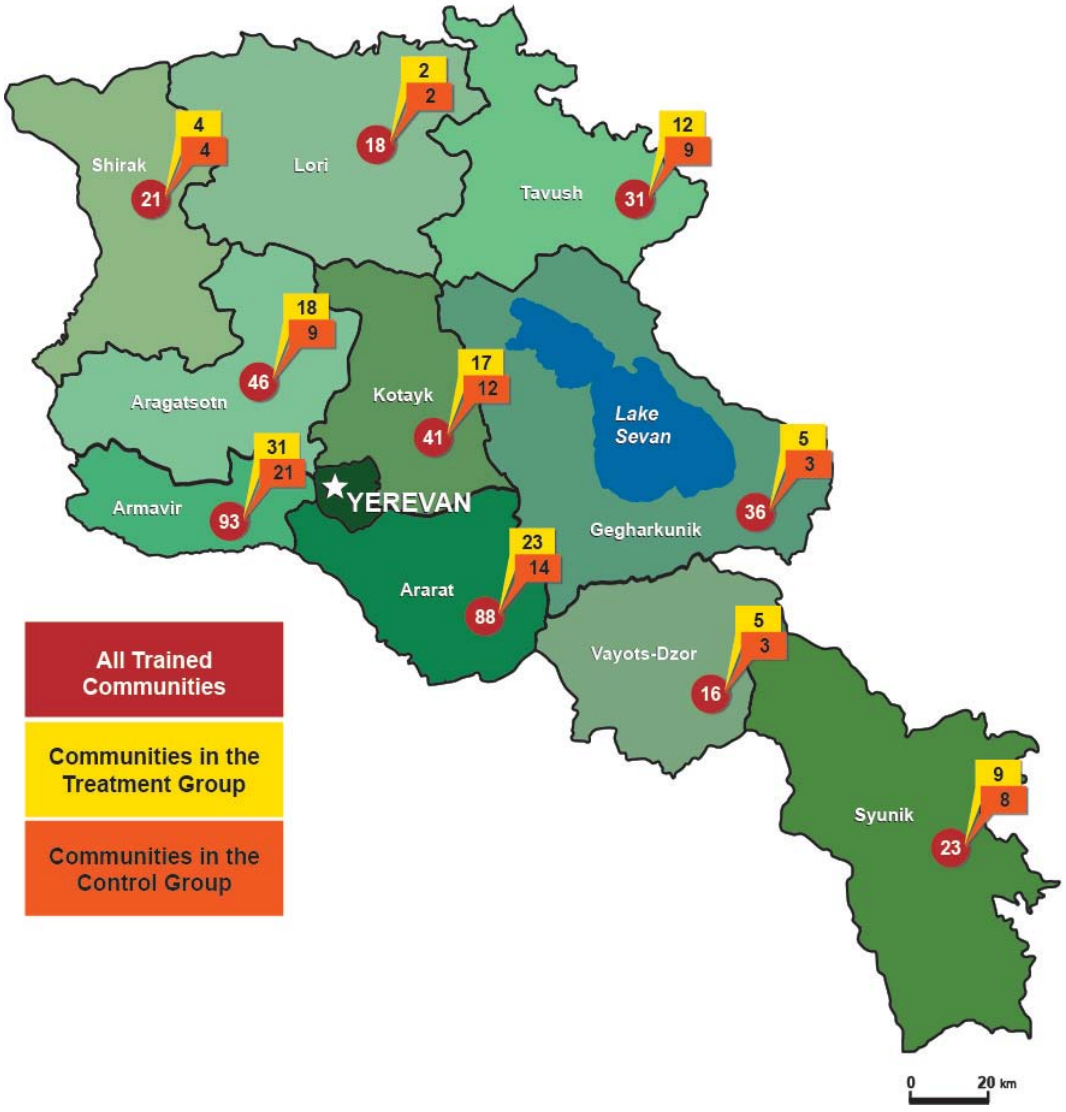
	All Zones	Ararat Valley	Pre-Mountainous	Mountainous	Subtropical
Year 2: Treatment Clusters	112	42	54	11	5
Year 5: Control Clusters	77	28	36	10	3
Total Clusters for Analysis	189	70	90	21	8
Total Communities for Analysis	211	80	100	22	10

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

[19] Table II.3 excludes a few communities surveyed at baseline that are not in our analysis sample, such as two villages that were found to have almost no active farmers. One village that had been inaccessible for the baseline FPS due to heavy snow was not included in the analysis. Additionally, community leaders in three communities that were the sole treatment or control community in their respective WUAs refused to cooperate with the final follow-up survey. Since that left no valid comparison of the treatment and control groups in these WUAs, our analysis excludes all communities in their WUAs.

[20] Two-hundred and two communities were scheduled to receive training but were not in our research sample. In total, 413 communities were scheduled to receive training.

Figure II.2. Distribution of Trained Communities and Communities in the Research Sample, by Marz



Sources: Administrative data and 2010-2011 Farming Practices Survey.

Determining whether training programs affect household well-being is the key research question, and it is important for that the survey sample identify farmers who are likely to participate in training so as to maximize the chance that farmers who would participate in the interviews also participate in training. Although we could readily identify participating farmers in the treatment villages, it is difficult to get such a sample frame from the control villages, where training would not be offered for at least three or more years. Hence, there is a big challenge in identifying a relevant sample frame for the FPS. An alternate approach would have been to select a random set of farmers in the village without regard to whether they are likely to participate in training or not, and assess the percent of farmers who do participate. However, our goal is to assess how effective training is for those who receive it, and hence we want to maximize the chances of finding farmers that are likely to participate in training.

Our initial approach to developing the sample frame was to draw names of farmers from lists of members maintained by WUAs. However, early efforts to verify this approach revealed that many of these lists were outdated and could not be used to draw the sample. For instance, in some cases, the WUA member might be a grandmother who is no longer farming, and the actual farmers are various household members of her family that farm on different plots. In other cases, the actual WUA member was no longer in the village and had migrated to urban areas or out of the country. Based on these assessments, an alternate approach was suggested whereby MCA-Armenia requested that the WUAs work with village mayors to compile a list of farmers in each village who met some specific criteria related to actively engaged in farming. The criteria were designed to align with the characteristics of farmers participating in ACDI's training programs, most notably, being actively engaged in farming as assessed by the mayor, having modest farm area, living in the community for several years, and being of working age (between 25 and 70 years old). The number of farmers' names requested depended on the size of the village but averaged about 60.

Pretesting the lists provided by mayors revealed that even these lists were of mixed quality, often because the WUAs had not consulted with the mayors in compiling them. In some cases, the lists included farmers that were no longer in the village, individuals that were no longer farming, and deceased individuals. In such cases, AREG updated the sample frame with the assistance of village mayors and marz officials, either at the marz offices or in the village itself. AREG and mayors targeted the households of farmers who were most likely to benefit from the training programs: those who were actively engaged in farming and had lived in the community for several years.

Final follow-up surveys were completed in 2010 and 2011 by 3,547 households (a 75 percent response rate) from the baseline sample.[21, 22] Nonresponse weights were used to correct for possible survey nonresponse bias. The construction of nonresponse weights and imputation procedures for select variables are discussed in Appendix A. All impact estimates presented in this chapter used regression adjustment to improve statistical precision and to account for chance differences between the treatment and control groups. Reported means for the treatment and control groups are also regression adjusted. Our regression specifications are also described in Appendix A.

We supplemented our quantitative analysis with findings from the Qualitative Process Analysis (Socioscope 2010), ACDI's Adoption Report (2011), MCA-Armenia's draft Compact Completion Report (forthcoming), and our own observations from field visits and interviews. Socioscope (2010) conducted a qualitative analysis of over 100 focus groups and interviews of farmers and other stakeholders between August and December of 2009. Socioscope also examined the implementation of the training program by observing over 20 trainings, demonstration farms, and collection centers. ACDI (2011) administered a survey to measure adoption rates of OFWM and HVA practices among a sample of trained farmers. The adoption survey also contained questions on why trained farmers did not implement some practices and what practices were planned for the next agricultural season.

[21] The final follow-up survey was fielded at the same time that many control communities first became eligible for training. However, the survey refers to the agricultural season preceding training in these communities, so those farmers would not yet have benefitted from training.

[22] An interim survey round was conducted in 2008-2009. The interim round was originally intended to provide estimates of intermediate impacts, particularly adoption of agricultural practices soon after training was complete. However, training was rolled out such that many of the treatment communities had not been offered training as of the 2008 agricultural season, while others had. Hence, it is neither appropriate for measuring intermediate impacts nor for using as baseline data. However, it is still useful for measuring training participation rates as discussed below.

MCA-Armenia's Compact Completion Report (forthcoming) examined the implementation of the training program in 2010 and 2011 to see if processes had changed since the Socioscope (2010) report.

B. Description of Households in the WtM Training Evaluation

Table II.4 shows the demographic and basic farm characteristics of the analysis sample. We would ideally examine characteristics of the primary decision maker in each household, but our approach for identifying the primary decision maker was imperfect. We initially focused on the head of household, as identified by the respondent, but many respondents identified the oldest person in the household as the head even when that person was too old to likely be the household's primary decision maker.[23] As an alternative way to identify the primary decision maker, we also examined characteristics of the survey respondent. Whenever feasible, survey administrators were instructed to select as the respondent the person with primary responsibility for household farming decisions; however, the lead farmer was not always available. Examining characteristics of both the respondent and the identified head of household—both of whom were often the primary decision maker, but not always—is suggestive of the characteristics of the lead farmers in each household; however, considering the ambiguity of these designations, we do not provide separate estimates of the impacts based on characteristics of the respondent or the household head.

On average, the treatment and control groups had similar characteristics and land holdings, which is further support that random assignment was implemented well. This gives us confidence for interpreting WtM training as the cause of differences in outcomes between the treatment and control groups. Overall, few households reported a female head of household (about 9 percent) or had a female respondent (14 percent). Most heads of household and respondents had completed secondary school or higher. The average respondent was 51 years old, and the average head of household was a few years older, as expected. Households had about one and a half hectares of farm land on average, and only a small proportion of land was used for orchards or vineyards.[24]

[23] Because the primary decision maker is unknown, we cannot describe individual characteristics of beneficiaries with certainty. While this is important contextual information, it should not affect our impact estimates because outcomes are defined at the household level. We are able to accurately describe characteristics of the household. The second aspect of this issue relates to gender-specific impact estimates. Because of the aforementioned ambiguities, impacts separated by gender of the respondent or head of household cannot be interpreted meaningfully. As a result, we do not estimate any gender-specific impacts. While it was not possible in this impact evaluation to clearly define the primary decision maker, this issue is a valuable lesson for future MCC projects to consider.

[24] At baseline, the treatment and control communities were statistically comparable as expected because of the random assignment procedure. In 60 comparisons of the treatment and control communities (Appendix C of Fortson et al. 2008), we found 5 statistically significant differences between the research groups at a 0.10 level: treatment communities had a higher percentage of female-headed households, higher revenues from tomatoes, higher total agricultural sales, higher monetary profits, and higher monetary income. This represents an 8 percent rejection rate, compared to a 10 percent rejection rate that we would expect due to chance.

Table II.4. Individual and Household Characteristics (percentages except where indicated)

	Treatment Group Mean	Control Group Mean	Difference	*p*-value
Demographic Characteristics				
Head of Household's Age (years)	55	55	0	0.94
Female-Headed Household	9	8	0	0.72
Head of Household's Education				
Less than secondary	13	13	0	0.80
Full secondary	45	47	-2	0.53
Secondary vocational	27	25	2	0.30
More than secondary	15	16	-1	0.62
Respondent's Age (years)	51	51	0	0.62
Female Respondent	14	14	0	0.98
Respondent's Education				
Less than secondary	11	9	2	0.19
Full secondary	45	47	-2	0.52
Secondary vocational	27	27	1	0.65
More than secondary	17	18	-1	0.50
Total People in Household	5.1	5.1	0.0	0.89
Number of Children in Household	1.2	1.2	0.0	0.39
Land Holdings				
Total Land Owned or Rented (hectares)	1.6	1.7	-0.1	0.72
Arable Land Owned or Rented (hectares)	1.2	1.3	-0.1	0.68
Orchards Owned or Rented (hectares)	0.1	0.1	0.0	0.90
Vineyards Owned or Rented (hectares)	0.1	0.1	0.0	0.78
Sample Size	**2,133**	**1,414**		

Source: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Treatment and control group percentages and means were estimated using nonresponse weights. Demographic characteristics are measured in the 2010-2011 FPS. Land holdings are measured in the 2007-2008 FPS. Reported differences may not equal the difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

WtM training was offered in all of the treatment communities in our sample, but not all farmers chose to attend or complete training. Likewise, WtM training was not offered in control communities until late in the Compact, but some farmers in control group communities could travel to other communities to attend training in prior years.[25] We could only plausibly observe impacts of WtM training if our treatment group was substantially more likely to complete training during the first years when training was offered, before it became available to the control group farmers (Table II.5). Although about 10 percent of control households reported completing WtM training during the first two years of WtM training, nearly three-fifths of treatment group households completed training in those years. These tabulations do not count households that reported completing WtM training at the final follow-up FPS but not previously, as most of these farmers had just been

[25] The FPS asked households if they or someone else in their household attended training. It also asked farmers if they received a certificate for attending training. Certificates were given to farmers who completed WtM training but are not usually given to training participants. This helped us to distinguish participation in WtM training from other training that may have been offered without relying on respondents to know who provided the training.

trained. The control households who reported completing WtM training could possibly be explained by several factors, all of which likely occurred to some degree. First, some farmers traveled to other locations to attend training. Anecdotal evidence suggests that this occurred some, especially when treatment and control communities were nearby, but it was infrequent. Second, some farmers may have attended other training programs with similar features, including receipt of a certificate confirming completion. Third, and most likely, there may have been some reporting errors of farmers incorrectly reporting that they attended training and received a certificate. Both treatment and control farmers may have misreported in this way, which would inflate the reported WtM training rates for both groups.

Table II.5. Respondent Households Who Completed Training During First Two Years of WtM Training, by Zone (percentages)

	All Zones	Ararat Valley	Pre-Mountainous	Mountainous
Treatment	59	58	57	63
Control	10	12	9	10

Sources: 2007-2008 and 2008-2009 Farming Practices Surveys.

Note: Treatment and control group percentages were estimated using nonresponse weights. See Appendix A for description of estimation methods.

C. Implementation Findings

We based our discussion of implementation findings on the WtM Qualitative Process Analysis Report (QPA) (Socioscope 2010) and the 2011 Compact Completion Report (CCR) (MCA-Armenia forthcoming). MCA-Armenia commissioned the WtM QPA from Socioscope and the Strategic Development Agency, an NGO, (hereafter referred to collectively as "Socioscope") in 2009 as an intermediate implementation evaluation. The CCR reports implementation findings at the end of the Compact, in 2011, to examine whether WtM processes had changed since 2009.

Socioscope (2010) reported that training participants valued the trainers' knowledge about agriculture, particularly regional agricultural conditions. Farmers who had been trained recalled key OFWM and HVA concepts and appreciated that trainings were led by regional agricultural experts. Training was also highly desired in some communities. In these areas, community members organized up to 5 additional trainings because the initial training did not have space for them (MCA-Armenia 2010).

However, a major finding in Socioscope (2010) was that the high targets for the number of farmers trained were difficult to satisfy while focusing on the intended set of beneficiaries. For example, some training sessions included participants who were not actively farming, such as the elderly.[26] Furthermore, some village mayors and ACDI field staff overemphasized WtM credit to potential training participants, believing that insufficient numbers of farmers would attend training without that incentive. Many farmers in multiple communities attended training believing that it

[26] We cannot say how common this was among all training participants, but by design, very few farmers in the FPS sample did not farm any land, and the vast majority cultivated more than just their kitchen plot. Nonetheless, a small minority of the sample cultivated small plots of land—we estimate that about one in ten farmers cultivated less than a tenth of a hectare of land at follow-up.

would directly qualify them for MCA credit. These farmers were not otherwise interested in the substance of the training programs.[27]

Even among farmers who were the intended beneficiaries of training, a number of factors deterred them from adopting the methods or techniques presented in the training. Although the OFWM training focused on water conservation, farmers in Armenia pay for water based on the amount of land and crops they intend to irrigate; as a result, there is no private incentive to conserve water. ACDI (2011) found that farmers believed drip irrigation to be the best OFWM technique, and it was a practice that many learned of because of the training, but it is a relatively expensive improvement. The most common reason given by farmers for not using OFWM and HVA practices was financial constraints (Socioscope 2010; ACDI 2011; MCA-Armenia forthcoming). This issue relates both to farmers' trying to get credit through training and the small impacts seen on advanced OFWM techniques.

Another common reason for not adopting OFWM and HVA practices was a lack of irrigation infrastructure. While training was intended to complement irrigation rehabilitation, rehabilitation projects were not completed in most communities until near the end of the Compact. Moreover, many communities identified as having good irrigation water prior to irrigation rehabilitation were later recognized as in fact having poor irrigation water. As a result, the ability of treatment farmers to implement OFWM and HVA techniques may have been stymied by a lack of reliable access to irrigation water.

Overall, WtM training faced serious implementation challenges in finding intended beneficiaries and making improvements accessible. The repeated theme in interviews, focus groups, and surveys of farmers is a lack of resources to implement new practices. These findings help explain a lack of impacts on intermediate and longer-term outcomes despite the intensive training curriculum.

D. Impacts on Agricultural Practices

1. On-Farm Water Management Practices

OFWM training covered a variety of practices to use water more effectively, ranging from pre-planting practices such as modifying furrow sizes to growing-season actions such as using monitoring tools like soil moisture meters. Practices covered by the OFWM training were categorized by MCA-Armenia and ACDI into five groups: simple, medium, advanced, related to irrigation scheduling, and related to organization. Farmers were asked at baseline and follow-up to select all of the OFWM practices they used from a list of training topics. The survey did not gather information on how well the practices were implemented. At baseline, few farmers used any OFWM practices, and nearly all of the practices used were simple. For example, furrow spacing was the most commonly used irrigation practice at baseline, but it was used by only 7 percent of farmers. No other technique was used by more than 1 percent of farmers at baseline.

[27] In early 2012, MCA-Armenia staff stated that they discouraged the promotion of WtM credit to meet training targets. However, ACDI/VOCA's training targets (and payment structure based on meeting those targets) motivated field staff to use the promise of credit to enroll as many eligible farmers as possible in training programs.

The treatment and control groups adopted similar levels of OFWM techniques (Figure II.3; specific improvements shown in Table B.1). Impact estimates are shown above the bars in the figure. Training focused on teaching OFWM techniques, so the lack of impacts indicates that training did not successfully meet the fundamental objective of affecting farmers' practices. However, both the treatment and control groups were much more likely to report using OFWM practices, particularly simple improvements, at follow-up than had been the case at baseline. Simple OFWM practices were used by about 45 percent of the treatment and control group at final follow-up. Furrow size modification accounts for much of this rate (Table B.1); no other simple OFWM practice was used by more than 4 percent of the treatment or control groups.

The increase in use of furrow size modifications observed for the control group appears to have been due to a difference in reporting between baseline and final follow-up rather than a change in the practices used by control group farmers. The baseline survey asked farmers whether they had used furrow row spacing but the explanation interviewers provided to respondents was vague; as a result, few farmers reported using furrow row spacing. At follow-up, farmers answered a more precisely worded question, whether they had used "modification of furrow sizes (length, width, depth, and inter-furrow area)." Subsequent informal conversations with farmers confirmed that the farmers had not actually changed any behaviors relating to this practice.

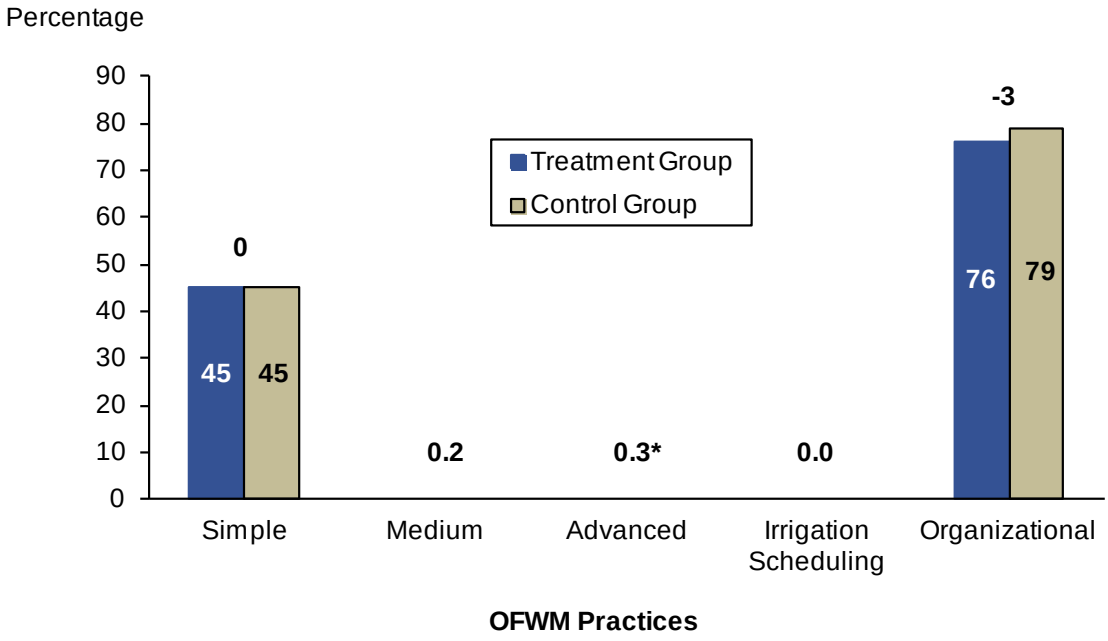
Few farmers in our sample adopted medium improvements (such as gated pipes), advanced improvements (such as drip irrigation), or irrigation scheduling improvements. The impact on advanced improvements was statistically significant at the 10-percent level (*p*-value: 0.06). However, the adoption rates for these improvements were less than half a percent even among the treatment group.[28]

There was informal evidence that there may have been adoption of advanced practices in a handful of communities not included in our analysis. In particular, we visited three communities that were offered training in the pilot phase of the program and were therefore not included in the evaluation. In each community, there were many farmers who had adopted drip irrigation in greenhouses on their kitchen plots, and based on our conversations, their adoption was plausibly attributable to the program. Each community shared two key features uncommon in most rural Armenian communities: many farmers in these communities had greenhouses already, and the farmers were generally better poised financially to make agricultural investments. Although the estimates we present suggest there was very limited adoption of advanced practices, we take these interviews as evidence that there may have been impacts concentrated in a small number of pilot phase communities.

Organizational improvements, such as the preparation of irrigated land or having a copy of the farm's WUA water contract, were used by most farmers, but there were no significant impacts on adoption rates. We observed that 76 percent of the treatment group and 79 percent of the control group implemented an organizational improvement. Organizational improvements were not tracked in the baseline FPS, so we cannot compare the rates prior to training.

[28] Practice categories are not defined to be mutually exclusive—most farmers included in the count of farmers who adopted advanced practices also are included in the count of farmers who adopted simple practices.

Figure II.3. Impacts of WtM Training on OFWM Practices (percentages)



Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group percentages were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

2. Irrigation

There was no evidence that training increased the area of land irrigated (Table II.6). [29, 30] Treatment group farmers had slightly less total agricultural land and irrigated land than the control group.

Table II.6. Impacts of WtM Training on Land Owned or Rented and Irrigated (hectares)

	Treatment Group Mean	Control Group Mean	Impact	*p*-value
Total Agricultural Land				
All	1.6	1.7	0.0	0.49
Irrigated	0.7	0.8	-0.1	0.15
Arable Land				
All	1.2	1.2	0.0	0.93
Irrigated	0.4	0.4	0.0	0.32
Orchard				
All	0.1	0.1	0.0	0.30
Irrigated	0.1	0.1	0.0	0.29
Vineyard				
All	0.1	0.1	0.0	0.29
Irrigated	0.1	0.1	0.0	0.31
Kitchen Plot				
All	0.2	0.2	0.0	0.61
Irrigated	0.1	0.1	0.0	0.71
Other				
All	0.0	0.0	0.0	0.28
Irrigated	0.0	0.0	0.0	0.68
Sample Size	**2,133**	**1,414**		

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group means were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. These outcome measures have been censored at the 98th percentile. See Appendix A for description of estimation methods.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

3. HVA Practices

HVA training covered a wide range of practices intended to increase crop yields, improve soil quality, and increase crop values. The final follow-up FPS presented farmers with an extensive list of

[29] To prevent outliers from unduly affecting the impact estimates and standard errors, we have censored the outcome measures in Table II.6 at the 98th percentile. Results from uncensored measures for this and other censored outcome measures are available in Appendix B in Table B.9.

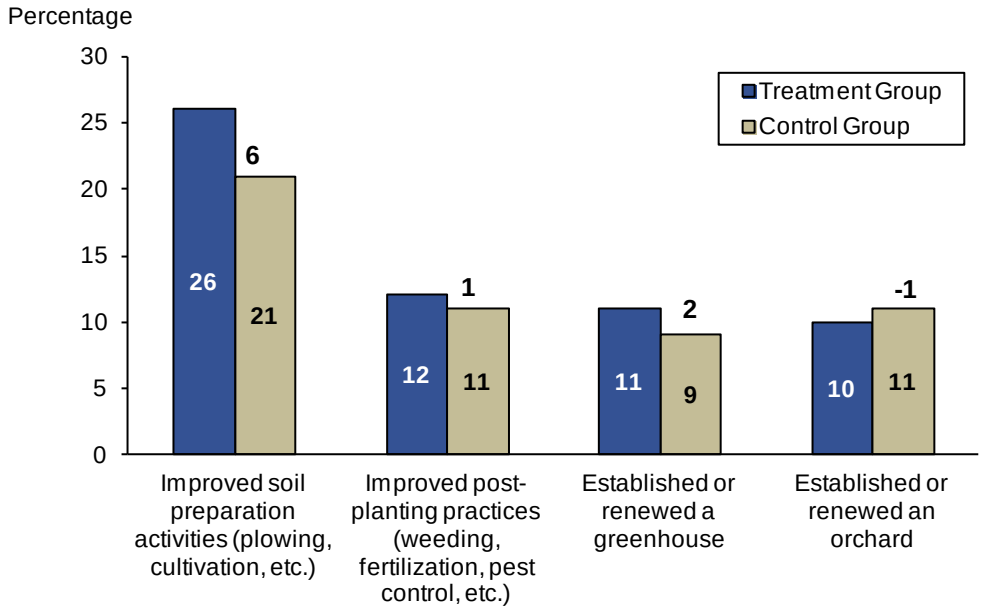
[30] Standard errors for training impact estimates for key outcomes, as well as the associated minimum detectable impacts, are reported in Appendix B, Table B.13.

HVA farming practices, organized into two categories: industrial-economical and social-environmental (ACDI 2011).

Industrial-economical practices emphasize gains in efficiency or value of production, such as producing more high-value crops. The most prevalent industrial-economical practices are shown in Figure II.4, with the full list of all these practices shown in the appendix (Table B.2). Impact estimates are presented above the bars in Figure II.4.

Farmers in the treatment group were 6 percentage points more likely than farmers in the control group to use soil preparation improvements such as plowing and soil cultivation, but this impact is not statistically significant at the 10-percent level (*p*-value: 0.11). Improved soil preparation activities, which could increase crop yields, were the most widely used industrial-economical HVA practice; they were employed by 26 percent of the treatment group and 21 percent of the control group. No other impacts on industrial-economical practices were statistically significant. This finding includes greenhouse farming, which is relatively expensive, even though greenhouse farming was one of HVA practices from training that was most frequently recalled by trained farmers (Socioscope 2010). Only two other practices had adoption rates above 7 percent: the improvement of post-planting practices (such as weeding, fertilization, and pest control) and the establishment or renewal of an orchard.

Figure II.4. Impacts of WtM Training on Industrial- Economical HVA Practices (percentages)



Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group percentages were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

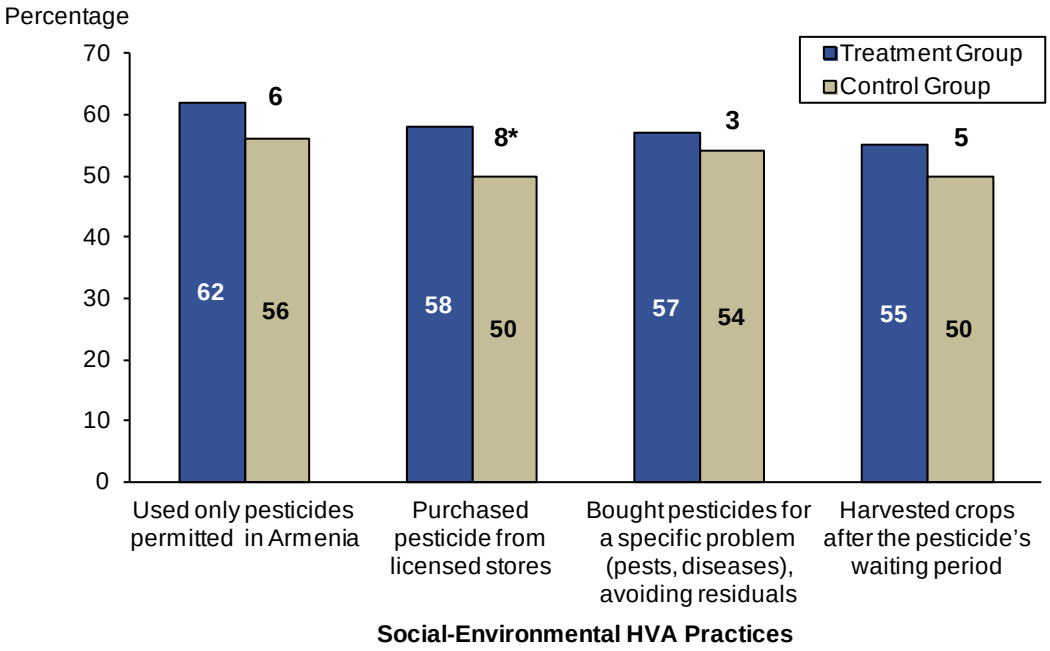
HVA = High-Value Agriculture.

Social-environmental practices focus on environmentally friendly, socially responsible practices that may not translate directly into gains in productivity or profits but could have long-term effects on farmers' health, consumers' health, or the environment. Proper, safe use of pesticides was emphasized in training, and social-environmental practices were among the HVA practices that trained farmers were most likely to remember (Socioscope 2010). Usage rates of social-environmental HVA practices were generally higher than for industrial-economical HVA practices, particularly those relating to pesticides. We show treatment and control means for the most prevalent social-environmental HVA practices in Figure II.5; the list of all social-environmental HVA practices approved for training appears in the appendix (Table B.3).

Farmers in the treatment group were 8 percentage points more likely to report purchasing pesticides from licensed stores, and this impact estimate is statistically significant at the 0.10 level (p-value: 0.08). No other statistically significant impacts were observed for the use of social-environmental HVA practices. Treatment farmers were also 6 percentage points more likely than control group farmers to exclusively use pesticides permitted in Armenia (*p*-value: 0.15).

Trained farmers may use pesticides more safely because these practices are relatively inexpensive and do not require a lot of time to implement. Though farmers will not see immediate economic benefits, these practices may improve farmers' and consumers' health.

Figure II.5. Impacts of WtM Training on Social- Environmental HVA Practices (percentages)



Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group percentages were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

HVA = High-Value Agriculture.

The small but positive impacts on select HVA practices were not accompanied by any statistically significant impacts on the types of crops being cultivated (Table II.7). However, cultivation of HVA crops was ubiquitous among farmers in the treatment group and control group at final follow-up, with more than 92 percent of treatment and control farmers cultivating at least one HVA crop. Over half of respondents cultivated non-HVA crops. Similarly, there were no notable differences between the treatment and control groups in the land area devoted to cultivating specific crops (Table B.4).

Table II.7. Impacts of WtM Training on Cultivated Crops (percentages)

	Treatment Group Percentage	Control Group Percentage	Impact	*p*-value
HVA crops	94	93	1	0.50
Grape	28	29	-1	0.75
Other fruits or nuts	67	71	-4	0.16
Tomato	35	38	-4	0.26
Vegetables and herbs	43	45	-2	0.62
Potato	28	28	0	0.92
Non-HVA crops	50	51	-1	0.64
Grain	34	32	3	0.24
Grass	26	29	-3	0.15
Sample Size	**2,133**	**1,414**		

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group percentages were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

HVA = High-Value Agriculture.

At the time of the final FPS, the MCA-funded collection centers were not yet operational, but pre-existing collection centers were available. If trained farmers were more likely to use these pre-existing centers, there might be potential for program linkages in future years. However, no such evidence was found. We estimated a statistically significant, negative impacts on the usage of a collection center (-6 percentage points) but no significance difference in the average amount of produce taken to a collection center (Table II.8). We do not believe there was a programmatic reason that the control group would more frequently use collection centers; more likely, the statistically significant negative impact is a spurious relationship due to chance.

Table II.8. Impacts of WtM Training on Use of Collection Centers (percentages)

	Treatment Group Percentage	Control Group Percentage	Impact	*p*-value
Used Collection Center	8	13	-6**	0.04
Percent of Produce Taken to Collection Center	6	10	-4	0.16
Sample Size	**2,133**	**1,414**		

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group percentages were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods. Percentages of produce taken to collection centers include farmers who reported zero values.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

HVA = High-Value Agriculture.

E. Impacts on Agricultural Production

The training component's long-term objectives include increased production overall as well as greater emphasis on HVA cultivation, both of which should lead to increased farm profits.[31] Our analysis of the impact of WtM training on production quantities and values are shown in Table II.9. Impacts on production and revenues of other, specific crops within these categories are examined further in Appendix B (Tables B.5–B.7). All estimates are annual values for the 2010 agricultural season.

Throughout this section and the next, we report estimates for outcome measures that have been censored at the 98th percentile. As discussed in more detail in Appendix A, we found no evidence that high outcome outliers were attributable to the training program, but their presence severely skews the estimated impacts and inflates standard errors. We chose the 98th percentile because it was the point at which the impact estimates stabilized; further censoring did not change the estimates much. Our core findings do not materially change when we censor high outliers, but this allows us to report estimates that are more representative of the typical Armenian farmer. We censored each outcome measure individually, so some reported estimates for totals may not equal the sums of their respective components. Results from the uncensored measures are included in Appendix B (Table B.10).

[31] Some less widely grown crops, such as flowers, are excluded from our estimate of production because farmers reported their production of flowers in bunches, and there is no straightforward conversion to metric tons. Our estimate of production does, however, include farmers' sales and harvest values for flowers and other crops that were not reported in tons.

We found no statistically significant impacts on total production, production of HVA crops, or production of non-HVA crops (see the top panel of Table II.9). Among the subcategories of HVA crops, only the -0.3 ton impact on grape production and 0.1 impact on potatoes are statistically significant, and their impacts are in opposite directions. There were also no impacts on land cultivated overall, for HVA crops, or for non-HVA crops.

Treatment farmers sold significantly more potatoes (the middle panel of Table II.9), earning $32 more in potato revenues than control farmers. The increase in potato revenues was statistically significant at the 0.05 level. This significant increase was offset by a negative and statistically significant impact estimate on revenues from grapes (-$67; p-value: 0.09). The estimated impact on revenues from HVA was $40 annually, but it was not statistically significant. Revenues from non-HVA crops were almost identical for the treatment and control groups.

Agricultural revenue is limited as a measure of production because it does not reflect any crops consumed by the household, which can also be considered income for the farmer. Because many farmers, especially those outside of Ararat Valley, are subsistence farmers who sell little of their harvest, revenues do not reflect the full value of farmers' production. Therefore, we also calculated harvest values that include sales as well as the value of households' own consumption of their production.[32]

The impact of training on the total value of farmers' harvests was not statistically significant, but the magnitude was large (the bottom panel of Table II.9). The estimated impact of $165 was approximately a tenth of the control group's (regression adjusted) mean, but the impact was imprecisely estimated because of the considerable variability in this outcome measure. Consistent with the findings for harvests, we again find a significant negative impact on grapes that is partially offset by a significant positive impact on potatoes. We also observed positive, marginally significant impacts on harvest values of tomatoes ($38; *p*-value: 0.10) and vegetables and herbs ($63; *p*-value: 0.11)

Although the overall estimated impacts were not statistically significant, there may still be positive impacts of training on harvest values that cannot be detected with our sample. However, considering the pattern of mostly null findings on intermediate measures such as agricultural practices, cropping patterns, and tonnage of production—all of which could be estimated with greater precision than could harvest value—this large but insignificant impact estimate for total market value is more likely to be due to chance. This impact estimate would be considered more stable if we had observed systematic positive impacts on intermediate measures. We explore this issue in more depth when we discuss similarly large and insignificant impacts on household income.

[32] We calculate market value of harvests in a sequential process. If a farmer reported selling a positive amount of a crop, the price per ton for that farmer's sale was multiplied by the number of tons he or she produced to obtain the market value of the harvest. If a farmer did not report selling any of a particular crop that he or she cultivated, the harvest was multiplied by the median price per ton for that crop in that farmer's WUA. If no median price per ton was available for that crop and WUA, we multiplied the farmer's harvest by the crop's median price per ton in his or her zone. If no median was available for that crop and zone, we used the crop's median price in our sample. If no harvest amount was reported or the calculated harvest value was greater than reported revenues, we set the value of the harvest with the reported sale amount.

Table II.9. Impacts of WtM Training on Production, Revenues, and Market Value of Harvests

	Treatment Group Mean	Control Group Mean	Impact	*p*-value
Agricultural Production (metric tons)				
Total	6.0	5.8	0.2	0.63
HVA crops	3.8	3.8	0.0	0.97
Grape	0.6	0.9	-0.3**	0.04
Other fruits or nuts	0.5	0.5	0.0	0.83
Tomato	0.5	0.4	0.1	0.20
Vegetables and herbs	0.8	0.7	0.1	0.65
Potato	0.4	0.3	0.1**	0.01
Non-HVA crops	1.9	1.7	0.1	0.39
Grain	0.6	0.5	0.1	0.11
Grass	1.2	1.2	0.0	0.76
Land under Cultivation (hectares)				
Total	1.2	1.2	0.0	0.78
HVA crops	0.4	0.4	0.0	0.50
Non-HVA crops	0.7	0.7	0.0	0.57
Revenues from Crops Sold (USD)				
Total	1,263	1,219	44	0.70
HVA crops	1,164	1,124	40	0.72
Grape	213	280	-67*	0.09
Other fruits or nuts	206	214	-8	0.80
Tomato	150	119	31	0.14
Vegetables and herbs	240	192	48	0.17
Potato	72	40	32**	0.03
Other HVA crops	26	32	-5	0.55
Non-HVA crops	74	65	10	0.40
Grain	32	27	5	0.47
Grass	22	21	1	0.87
Other non-HVA crops	4	1	4	0.24
Market Value of Harvests (USD)				
Total	1,874	1,709	165	0.21
HVA crops	1,487	1,391	96	0.43
Grape	240	320	-80**	0.05
Other fruits or nuts	298	292	5	0.89
Tomato	177	139	38*	0.10
Vegetables and herbs	285	222	63	0.11
Potato	141	95	47***	0.01
Other HVA crops	53	58	-4	0.72
Non-HVA crops	323	281	42	0.10
Grain	180	155	25	0.21
Grass	117	111	6	0.63
Other non-HVA crops	5	1	5	0.19
Sample Size	**2,133**	**1,414**		

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group means were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

USD = United States dollars. HVA = High-Value Agriculture.

We present estimates of impacts on crop production, revenues, and harvest values by zone in Table II.10.[33] Separating these impacts is valuable because the baseline report found pronounced differences in production patterns across zones, and trainings were tailored to the specific agricultural conditions in each zone. At baseline, Ararat Valley had the highest crop sales and harvest values, primarily due to production of fruits, tomatoes, grapes, and vegetables. This zone is also close in proximity to the large markets in Yerevan, so there are greater opportunities to sell HVA crops (Socioscope 2010). In contrast, in the Mountainous Zone at baseline, grains and potatoes contributed most to total harvest values, and a large portion was consumed by households instead of sold.

Total production, total revenues, and total harvest values were not statistically different for treatment and control farmers within the Ararat Valley and Pre-Mountainous zones. However, WtM training statistically significantly increased the average production of treatment farmers in the Mountainous Zone by 1.9 tons, which contributed an average of $253 more in revenues and $641 more value to households. The differences in production and harvest value were shared by HVA and non-HVA crops. The positive findings for total production and value of harvests were statistically significant at the 0.05 and 0.01 levels, respectively, and the impact on revenues in the Mountainous Zone was statistically significant at the 0.10 level.

Though the sample sizes were larger for Ararat Valley than for the Mountainous Zone, only the Mountainous Zone impacts were significant. This phenomenon was because average revenue and harvest value were substantially higher and more variable in Ararat Valley than in the Mountainous Zone, as discussed in the baseline report (Fortson et al. 2008). The Mountainous Zone's impacts were much higher relative to its pretraining averages than were the other zones' impacts.[34]

The last component of agricultural income is agricultural expenditures, including expenditures from the last agricultural season on fertilizers, pesticides, irrigation water, hired labor, rented equipment, and taxes. Since WtM taught farmers about new practices, many of which are costly, adoption could have also required farmers' investment in new crops and technologies to increase, with corresponding increases in their expenditures. We found no statistically significant impacts on agricultural expenditures, in total or by type (Table II.11). Farmers spent the most on hired labor, equipment, and tools; fertilizers and pesticides; seeds and seedlings; and irrigation.

[33] We do not present estimates specific to the Subtropical Zone because there were not enough respondents to generate reliable estimates.

[34] There were no significant impacts on OFWM agricultural practices (simple, medium, advanced, irrigation scheduling, or organizational improvements) in the Mountainous Zone. Farmers in the Mountainous Zone were significantly more likely to buy pesticide from licensed stores and to avoid buying pesticides in damaged packaging.

Table II.10. Impacts of WtM Training on Production, Revenues, and Market Value of Harvests, by Zone

	All Zones	Ararat Valley	Pre-Mountainous	Mountainous
Agricultural Production (metric tons)				
Total	0.2	-0.1	0.2	1.9**
HVA crops	0.0	0.0	0.0	0.7
Non-HVA crops	0.1	0.0	0.2	0.9**
Land under Cultivation (hectares)				
Total	0.0	-0.1	0.1	0.1
HVA crops	0.0	0.0	0.0	0.0
Non-HVA crops	0.0	0.0	0.1	0.1
Revenues from Crops Sold (USD)				
Total	44	143	-78	253*
HVA crops	40	124	-73	199*
Non-HVA crops	10	26*	5	29
Market Value of Harvests (USD)				
Total	165	248	52	641***
HVA crops	96	172	11	327**
Non-HVA crops	42	27	51	168*

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group means were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods. We do not present estimates specific to the Subtropical Zone because there were not enough respondents to generate reliable estimates.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

USD = United States dollars. HVA = High-Value Agriculture.

Table II.11. Impacts of WtM Training on Agricultural Expenditures (USD)

	Treatment Group Mean	Control Group Mean	Impact	*p*-value
Total	817	811	6	0.88
Irrigation	116	119	-3	0.62
Seeds and seedlings	89	86	3	0.73
Fertilizers and pesticides	216	215	1	0.93
Hired labor, equipment, and tools	262	257	6	0.76
Taxes and duties	49	53	-4	0.18
Cellophanes	37	34	3	0.70
Other major expenses	8	3	5	0.26
Sample Size	**2,133**	**1,414**		

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group means were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

USD = United States dollars.

F. Impacts on Income

The FPS collected rich data on income for each member of the household at baseline and final follow-up. Although the program was not expected to directly affect nonagricultural income, it could cause households to reallocate their labor between the agricultural and nonagricultural sectors. For example, farmers might have worked fewer jobs in order to spend more time cultivating HVA crops.

Our measure of nonagricultural income was the previous year's total earnings from employment of the household head, spouse, and any grown children, plus the household's annual income from pensions, remittances, and social programs. Farmers in the treatment and control groups had similar nonagricultural income of approximately $2,300. Our measure of agricultural income used the total value of all produced crops. The total value of crops included those that are sold, bartered, or consumed by the household, as described previously.[35]

Agricultural profit was then calculated as the difference between total value of the harvest minus agricultural costs, and economic income was defined as the sum of agricultural profit and nonagricultural income. Each of the outcomes examined in this section have been censored individually at the 98th percentiles. Uncensored results are available in Appendix B. At final follow-up, households in the treatment group had an average of $166 more in agricultural profit (p-value: 0.13) and $206 more in economic income (*p*-value: 0.17) than households in the control group. This represents a 20 percent increase in economic profit and a 6 percent increase in economic income relative to the control group (Table II.12). The differences are almost entirely attributable to the previously reported differences in the average market value of farmers' harvests, with similar significance levels.

Table II.12. Impacts of WtM Training on Annual Economic Household Income (USD)

	Treatment Group Mean	Control Group Mean	Impact	*p*-value
Nonagricultural Income	2,275	2,276	-2	0.98
Agricultural Income				
Total value of harvest	1,874	1,709	165	0.21
Agricultural profit (value – costs)	1,006	841	166	0.13
Total Economic Income	3,386	3,180	206	0.17
Sample Size	**2,133**	**1,414**		

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group means were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

USD = United States dollars.

[35] As a check, Appendix Table B.8 shows the impacts on monetary agricultural income, which is based on the value of crops sold and excludes the value of crops consumed in the household. We do not find statistically significant impacts on monetary income from agriculture.

Our finding of positive but statistically insignificant impacts on economic income was generally mirrored within zones (Table II.13), though splitting them into subgroups causes the estimates to be less precise and be more likely to yield chance differences. Only the Mountainous Zone had statistically significant impacts on agricultural profit ($535), though not on economic income. Ararat Valley had smaller estimated impacts on agricultural income but a marginally significant impact on nonagricultural income, and a statistically significant estimated impact on household income of $515.

Table II.13. Impacts of WtM Training on Annual Economic Household Income, by Zone (USD)

	All Zones	Ararat Valley	Pre-Mountainous	Mountainous
Nonagricultural Income	-2	185*	-64	-293
Agricultural Income				
Total value of harvest	165	248	52	641***
Economic profit (value – costs)	166	298	-2	535***
Total Economic Income	206	515*	-5	192

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group means were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods. We do not present estimates specific to the Subtropical Zone because there were not enough respondents to generate reliable estimates.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

USD = United States dollars.

We conducted a series of specification checks to further explore the (potentially) economically meaningful but statistically insignificant overall impact on household income. The purpose of these explorations was to assess whether sampling variability was obscuring legitimate positive impacts of training. We examined how variation in economic income affected our overall impact estimate on economic income. Using the same regression model, we estimated the impact without censoring households' economic income at the 98th percentile (Table B.12). Simply including a small number of extreme values of economic incomes in the analysis increased our overall impact for economic income to $457. The estimate based on censoring economic income at the 98th percentile is less sensitive to further censoring. For example, if we censor all incomes higher than the 95th percentile, the impact decreases to $166. None of the estimates using censored incomes are statistically different from 0. Similar findings resulted when we used a median regression model or examined the overall impact estimate on a household's percentile of economic income, both of which are less sensitive to outlier values. All of these alternative models indicated that a small number of farmers with the highest incomes drove the large impact estimate over all zones when outcomes were not censored.

Although we attempted to identify and recode entries that were erroneous (Appendix A), it remains possible that some of the outliers among the highest earning farmers may be due to inaccurate reports or data entry errors. Another possibility is that these were legitimate values that happen to be somewhat higher on average for the treatment group than the control group, unrelated to the program. A third possibility is that training truly benefitted a small proportion of the sample in substantial ways. We explored this latter hypothesis by examining the characteristics and adoption rates of farmers with economic income in the top one percent. The proportions of this group in the treatment and control group mirrored the overall sample. Additionally, none of the top one percent

and only one farmer in the top two percent adopted any of the medium or advanced improvements that might have plausibly caused substantial impacts on production. Further, their other adoption rates were not appreciably different than rates of other farmers. This exploratory analysis was not conclusive, but it does suggest that the outliers are unlikely to be a small subset of farmers who benefitted strongly from training.

In 2009 and 2010, Armenia experienced two events that could influence the estimated impact on household income: adverse agricultural conditions and the global financial crisis. The weather conditions in 2010 caused agricultural production to decrease nationally, and the global financial crisis may have affected the behavior of participating WtM lenders. If the events equally affected farmers in the treatment and control groups, then the impacts would be the same in the absence of these events. On the other hand, the estimated impacts on household income could have been muted if, for example, farmers who participated in training invested in new technologies that did not reap benefits because of agricultural conditions or were unable to obtain loans to invest in new technologies. Conversely, estimated impacts could have been larger than normal if trained farmers adopted technologies that allowed them to better weather the adverse agricultural conditions. However, 2010 agricultural conditions should not have affected farmers' adoption of new technologies, as those decisions would have been made before the year's weather conditions would have been known. Because there is little evidence that farmers adopted new technologies in 2010, it is unlikely that the weather conditions muted the estimated impacts on household income. Survey data were not collected for the 2009 agricultural season, but there was also little evidence of impacts on adoption in data from the 2008 agricultural season (not reported), before the global financial crisis, so it is not likely that the global financial crisis adversely affected adoption of practices in 2009 or 2010.

G. Impacts on Poverty Rates

Our analysis of farmer well-being concluded with an examination of poverty rates for the treatment and control groups. This dimension of well-being is distinct from income because our poverty calculations focused on the value of goods consumed by the household, rather than income. Consumption-based measures have the advantage of being less susceptible to annual fluctuations than income, making them a more stable measure of well-being. On the other hand, the program was designed to affect households' agricultural income, not their consumption.

Our approach to poverty measurement was based on the calculations used for the Integrated Living Conditions Survey (ILCS), an annual household survey conducted by Armenia's National Statistical Service (NSS). We first sum the value of all consumption by the household, including food, health care, other nondurable goods, and durable goods. This sum was adjusted based on the number of adults and children in the household to determine consumption per person. Then, our estimate of total consumption per person was compared to three distinct poverty lines calculated for 2010 by NSS in collaboration with the World Bank: the "food poverty line," the "lower general poverty line," and the "upper general poverty line" (NSS 2010). The food poverty line represents the cost to consume the average caloric requirement for a person in Armenia.[36] The lower and upper

[36] The average caloric requirement for an Armenian is 2,232 calories per day, as calculated in 2004 by NSS and the World Bank. The cost of this caloric amount is based on the specific food items consumed by a reference population, scaled to that number of calories.

general poverty lines add the values of some nonfood consumption to the food poverty line.[37] The food poverty line is the lowest of the poverty lines, and the upper general poverty line is the highest of the poverty lines, so poverty rates calculated with the food poverty line will be lower than those rates calculated with the upper general poverty line.[38]

Ideally, we would assess whether households are in poverty by calculating total consumption from detailed, daily consumption diaries of durable and nondurable goods. However, collecting this information would be expensive and was not feasible in the FPS. Instead, each round of the FPS gathered households' reports of their expenditures in the past month on purchased food, health care costs, housing products, public utilities, transportation, and other expenses. The final follow-up FPS added questions on consumption of education and other annual costs, which were also included in our poverty calculations. We also estimated the value of crops that the household consumed from its own production and added this to the sum of expenditures. Finally, we applied an adjustment factor to account for durable goods.[39]

Table II.14 presents poverty rates associated with the three poverty lines. The overall poverty rates in our sample using the lower and upper poverty lines were 15 and 28 percent, respectively; there were no significant impacts on any of the poverty rates.

[37] The lower and upper general poverty lines replace the complete poverty line discussed in Fortson et al. (2008) and used before 2009. The complete poverty line also added a minimum value of nonfood consumption to the food poverty line. ILCS calculated the complete poverty line until 2009, when it instituted a series of methodological changes. It improved the accuracy of its calculations by taking into account a greater variety of food items and the exact number of days each household member in its survey was present in the household. We cannot directly compare our calculations with the poverty rates in the baseline report because ILCS also assumes now that a household consumes a durable good uniformly over its life expectancy and applies the same price deflator to the costs of food and nonfood goods. Previously, ILCS took into account the reported ages of durable goods and used separate price deflators for food and nonfood goods (NSS 2010).

[38] The primary difference between the lower and upper general poverty lines is the reference population used to identify the share of expenditures on nonfood items. The lower poverty line examines the consumption of households whose *total consumption* is near the food poverty line. This is known as the Consumption Basket Method. In Armenia in 2009, about 70 percent of this reference population's total consumption was food. The upper poverty line examines the consumption of households whose *food consumption* is near the food poverty line. This is known as the Food Expenditures Method. In Armenia in 2009, about 57 percent of this reference population's total consumption was food (NSS 2010).

[39] The adjustment factor is 9.4 percent and is the same factor used in Fortson et al. (2008). It is based on the proportion of total consumption due to durable goods in the 2004 ILCS survey.

Table II.14. Impacts of WtM Training on Poverty Rates (percentages)

	Treatment Group Percentage	Control Group Percentage	Impact	*p*-value
Households Below Food Poverty Line	5	6	0	0.75
Households Below Lower Poverty Line	16	15	0	0.88
Households Below Upper Poverty Line	28	28	0	0.99
Sample Size	**2,133**	**1,413**		

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group percentages were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

Examining specific zones, we found one statistically significant impact on the lower poverty rate in the Mountainous Zone, which increased by 6 percentage points (Table II.15). This significant impact is not part of a pattern of significant negative findings for the Mountainous zone and may be due to chance; we estimated a positive and statistically significant impact on revenues and harvest values in the Mountainous Zone (Table II.10). Only treatment farmers in Ararat Valley were estimated to have lower rates of poverty than the control group consistently across the different poverty lines, but the differences were not statistically significant.

Table II.15. Impacts of WtM Training on Poverty Rates, by Zone (percentages)

	All Zones	Ararat Valley	Pre-Mountainous	Mountainous
Households in Food Poverty	0	-1	-1	1
Households Below Lower Poverty Line	0	-3	0	6*
Households Below Upper Poverty Line	0	-4	2	4

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group percentages were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods. We do not present estimates specific to the Subtropical Zone because there were not enough respondents to generate reliable estimates.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

Although there were no overall impacts on poverty rates, there could nevertheless be impacts on consumption for households higher in the consumption distribution. To examine this, we characterized household consumption as a proportion of each of the three poverty lines (Table II.16). For example, the average household in the treatment group had consumption equivalent to 254 percent of the food poverty line. The estimated impacts on consumption were negative but not statistically significant.

Table II.16. Impacts of WtM Training on Consumption Relative to Poverty Lines (means)

	Treatment Group Mean	Control Group Mean	Impact	*p*-value
Consumption Relative to Food Poverty Line	254	258	-4	0.52
Consumption Relative to Lower Poverty Line	176	179	-3	0.52
Consumption Relative to Upper Poverty Line	144	146	-2	0.52
Sample Size	**2,133**	**1,414**		

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group means were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

To further explore the possibility of distributional effects, we grouped households based on their consumption at baseline relative to the complete poverty line (CPL) measure in use at that time and calculated the impact of WtM training on each group's consumption at final follow-up. Each grouping contained over 200 households except for the group that consumed over 4 times the complete poverty line, which had slightly fewer than 150 households. For simplicity, we only report findings for consumption relative to the lower poverty line at follow-up. There was no impact on consumption for any grouping of households (Table II.17).

Table II.17. Impacts of WtM Training on Consumption of Respondent Households Relative to the Lower Poverty Line, by Baseline Consumption Level (means)

Baseline Consumption Level	Treatment Group Mean	Control Group Mean	Impact	*p*-value
Below CPL at Baseline	298	312	-13	0.21
1-2 Times CPL at Baseline	258	260	-2	0.78
2-3 Times CPL at Baseline	265	264	1	0.92
3-4 Times CPL at Baseline	212	228	-16	0.24
4 or More Times CPL at Baseline	292	284	9	0.63
Sample Size	**2,133**	**1,414**		

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group means were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

CPL = Complete Poverty Line.

Household consumption and income are related both measures of household well-being. Income is the outcome of greatest interest to MCC, but income is a highly variable outcome that is measured somewhat imprecisely. Consumption is measured much more precisely, and that the consumption estimates suggest no impact of WtM training on consumption bolsters the interpretation that it is unlikely that WtM training affected household income.

SUMMARY OF WATER-TO-MARKET TRAINING FINDINGS

Implementation Findings

Water-to-Market (WtM) training provided On-Farm Water Management (OFWM) training to 45,000 farmers and High-Value Agriculture (HVA) training to 36,000 farmers, meeting revised targets for training. The final cost of WtM training was about $14.3 million USD. The initial targets were 60,000 farmers for OFWM training and 30,000 farmers for HVA training. These targets were revised to better reflect the complementarities of the training topics, and also because of budget considerations after the Armenian dram was devalued. However, training was sometimes given to people who were unlikely to benefit, such as the elderly. Many farmers attended training because they believed that training would lead to receipt of MCA credit. Practices discussed in trainings were tailored to regional agricultural conditions, and trained farmers appreciated that trainings were led by local experts. Financial limitations were the most common reason given for not implementing OFWM and HVA practices. Another common barrier was a lack of irrigation infrastructure. Training was intended to complement irrigation rehabilitation, but rehabilitation projects were not completed in most communities until near the end of the Compact period.

Impact Findings

We did not find evidence that training substantially improved long-term measures of farmers' well-being such as income, poverty, or consumption. We also did not find evidence of impacts on adoption of new OFWM practices that might suggest longer-term impacts could yet develop. There were some positive impacts on HVA practices involving proper pesticide use, which could possibly lead to future improvements in farmers' and consumers' health. There was also evidence of positive impacts on agricultural production in the Mountainous Zone, which were shared among HVA and non-HVA crops. An important contextual factor is that impacts were measured after a difficult agricultural year, with ambiguous implications for impacts in a typical year.

Sustainability

There was little evidence that WtM training increased adoption of key agricultural practices, with only a handful of exceptions mentioned above. Institutional factors may have inhibited adoption of OFWM practices, including the lack of monetary incentives to conserve water and limited access to credit. Farmers were unable or unwilling to invest in cultivating higher-value crops. Active participation of farmers at demonstration farms could help sustain or expand adoption of new practices because, even after a training session ended, trained farmers could consult a local source of knowledge. However, trained farmers indicated that they were unlikely to share knowledge of OFWM and HVA practices with other, untrained farmers.

Lessons Learned

The findings from the evaluation of WtM training suggest that inducing farmers to change their behaviors is challenging, particularly when there are other unresolved constraints preventing them from adopting new practices. Future training programs could possibly serve farmers better by conducting more intensive trainings for smaller numbers, in which case more time could have been spent following up with farmers to resolve adoption constraints. However, because so many farmers were trained as part of WtM, modest positive impacts would have sufficed to justify the investment in training. Our impact estimates are not sufficiently precise to rule out this possibility.

III. EVALUATION OF WTM CREDIT

A. Overview of WtM Credit

The strategic goal of the WtM Activity's Access to Credit (WtM credit) component is to provide long-term credit to individuals who were trained under as part of WtM training. At its inception, WtM credit was designed in response to the capital constraints of Armenian farmers, who had little access to medium- and long-term loans to finance agricultural investments.[40] To mitigate these constraints, WtM credit provides beneficiaries with the necessary resources to finance new irrigation and production technologies introduced in WtM training, including greenhouses, drip irrigation systems, and tractors.

Under WtM credit, MCA initially planned to disburse at least $8.5 million USD to WtM beneficiaries through intermediary credit organizations, and $8.8 million was ultimately spent, including overhead costs. In 2008, four credit organizations were selected in a competitive process to distribute $1.5 million in MCA-Armenia loans. In 2009, an additional six credit organizations were approved to administer WtM loans.[41] These 10 providers—six universal credit organizations (UCOs)[42] and four banks—were charged with distributing the remaining $7 million in loans from 2009 to 2011. One institution chose not to make any WtM loans, leaving a total of 9 participating lending organizations. WtM credit is implemented and monitored by the Rural Finance Facility (RFF), a public Armenian financial institution.[43] The credit component is operating in 10 Armenian marzes, or administrative districts (all marzes except Yerevan). Lending is planned to continue until 2020 under the program's revolving fund, which funds subsequent loans using repayments from earlier loans.[44]

Table III.1 provides a summary description of WtM credit's objective, target population, funding, and other key characteristics.

[40] For example, only 6 percent of commercial lending in Armenia in 2008 was related to agricultural investments (Urutyan 2009).

[41] The selection process was different in the first and second rounds of WtM lending. During the first round, $1.5 million USD was distributed in lots of $100,000. MCA and other stakeholders selected 4 institutions to distribute one or more lots on the basis of their proposed interest rates, with lower rates judged by MCA as more attractive than higher rates. For the second stage, MCA made the credit line available to any financial institution that would accept the basic loan conditions: a maximum interest rate of 12 percent and some limitations on commission fees and loan purposes.

[42] Under Armenian legislation passed in 2002, UCOs are financial organizations that can operate as credit and savings unions, leasing and factoring companies, and universal nonbank financial institutions. As of January 1, 2009, the nation had 25 licensed UCOs. Their assets comprised about 61 billion Armenian drams (AMD), 15 percent of which were directed to agricultural sectors (Urutyan 2009).

[43] The Armenian Ministry of Finance established the RFF in 2006 to distribute and monitor World Bank and International Fund for Agricultural Development (IFAD) credit lines.

[44] Under current plans, RFF will oversee the revolving fund until 2020. No decision has been made among stakeholders regarding the continuation of the fund after that date.

Table III.1. Summary of WtM Credit

Objective	Provide long-term credit to small farmers for investments in greenhouses, cooling facilities, development or expansion of orchards, irrigation technologies, and other agricultural investments.
Funding	$8.5 million (USD) in investment capital, with additional capital available through a revolving fund. Total cost (including overhead) of $8.8 million.
Target Population	Small farmers who were trained in WtM training.
Implementing Parties	Rural Finance Facility (RFF), 5 universal credit organizations (UCOs), and 4 banks.
Time Frame	2008 to 2011, but fund loans are expected to proceed through the revolving fund until 2020.
Activities/Assistance	Investment capital in the form of low-interest, multi-year loans.

WtM loans can be used to strengthen agricultural production, modernize equipment, build greenhouses, expand orchards and vineyards, and purchase root stock as well as for post-harvest agribusiness activities including marketing, processing, establishing consolidation centers, and developing and expanding processing factories. The majority of each WtM loan must be used for investment purposes, and no more than 20 percent of the loan value can be used for working capital. The loans have a maximum interest rate of 12 percent and a term between 2 and 7 years. In addition, the maximum loan amount is 10.5 million Armenian drams (about $28,500 USD).

WtM credit has a similar structure to previous loan programs for rural Armenian borrowers designed by the World Bank and the International Fund for Agricultural Development (IFAD). These programs featured similar roles for RFF as well as participating lending organizations. Under the MCA, World Bank, and IFAD programs, participating lending institutions submitted loan applications to RFF staff, and RFF conducted due diligence, made a final recommendation on each loan, and coordinated disbursements. All three programs also featured loans for similar agricultural purposes and with comparable interest rates and similar maturities.

The WtM credit program introduced some key innovations, however, relative to World Bank and IFAD programs. First, with a maximum amount of less than $30,000 USD, WtM loans are smaller than World Bank and IFAD loans, which had a maximum amount of $150,000 USD.[45] In addition, WtM loans are provided in Armenian drams, as opposed to U.S. dollars, as was the case with these other programs. This protects WtM loan recipients from currency market fluctuations, as occurred during the devaluation of the U.S. dollar vis-à-vis the Armenian dram in 2009. WtM loans also feature in-person monitoring on the part of RFF staff to verify that investments are used for their designated purpose. This monitoring did not take place with IFAD and World Bank credit lines, which featured monitoring of financial institutions but not of borrowers' investments. Additional comparisons of these programs' loan conditions are provided in Section III.D.

[45] In addition, IFAD loans had a minimum amount of $40,000 U.S. dollars, whereas WtM and World Bank loans had no minimum amount.

B. Research Questions and Methods

A rigorous analysis of WtM credit was not planned prior to implementation, chiefly due to the infeasibility of identifying an adequate comparison group for MCA loan recipients. However, MCC decided in early 2011 to evaluate the implementation and effects of WtM credit to the extent possible with existing data sources. Based on our research framework and conversations with MCC staff, we developed the following research questions for WtM credit:

1. **How was WtM credit implemented?** What were the program targets? Did the program meet its targets in terms of the number and value of loans awarded? How were beneficiaries targeted across participating lending institutions? Did the number of loans vary across lending institutions? If so, why? Under what circumstances was WtM credit awarded, and for what purposes was it used? (Section III.C.) Did WtM credit have a unique niche vis-à-vis other agricultural credits? (Section III.D.) What were the characteristics of recipients of WtM credit compared to the recipients of other credit and to nonrecipients? (Section III.E.)
2. **Did WtM credit have the intended effects?** Did farmers who received WtM credit have higher rates of adoption of training principles and practices, investment, production, and income than farmers who did not receive WtM credit? Will the new credit lines be sustained? (Section III.F.) Was the behavior of other financial institutions altered as a result of the program? (Section III.G.)

To answer several questions about the credit program's implementation and intended effects, we used findings from the WtM QPA report (Socioscope 2010). In particular, we used the report's findings on loan recipient targeting and characteristics. To collect additional information on program implementation and intended results, we conducted in-person interviews with MCA staff, personnel at the RFF, two lending organizations that participated in the WtM credit component (one bank and one UCO), representatives from the World Bank and the IFAD, and two WtM borrowers. During interviews with MCA, RFF staff, lenders, and other stakeholders, we discussed the loan application and approval process and whether lending targets were met. In interviews with the World Bank and IFAD, we focused on determining the similarities and differences between WtM credit and other agricultural credit available in rural Armenia and on documenting lending institutions' response to MCA lending. In interviews with borrowers, we documented their investments, agricultural production and sales, and experience with WtM credit.

To answer several questions about borrower and loan characteristics, as well as the apparent effects of WtM credit, we used RFF administrative data and Farming Practices Survey (FPS) data. As originally designed, the FPS was not intended for use in determining the impact of WtM credit on farmers' agricultural and economic outcomes. With growing interest among MCC and MCA-Armenia regarding WtM credit, however, follow-up rounds of the FPS included an additional subsample of WtM and non-WtM credit recipients who had not been interviewed in earlier rounds. Partly as a result of these efforts, 1,106 farmers interviewed in the final round of the FPS reported receiving credit in the previous year; 64 of them (about 6 percent of all credit recipients in the sample) reported receiving credit through WtM credit. We used information from this sample of credit recipients to describe the characteristics of WtM loans.

In addition to comparing WtM loans with non-WtM loans, we used FPS data to assess the effects of WtM credit on key production, sales, and income results. Our analysis assessing the effects of WtM credit compared outcomes for WtM credit recipients against other farmers in the FPS (regardless of whether or not they received any non-MCA credit). This group provided our estimate of the counterfactual, that is, what farmers' outcomes would have been in the absence of WtM credit.

The regression model for credit was developed in the same way as for the impact evaluation of training and is described in Appendix A. However, unlike WtM training, in which the random assignment evaluation design allowed for a rigorous evaluation, the assessment of effects of WtM credit had several important limitations. First, the sample size was small, as only 27 WtM borrowers completed baseline and follow-up FPS interviews. As a consequence, the estimates of program impacts were imprecisely modeled, meaning that the true effects of the program may not be well-measured. Second, we could not fully account for all differences between WtM loan recipients and the comparison group. The nonexperimental evaluation design assumes that all relevant differences between the two groups were observed, but important factors—such as farmers' motivation and predisposition to invest in new technologies or crops—were not completely captured by the baseline survey data. Failing to account for these factors likely caused upward bias in the impact estimates because the farmers whose unobserved characteristics make them most likely to apply for WtM credit are also most likely to invest in new technologies or crops and may already have higher incomes, even without a WtM loan.

For these reasons, we consider the estimates we present as suggestive, but not conclusive. As such, follow-up differences between WtM borrowers and non-borrowers are not defined as impacts, but as potential effects of WtM credit. Table III.2 provides a summary of the data sources and research designs we used to answer our primary research questions for WtM credit.

Table III.2. Data Sources and Research Design Used to Address Primary Research Questions for WtM Credit

Research Question	Data Sources	Research Design
How was WtM credit implemented?	WtM Qualitative Process Analysis Report; in-person interviews with RFF, participating lenders, World Bank, IFAD, and MCA; RFF administrative data	Mixed methods, with a focus on qualitative data
Did WtM credit have the intended effects?	2007-2008 and 2010-2011 Farming Practices Surveys	Nonexperimental design in which outcomes of WtM loan recipients were compared to those of nonrecipients

C. Implementation Findings

In this section, we discuss lenders' methods of targeting potential WtM borrowers, the loan application process, overall levels of MCA lending and repayment, and continued lending under the revolving loan fund. An understanding of these three topics is fundamental to assessing the WtM credit component's overall implementation.

1. Targeting and Recruiting

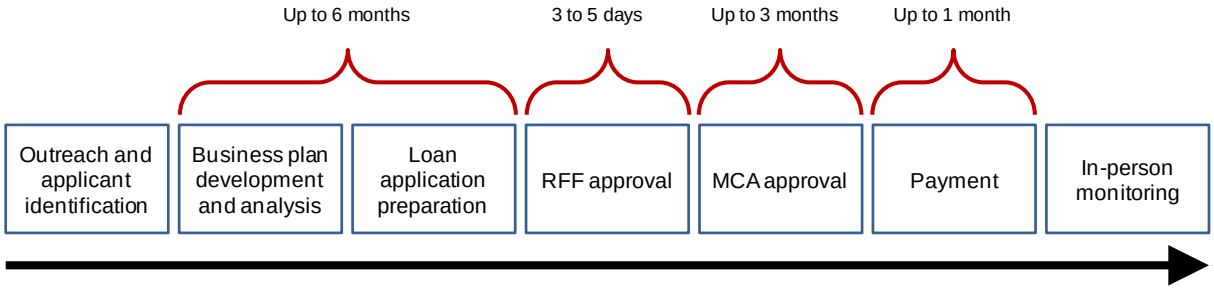
Each participating financial institution had a unique approach to targeting WtM loan recipients, but UCOs were more active overall than banks in actively recruiting potential borrowers. For instance, loan officers in one UCO requested the names of WtM-trained farmers from mayors' offices as part of their outreach efforts. These loan officers then visited individual farmers to assess their agricultural activities and interest in WtM credit. In contrast, banks' outreach efforts were generally more modest and confined to interactions with clients in branch offices. However, one particularly active bank reported advertising WtM credit on the Internet and meeting with mayors and farmers on a monthly basis to identify potential borrowers. Individual borrowers were also recruited by banks and UCOs through presentations during WtM training sessions, at village administrations meetings, and through the networks of former clients.

According to the 2010 QPA report on the WtM activity, the distribution of loans made across communities and marzes was highly influenced by the presence of participating banks and UCO branches in each locality. Communities and marzes in which participating lenders had branch offices tended to have more WtM loans. This seems logical, given that lenders were more likely to target potential borrowers who lived near branch offices, as travel costs associated with outreach and monitoring were lowest for these individuals. Similarly, WtM training participants were also more likely to travel to participating branch offices, apply for WtM credit, and secure a loan if these offices were close to their place of residence.

2. Application Process

Figure III.1 provides a visual representation of the application process for WtM credit. First, participating banks and UCOs conducted outreach to potential clients who completed WtM training. Once they identified viable applicants, these lending institutions worked with those individuals to develop brief business plans for their desired investments. Lending institutions also analyzed each applicant's credit history, collateral, and other characteristics as part of their standard risk assessment. According to MCA sources, this entire process generally lasted from 15 days to six months. Next, lending institutions assembled loan applications for viable borrowers and sent them to RFF for approval. RFF had three to five days to verify that each application met MCA requirements regarding the amount requested, purpose of the loan, and applicant's completion of WtM training. Once compliance was verified, RFF sent applications to MCA, which had three days to review the applications, approve them, and send them to a fiscal agent for payment. Next, the fiscal agent transferred the money to the borrower within one month. In addition, RFF was responsible for monitoring at least 60 percent of loans to ensure that investments were carried out as planned. If RFF identified any deviations between planned and actual investments, it recalled the entire loan amount from the borrower.

Figure III.1. WtM Credit Development and Approval Process

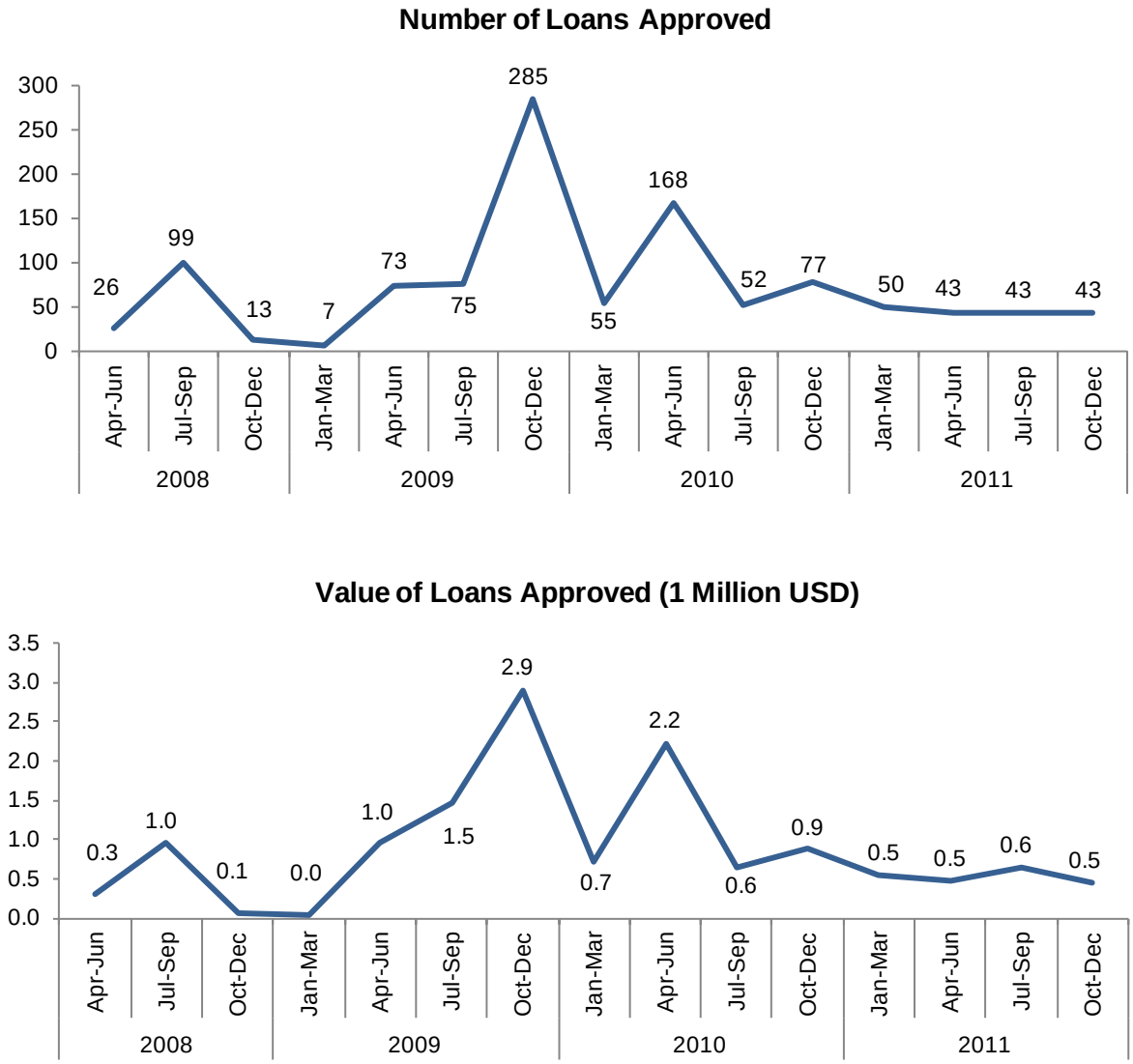


In interviews, lending organization staff said that the entire loan development and approval process could take as few as 10 days if the applicant's paperwork was in order and there were no issues with collateral. However, there were often legal issues to resolve and actual payment by the fiscal agent could take up to one month. The WtM QPA report emphasized beneficiaries' dissatisfaction with delays in the credit process; those delays were mostly related to problems with receipts for water payments, land titles, and debt payment documents or with cadastral registration issues. According to the WtM QPA report, these delays complicated farmers' ability to make agricultural investments in a timely manner. Some farmers who expected to receive credit in time to cultivate a particular crop in spring had to wait until the following year due to disbursement delays.

3. MCA Lending and Repayment

From 2008 to 2011, 1,109 WtM loans (valued at $13.3 million USD) were approved by RFF and MCA personnel (Figure III.2). Relative to other quarters, a large number (and amount) of loans were approved in the fourth quarter of 2009 and the second quarter of 2010. The sharp rise in lending in late 2009 is likely related to a high volume of approved loans shortly after the second tranche of funds became widely available in mid-2009, as well as the high demand for agricultural loans in the last three months of each calendar year. Given the time required to complete agricultural investments, many loans disbursed in late 2009 were used to finance greenhouses for vegetable production beginning in spring 2010.

Figure III.2. Number and Value of MCA Loans Approved, 2008- 2011



Note: A conversion rate of 368.81 AMD = 1 USD was used for all conversions in this figure, the conversion rate on July 1, 2011, which was the reporting date for RFF data.

Related to their more intensive outreach efforts, UCOs have an overall higher level of lending than banks. By mid-2011, UCO lending accounted for 79 percent of the WtM loan portfolio (Table III.3). The higher participation of UCOs relative to banks was partly attributable to UCOs' limited credit supply compared to banks. In contrast to banks, which could get funds through regular customer deposits, UCOs did not have alternate sources of investment capital. In interviews, UCO representatives reported that MCA's 4 percent interest rate—the portion of repayments that lenders must return to MCA—was relatively cheap and provided them with an opportunity to expand their modest loan portfolios. In addition, several UCOs were well positioned to administer MCA loans because they had previous experience working with farmers in rural areas and were willing to travel to these areas to conduct outreach activities. During an interview, an RFF staff member reasoned that UCO loan officers had preestablished relationships with farmers and a better understanding of farmers' needs than loan officers at participating banks and suggested that these factors probably played some role in the higher number of MCA loans generated by UCOs versus banks.

Table III.3. Summary of MCA Lending, by Participating Financial Institution

	Number of MCA Loans	Total Amount Disbursed (USD)	Average Loan Amount (USD)	Average Interest Rate (percentages)	Average Loan Period (months)
Universal Credit Organizations	823	9,633,137	11,704	11.5	60.0
Farm Credit Armenia	269	3,054,988	11,358	10.9	52.4
Nor Horizon	116	867,249	7,475	11.8	70.0
ANIV	127	1,529,912	12,047	12.0	59.7
CARD	172	2,648,654	15,398	11.5	61.6
GFC	139	1,532,334	11,025	12.0	52.6
Banks	200	2,529,463	12,647	10.0	63.7
Armbusinessbank	133	1,896,752	14,262	9.8	69.0
Ameriabank	1	27,114	27,114	12.0	48.0
ASHIB	4	52,602	13,150	11.5	51.3
Converse Bank	62	552,995	8,921	10.5	53.3
Total	**1,023**	**12,162,599**[a]	**11,889**	**11.2**	**59.2**

Source: RFF administrative data.

Note: A conversion rate of 368.81 AMD = 1 USD was used for all conversions in this table, corresponding to the conversation rate on July 1, 2011, the reporting date of RFF administrative data.

USD = United States dollars.

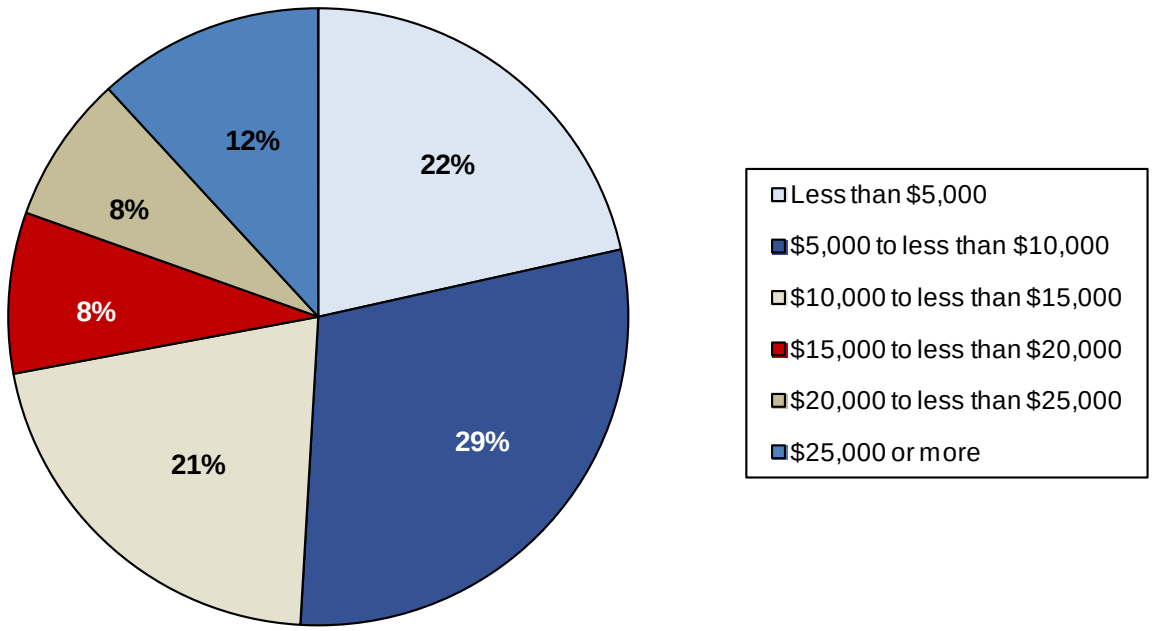
[a] By December 2011, total disbursements (including disbursements related to revolving funds) reached over $13 million. The total number of loans (and total amount disbursed) does not match totals in Figure III.2 because the data source for Table III.3 is restricted to all loans approved as of July 1, 2011.

Socioscope (2010) mentioned these key reasons as the major factors in UCOs' high lending levels, and added that banks were less likely to lend because of their traditional office-based work style and predisposition to minimize financial risk. However, one bank made over 100 MCA loans by July 2011. Staff from this bank reported using flexible collateral conditions, assistance with drafting business plans, and an individual approach toward each loan applicant. The QPA report mentioned these characteristics as common across participating lending organizations that had made a substantial number of WtM loans.

By September 2010, WtM credit surpassed its target amount of $8.5 million in disbursed funds. Lending continued into 2011 and 2012, however, through use of the credit component's revolving fund, in which repaid capital was re-lent by participating institutions. Synthesizing information from stakeholder interviews and summary reports on WtM credit, we hypothesize that the primary factors that allowed WtM credit to meet its lending targets were the high demand (relative to supply) for the loan product given its low interest rates; the loan program's well-defined administrative structure and target population; and a strong alignment of incentives between MCA, RFF, several UCOs, and at least one participating bank.

As of July 1, 2011, 1,023 loans were approved and disbursed by the RFF (Table III.3).[46] According to RFF data, the average size of loans was around $11,900 USD, the average term was 59 months, and the average interest rate was 11.2 percent. In addition, about half of all WtM loans were for less than $10,000 (Figure III.3). Particularly notable was that the scale of WtM lending—around 1,000 loans by July 2011—was small in proportion to the 47,800 households trained through WtM. According to nearly all farmers who were interviewed, a large portion of trainees' demand for credit went unmet. This unmet demand resulted in a high level of dissatisfaction among farmers who participated in training hoping for access to credit but did not secure a loan. Many of these farmers thought that participating in WtM training would lead to WtM credit. Participation in training was required, but loan applicants also had to demonstrate that they would use the loan for approved agricultural purposes and were likely to be able to repay the loan. According to participating lenders, only a few trained farmers were rejected for loans on these grounds. However, as noted by Socioscope (2010), a substantial portion of trained farmers reported that they did not apply for credit due to the program's stringent application requirements and a general mistrust of the process. This mistrust gradually emerged over the course of the WtM credit component as trained farmers learned that securing a WtM loan was more difficult than they had originally believed.

Figure III.3. Distribution of WtM Loan Amounts (USD)



Source: RFF administrative data.

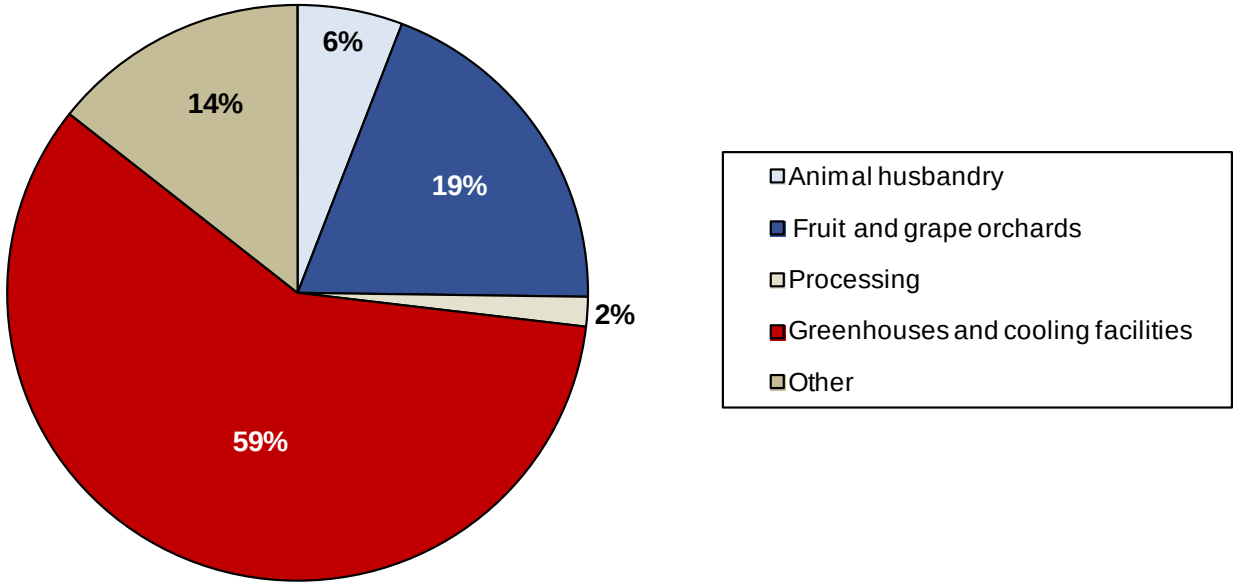
USD = United States dollars.

Sample size = 1,023 approved loans.

[46] The number of approved loans had reached 1,056 by September 2011, when MCA-Armenia's *All About Results* report was published. By the end of 2011, 1,109 WtM loans had been approved.

As illustrated in Figure III.4, about three of every five WtM loans were used to build greenhouses and cooling facilities, and one of every five loans was for investments related to fruit and grape orchards. In contrast, less than one in ten loans was devoted to animal husbandry or processing. With an average size of around $16,700, loans made to finance processing investments were larger than loans made for other purposes, followed by loans for investments in greenhouses and cooling facilities (Table III.4).

Figure III.4. Purposes of WtM Credit



Source: RFF administrative data.

Sample size = 1,023 approved loans.

Table III.4. Average Loan Size, by Purpose of WtM Credit (USD)

	Animal Husbandry	Fruit and Grape Orchards	Processing	Greenhouse and Cooling Facilities	Other Purpose	All Purposes
Average Loan Amount	$7,762	$9,639	$16,715	$13,632	$8,936	$11,889
Number of Loans	60	198	17	601	147	1,023

Source: RFF administrative data.

USD = United States dollars.

According to RFF administrative records, repayment of WtM loans was nearly 100 percent. As of May 2012, only 30 of 1,132 WtM loans had overdue principal payments. These overdue payments totaled less than $60,000 USD, less than 1 percent of all principal payments due by May 1, 2012.[47] In addition, 222 loans (or 20 percent of all loans as of early 2012) had been fully repaid by May 2012. This WtM repayment rate is higher than repayment rates for previous small agricultural loan programs, which are generally lower than 98 percent.[48] Interviewed stakeholders cited the program's in-person monitoring component and participating lenders' effective risk assessments during the application phase as reasons repayment levels were very high.

4. Continued Lending

The continued operation of the WtM revolving fund appears likely in the next few years, due primarily to strong demand among farmers, apparent motivation of participating institutions to continue making WtM loans, and high repayment rates as of July 2011. Representatives from two participating lenders stated that they would continue lending under the WtM revolving fund in the future. One RFF representative estimated that in the next two years, another $8.5 million would be lent to rural farmers through the revolving fund. MCA-Armenia estimated that by 2020, the final year of the revolving fund's operation, over 3,000 farmers would have received WtM loans.

D. Comparison of Credit Characteristics

According to MCA and RFF staff, as well as interviewed staff from participating lending organizations, WtM credit had a unique niche in the market from 2008 until 2011. The program's maximum 12-percent interest rate is very low, particularly in the agricultural sector. RFF staff posited that the annual market interest rate for a similar loan might be between 16 and 24 percent, or between 4 and 12 percentage points higher than the maximum WtM interest rate. Even among loan programs administered by RFF (which have a similar range of interest rates), stakeholders stated that WtM credit was unique. The WtM credit component's maximum loan size of $28,500 catered to smaller agricultural producers, whereas World Bank and IFAD loans assisted larger producers and financed nonagricultural as well as agricultural investments.

Table III.5 provides a comparison of agricultural lending programs during the period of WtM credit implementation from 2008 through 2011. Compared to other agricultural credit lines, which featured interest rates of up to 26 percent, all three credit lines administered under RFF featured more attractive interest rates: a maximum of 12 percent for WtM loans and a maximum of 16 percent for World Bank and IFAD loans. Of all the credit lines featured in Table III.5, the SEF International program appeared the most similar to WtM credit in terms of loan purpose, conditions, and loan amounts. However, with a range of loan sizes between $5,000 and $10,000 and a maximum maturity period of 24 months, this credit line appeared to finance smaller and shorter

[47] Fifteen of these loans involved repayments that were less than 60 days late, and 11 of these 30 overdue loans involved repayments that were more than 120 days late, and 15 of these loans involved repayments that were less than 60 days late.

[48] For example, the World Bank's Armenia Agriculture Reform Support Project (ARSP) credit line program, which distributed 17,500 small agricultural loans from 1998 to 2005, had a repayment rate of 97 percent for final borrowers (World Bank 2010). Similarly, IFAD's Rural Areas Economic Development Program had a repayment rate of 96 percent (IFAD 2011). Repayment is defined as the amount of payments received divided by the total amount due in the current period (in addition to the amount past due from previous periods).

term investments than WtM loans. These comparisons are consistent with stakeholders' assertions that WtM credit had a unique niche in the market given its designated purposes, loan amounts, and low interest rates.

As illustrated in Table III.5, the initial allocation of $8.5 million for agricultural loans under WtM credit was comparable with World Bank, IFAD, and SEF credit lines. However, with $20.5 million in new loans in 2008 alone, ACBA-Credit Agricole Bank had larger agricultural lending levels than any other financial institution. In fact, ACBA's agricultural lending in 2008 comprised 72 percent of the total commercial bank portfolio in agriculture in 2008 (Urutyan 2009). The fact that one bank accounted for most private agricultural lending in the country highlights the scarcity of credit for agricultural investments in Armenia.

Table III.5. Primary Agricultural Credit Programs in Armenia, 2006- 2011

	Time Frame	Purpose	Total Funding	Loan Conditions	Loan Amount	Interest Rates
WtM Credit (administered through RFF)	2008 to 2011, but loans with the revolving fund will proceed until 2020	Long-term credit for new irrigation and production technologies introduced in WtM training	$8.5 million USD in investment capital, with additional capital available through a revolving fund	Maturities between 24 and 84 months	Maximum loan amount of about $28,500 USD	No more than 12%
World Bank Rural Lending Program (administered through RFF)	2006-2011	Credit for rural projects not limited to agriculture	About $10 million USD	18-month grace periods and maturities between 24 and 84 months	Maximum of $150,000 USD	10-16%
IFAD Rural Areas Economic Development Program (administered through RFF)	2006-2009	Credit for farmers and rural enterprises not limited to agriculture	About $9 million USD	Maturities between 24 and 84 months	Minimum of $40,000 USD; maximum of $150,000 USD	10-16%
ACBA-Credit Agricole Bank	2008-2011	Long-term credit for agricultural investments	About $21 million USD in new agricultural lending in 2008	Maturities between 24 and 60 months	Maximum of $150,000 USD	12-26%
SEF International (affiliated with World Vision)	2008-2011	Credit for small businesses, including agricultural activities and animal breeding	About $6 million USD disbursed in 2009	Maturities between 6 and 24 months	Range between $500 and $10,000 USD	Not available

Sources: Urutyan 2009, MCC administrative documents, and interviews with World Bank, IFAD, and RFF representatives, 2011.

USD = United States dollars.

Table III.6 used FPS data to compare the loan conditions reported by WtM credit recipients to those reported by recipients of non-WtM credit. With a sample size of 64, the number of WtM credit recipients in the sample accounted for only around 6 percent of all WtM credit recipients. Although small, this sample allowed us to make some basic comparisons between WtM credit and other credit. Interestingly, a total of 1,042 of the 3,547 interviewed farmers in the FPS follow-up survey reported at least one non-WtM loan in the year preceding the interview (Table III.6). This represented nearly 30 percent of the entire follow-up survey sample.

As illustrated in Table III.6, substantial portions of WtM credit recipients reported receiving credit in 2009 and 2010, and these recipients were just as likely to borrow from a bank as a UCO. In contrast, non-WtM borrowers were more likely to report borrowing in 2010, and were much more likely to report receiving credit from a bank than from UCOs. Compared to other credit recipients, WtM credit recipients were more likely to report using credit for greenhouses, orchards, and cold storage facilities, and less likely to use credit to finance new seeds and seedlings or livestock investments.

Notably, WtM credit recipients reported lower interest rates (12 percent versus 21 percent) and higher loan amounts (approximately $13,500 versus around $2,600) than other credit recipients. In addition, WtM borrowers reported longer loan periods than other loan recipients, with an average maturity period of nearly 5 years (57 months) for WtM loans versus slightly over 1.5 years (20 months) for non-WtM loans. Collateral types also differed between the two groups, with WtM credit recipients much more likely to report using real estate as collateral (83 percent versus 27 percent of non-WtM loan recipients). This difference was likely a function of the higher loan sizes of WtM credit recipients, as higher loan sizes require more substantial forms of collateral. Overall, WtM loans' very low average interest rate (compared to other agricultural loans held by FPS respondents) provides evidence that the program's interest rate was highly subsidized, to the extent that WtM loans were available at an interest rate nearly 10 percentage points lower than smaller and more short-term agricultural loans in the credit market.[49]

Comparing characteristics of FPS interviewees who received WtM credit with the characteristics of all borrowers, FPS interviewees' loans appeared similar to the average WtM loan size, interest rate, and maturity periods of $12,000, 11 percent, and 5 years, respectively. Despite these similarities, we cannot assume that FPS interviewees who reported WtM loans have similar characteristics to the entire population of WtM loan recipients.

Based on Socioscope (2010), WtM borrowers' perceptions of their loan conditions were very positive. Interviewed farmers were satisfied with the loan conditions, particularly the low interest rates, long maturity, and use of Armenian drams for repayment. As for drawbacks, borrowers viewed the need for collateral, some age restrictions, and the requirement to start repaying the interest rates immediately after receiving the credit as negative aspects of loan conditions.

[49] Subsidized interest rates are defined as rates that do not fully cover administrative costs, capital costs, and expected defaults. Comparing WtM interest rates with market interest rates does not provide a scientific method of determining whether WtM credit interest rates were subsidized. However, it provides suggestive evidence of subsidies, given that similar credit programs—particularly from private banks—likely calculated interest rates in terms of these costs and expected default rates.

During interviews with Mathematica staff, lending organizations generally praised WtM loan conditions, but made some suggestions to improve future agricultural loan products—including allowing credit to be used for a wider range of productive purposes. Interviewees from one participating bank suggested including cattle breeding, fisheries, and flower cultivation as potential loan purposes.[50] Respondents from one participating lending institution also suggested that the repayment period be longer if warranted by the productive activity being financed.

[50] MCA staff maintained that in particular, investments in cattle breeding and fisheries were excluded from WtM credit because they did not advance goals outlined under the activity related to high-value agricultural production.

Table III.6. Credit Characteristics, by WtM Credit Receipt (percentages except where indicated)

	WtM Credit Recipients	Other Credit Recipients
Credit Awarded in:		
2008	17	6
2009	39	22
2010	45	70
2011	0	4
Source of Credit:		
Universal credit organizations	53	18
Card	11	1
GFC	6	0
Farm Credit Armenia	11	0
Nor Horizon	8	0
Finca UCO[a]	0	9
Aniv UCO	16	0
AREGAK UCO[a]	2	6
Banks	53	83
Armbusinessbank	42	2
AGBA-Credit Agricole Bank[a]	6	78
Converse Bank	5	0
ASHIB	2	2
Purpose of Credit		
Greenhouse	44	15
Orchards	27	19
Equipment (tractor)	14	16
Seeds, seedling, sprouts	11	35
Livestock	11	27
Cold storage	9	1
Land purchase or renting	3	6
Nonagricultural purposes	2	8
Other	3	12
Average Loan Amount (USD)	13,509	2,628
Average Annual Interest Rate (points)	12	21
Average Loan Period (months)	57	20
Collateral Required	84	31
Collateral Type		
Land	13	42
Real estate	83	27
Machinery	0	11
Car	2	12
Other	2	11
On Schedule with Payments	100	99
Sample Size	**64**	**1,042**

Source: 2010-2011 Farming Practices Survey.

Note: Percentages of respondents reporting credit from banks and UCOs sum to over 100 points due to a small proportion of respondents who reported more than one loan. Percentage of loans reported for each UCO and bank do not sum to percentage reporting a loan from any UCO or bank, respectively, due to rounding and respondents who reported loans from more than one UCO or bank.

Up to two purposes could be provided for each loan. For this reason, percentages for the purpose of credit do not sum to 100 percent.

USD = United States dollars.

[a] AREGAK UCO and ACBA-Credit Agricole Bank were not WtM credit providers. As such, any cases of WtM credit recipients with these loans represent individuals with at least one WtM loan and at least one non-WtM loan.

E. Description of WtM Credit Recipients and Nonrecipients

We also compared and contrasted the demographic characteristics and baseline agricultural outcomes of WtM credit recipients, non-WtM credit recipients, and individuals who did not report any loans in the year preceding the FPS survey (noncredit recipients). For this comparison as well as for our impact analysis in Section III.F, we used the sample of FPS respondents who completed both baseline and follow-up surveys. This restriction was necessary to account for observable differences between WtM credit recipients and the comparison group. Unfortunately, the original sample size of 64 individuals who reported WtM credit was reduced to 27 individuals once we limited the analysis sample to individuals who completed both surveys.[51] As a result of this very small sample size—as well as potential biases that may not have been eliminated after controlling for respondents' baseline outcomes—all estimates of demographic characteristics and baseline agricultural outcomes among WtM credit recipients and of their differences with other sample members should be interpreted with caution.

As shown in Table III.7, WtM credit recipients tended to be older and more educated than both other credit recipients and noncredit recipients. At baseline, WtM credit recipients owned or rented an average of around 3 hectares of land at baseline, compared to approximately 2 hectares and 1 hectare for other credit recipients and noncredit recipients, respectively. WtM borrowers reported higher average baseline farming expenditures and crop sales than the other two groups. Given WtM borrowers' higher average baseline crop sales as well as nonagricultural income, their annual total economic income—the sum of agricultural profit and nonagricultural income—was around $7,000, over double the average economic incomes reported by other credit recipients and nearly three times higher than incomes reported by those who did not receive credit.

These findings were consistent with Socioscope's WtM QPA report, which noted that WtM borrowers tended to be more highly educated and involved in agriculture than other WtM trainees. We used regression models to control for baseline differences between WtM credit recipients and other respondents in our analysis of the impact of WtM credit on agricultural and economic outcomes.

[51] Similarly, our original sample size of 1,042 individuals who reported receiving non-WtM credit was reduced to 370 after dropping those individuals who did not complete the baseline FPS. This loss in sample size was not the result of low response rates, as the final follow-up FPS successfully interviewed 75 percent of baseline respondents. Rather, it was the result of additional data collection efforts during the final round of the FPS, as discussed earlier in this chapter. To facilitate analysis of credit recipients, the survey firm attempted to conduct additional interviews with credit recipients in each community even if those households had not been respondents for the baseline survey. These additional interviews accounted for most of the sample loss when we restricted the sample to respondents to both surveys.

Table III.7. Baseline Farmer Characteristics by Credit Receipt at Follow-Up (percentages except where indicated)

	WtM Credit Recipients	Other Credit Recipients	Noncredit Recipients
Demographic Characteristics			
Respondent's Age (years)	51	46	50
Female Respondent	4	12	12
Respondent's Education			
Less than secondary	3	7	15
Full Secondary	26	47	43
Secondary (vocational)	29	31	28
More than secondary	41	15	14
Land Holdings and Agricultural Expenditures			
Total Land (hectares)	3.0	1.9	1.3
Irrigated Land (hectares)	2.4	1.6	1.1
Total Agricultural Expenditures (USD)	2,262	1,364	935
Agricultural Production and Sales			
HVA crops (metric tons)	18.6	11.4	6.3
Non-HVA crops (metric tons)	4.4	3.4	2.1
Revenue from HVA Crop Sales (USD)	5,142	2,639	1,549
Revenue from Non-HVA Crop Sales (USD)	540	179	70
Market Value of HVA Crop Harvests (USD)	5,680	2,918	1,737
Market Value of Non-HVA Crop Harvests (USD)	1,053	521	325
Annual Income and Profit (USD)			
Nonagricultural Income	1,856	1,290	1,275
Agricultural profit (value – costs)	4,814	2,176	1,094
Total Economic Income	7,249	3,526	2,417
Sample Size	**27**	**370**	**892**

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: These means are estimated using nonresponse weights. See Appendix A for description of estimation methods.

USD = United States dollars. HVA = High-Value Agriculture.

F. Potential Effects of WtM Credit

To estimate the effect of WtM credit on HVA practices and agricultural outcomes of farmers surveyed in the FPS, we compared the outcomes of WtM loan recipients to a group of 1,262 farmers who did not receive WtM loans (nonrecipients of WtM credit). That sample included 370 farmers who reported receiving a non-MCA loan and 892 farmers who reported not receiving any loan (see sample sizes in Table III.7).[52] This group provided our estimate of the counterfactual, that is, what farmers' outcomes would have been in the absence of WtM credit. To separate the effect of WtM credit from the effect of WtM training, we controlled for whether WtM training was offered in the respondents' community. As stated previously, these impact estimates were limited by the small analysis sample available and the possibility that other important predictors of agricultural outcomes, including farmers' motivation, cannot be completely accounted for in the regression specification (Appendix A).

As shown in Table III.8, WtM credit recipients were more likely than nonrecipients of WtM credit to report establishing or renewing a greenhouse (30 percent versus 15 percent; *p*-value: 0.01). This difference was also present when we restricted the comparison group to those farmers who reported receiving non-WtM credit (not shown). Given these findings, it is possible that WtM credit in particular—and not simply credit in general—played a role in facilitating farmers' greenhouse investments. Also, WtM credit recipients were more likely than comparison group farmers to make at least one organizational improvement (Table III.9). Notably, investments in greenhouses are capital-intensive and would thus imply a need for long-term credit. However, organizational practices such as preparing irrigated land and having a copy of a water supply contract would not likely require loans to implement. The higher adoption of these practices among WtM credit recipients may be an indication that these individuals were more predisposed to adopt these practices than nonrecipients of WtM credit regardless of access to capital.

[52] The comparison group was restricted to only those farmers residing in areas in which WtM credit was available. For this reason, the sample size of the comparison group (1,262 farmers) is smaller than sample sizes reported in impact estimates of WtM training.

Table III.8. Potential Effects of WtM Credit on Industrial- Economical HVA Practices (percentages)

	WtM Credit Recipients	Nonrecipients of WtM Credit	Difference	*p*-value
Produced HVA Crops for Budget Reasons	4	4	0	1.00
Changed Crop or Variety Based on Demand	8	9	-1	0.81
Established or Renewed an Orchard	11	11	0	0.97
Established or Renewed a Greenhouse	30	15	15**	0.01
Improved Soil Preparation Activities (plowing, cultivation, etc.)	36	32	4	0.53
Used High-Quality, Disease-Resistant Seeds or Planting Material	7	8	-1	0.83
Improved Post-Planting Practices (weeding, fertilization, pest control, etc.)	22	16	7	0.35
Shifted Time of Harvest by Using Plastic Tunnels or Planting Seedlings	4	4	0	1.00
Sample Size	**27**	**1,262**		

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Impact estimate on the practice of mixed cropping was statistically significant at the 5-percent level but had very low rates of adoption for both the treatment and control groups. Measured at follow-up, treatment and control group percentages were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

Table III.9. Potential Effects of WtM Credit on OFWM Practices (percentages)

	WtM Credit Recipients	Nonrecipients of WtM Credit	Difference	*p*-value
Simple Improvement	70	59	11	0.15
Modification of furrow sizes	70	58	12	0.10
Plastic cover for ditch	4	5	-2	0.60
Advanced Improvement	4	0	4	0.35
Drip irrigation	4	0	43	0.35
Sprinkler irrigation	0	0	0	--
Organizational Improvement	100	83	17***	0.00
Preparation of irrigated land	81	71	10	0.10
Have copy of water supply contract from WUA	68	60	8	0.28
Sample Size	**27**	**1,262**		

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group percentages were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

Table III.10 presents the potential effects of WtM credit on agricultural production, sales, and income. There was a large, statistically significant impact of credit on the amount of HVA crops produced. WtM credit recipients produced one and a half times as much tonnage of HVA crops as nonrecipients of WtM credit. Estimated revenues and harvest values were also substantially and statistically significant higher for WtM credit recipients than nonrecipients.

Table III.10. Potential Effects of WtM Credit on Production, Revenues, and Market Value of Harvests

	WtM Credit Recipients	Nonrecipients of WtM Credit	Difference	*p*-value
Agricultural Production (metric tons)				
HVA crops	15.5	9.5	6.0***	0.01
Non-HVA crops	2.1	2.4	-0.3	0.75
Revenues from Crops Sold (USD)				
HVA crops	5,038	3,264	1,774**	0.02
Non-HVA crops	95	179	-84	0.17
Market Value of Harvest (USD)				
HVA crops	5,539	3,521	2,017**	0.01
Non-HVA crops	324	438	-114	0.32
Sample Size	**27**	**1,262**		

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group means were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

USD = United States dollars. HVA = High-Value Agriculture.

Finally, we analyzed the effect of WtM credit on household income and consumption. WtM credit recipients had total economic incomes that averaged $2,300 higher than nonrecipients (Table III.11), and this difference was statistically significant.[53,54] As discussed previously, these estimates are vulnerable to upward bias. Due to this potential bias, WtM borrowers' higher agricultural production, sales, and income cannot be conclusively attributed to WtM credit.

[53] Restricting the comparison group to farmers who reported non-WtM credit also produced statistically insignificant impact estimates for economic income.

[54] Section II also presented findings from some sensitivity checks to determine whether the large standard deviation of the outcome masked notable true impacts of training, and whether outliers inflated the impact estimate. Due to the limited sample size of WtM credit recipients, such sensitivity analyses would not be informative in the present context.

Table III.11. Potential Effects of WtM Credit on Annual Economic Household Income and Consumption (USD except where indicated)

	WtM Credit Recipients	Nonrecipients of WtM Credit	Difference	*p*-value
Nonagricultural Income	3,178	2,709	469	0.15
Agricultural Income				
Total value of harvest	6,079	4,059	2,020**	0.03
Economic profit (value – costs)	4,110	2,164	1,946**	0.01
Total Economic Income	7,523	5,190	2,333***	0.00
Average Household Consumption Relative to Lower Poverty Line (percentage)	222	200	22	0.18
Sample Size	**27**	**1,262**		

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group means were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

USD = United States dollars.

To further explore whether the observed differences between WtM credit recipients and nonrecipients could be attributed to WtM, we visited two WtM credit recipients in small communities outside of Yerevan. The first recipient was a small-scale farmer who grew and sold potatoes and wheat. The borrower reported using his WtM loan to finance a 600 square meter glass greenhouse and a 35 square meter cooling facility for fruit production. The individual installed a drip irrigation system in the new greenhouse. The borrower reported that he secured the loan from Farm Credit Armenia and that the application process was quick and non-bureaucratic. He praised the loan's attractive conditions, particularly its low interest rate. However, he changed materials from plastic to glass, which required more time to build. As a result of this modification, he did not complete the greenhouse according to the original timeframe, and Farm Credit Armenia recalled a portion of his WtM loan. The recipient reported that he still completed the greenhouse, and reasoned that he likely could have built it without WtM credit. However, he reported that he would not have been able to finance his new cooling facility without WtM credit.

The second credit recipient household was a wife and husband who used WtM credit to build a 340 square meter greenhouse for cucumber production. They received the loan in early 2010 and constructed the greenhouse in three months. At the time of the visit, they were growing their fourth harvest and reported selling previous harvests to a local supermarket chain. They reported that the greenhouse was very profitable, estimating that they generated three times more income from greenhouse production compared to field production.

They reported installing a drip irrigation system in the greenhouse, based on knowledge gleaned in OFWM training. During the interview, they stated that they could not have financed the greenhouse without WtM credit, as non-WtM loans had interest rates of around 24 percent and maturity periods of only one to two years. The couple shared their plans to further improve the greenhouse with a new heating system, and to build additional greenhouses in future years.

In both cases, our perception was that the farmers were more entrepreneurial than typical Armenian farmers. We also cannot say for sure if they are representative of all WtM credit recipients. Based on the quantitative findings and these interviews, we believe the credit program possibly had a positive impact on participants' profits and income, but it is unlikely that the entire difference between MCA credit recipients and nonrecipients is attributable to MCA credit.

G. Additional Effects of WtM Credit

MCC and other stakeholders are interested in determining whether the WtM credit program generated additional lending in the agricultural sector from public or private sources. Although this question is impossible to answer with certainty, below we document some interesting recent developments in agricultural lending in Armenia and present a synthesis of qualitative information we gathered on the topic.

Interestingly, agricultural lending to small farmers increased substantially in Armenia during 2011 and early 2012, a few years after the WtM lending program began. Beginning in 2011, the government of Armenia offered subsidies of between 4 and 6 percentage points for agricultural loans of up to $8,000 USD.[55] In spring 2011, the government of Armenia also began providing two-year agricultural loans through established banks with a maximum amount of up to $8,000 USD and a 14 percent annual interest rate. The Armenian Ministry of Finance announced these subsidized lending programs less than a month after the Armenian president Serzh Sarkisian instructed the ministry to develop programs to make credit more affordable for poor farmers. Given that these initiatives developed independently from international donor activities, it is unlikely that new government-subsidized loan programs to small farmers were directly influenced by the WtM program.

However, some evidence suggests that WtM credit may stimulate additional agricultural lending among participating WtM lenders and influence other international donors' lending programs. During interviews in mid-2011, representatives from one participating bank mentioned that based on their experience with WtM credit, they would continue to make similar agricultural loans to borrowers, although these loans might have higher interest rates. One donor planned to initiate a credit program and was considering requirements similar to WtM credit with respect to in-person monitoring and participation in training as a prerequisite to access credit. In an interview with Mathematica staff, the donor's representative reported that in designing his organization's next credit line, he borrowed these aspects of WtM credit after observing their value in practice. Overall, interviewed donors expressed the view that these key innovations of WtM credit were best practices that should be replicated.

[55] Initiated in April 2011, this loan program is implemented by ACBA-Credit Agricole Bank, Ardshininvestbank, and Converse Bank. Less than $1 million USD in government funding was earmarked for the program in 2011, but this allocation will likely increase if the program generates a high level of demand.

In addition, there is limited evidence that the WtM program may have increased farmers' financial literacy and understanding of credit conditions. MCA's draft CCR report cited several examples in which WtM credit applicants and borrowers increased their basic understanding of credit and were better able to compare financial products among competing WtM lenders. However, this represented a departure from the 2010 QPA report, which stated that interviewed farmers reported applying for WtM credit at only one financial institution without checking credit conditions at other participating institutions.

Synthesizing these findings, we can reason that although the WtM program is unlikely to generate additional agricultural lending on a national scale, it likely shaped at least one other international donor's understanding of best lending practices, and appears to have left participating lending institutions with more experience and possibly greater motivation to expand agricultural lending. Also important, the program may have enhanced borrowers' understanding of loan conditions and agricultural investments, and has provided borrowers with a credit history that could be used to access additional investment capital in the future.

SUMMARY OF WATER-TO-MARKET CREDIT FINDINGS

Implementation Findings

The Water-to-Market credit component met lending targets because it targeted a demographic with a large demand for credit, it harnessed financial institutions incentives to make loans, and it relied on a pre-established operational structure in which Rural Finance Facility (RFF) verified loan applications and coordinated disbursements. MCA initially planned to disburse at least $8.5 million USD to WtM beneficiaries through intermediary credit organizations, and $13.3 million USD was ultimately disbursed from 2008 to 2011. However, the scale of WtM lending—around 1,000 loans by mid-2011—was small in proportion to the 47,800 farmers trained through WtM. According to nearly all interviewed stakeholders, a large portion of trainees' demand for credit went unmet. This unmet demand resulted in a high level of dissatisfaction among farmers who participated in training under the assumption that they would receive credit, but did not secure a loan.

Impact Findings

The evaluation approach had two important limitations. First, the sample size for WtM credit recipients was small. Second, the evaluation design had several potential sources of bias, including substantial baseline differences between treatment and comparison groups that could not be completely accounted for in the regression model. After controlling for baseline differences, WtM credit recipients reported economic incomes that were nearly $2,333 higher than nonrecipients, on average. This estimate was statistically significant but, in light of the analysis's potential bias, we cannot conclude with any certainty that WtM credit led to enhanced economic outcomes.

Sustainability

The continued operation of the WtM revolving fund appears feasible in the next few years, due primarily to strong demand from farmers, apparent motivation on the part of participating institutions to continue making WtM loans, and high repayment rates as of July 2011. One RFF representative estimated that in the next two years, another $8.5 million will be lent to rural farmers through the WtM credit program's revolving fund. There was also some evidence that the WtM lending program may stimulate additional lending to the rural agricultural sector. One donor, IFAD, is considering initiating a credit program that is similar to WtM credit line regarding in-person monitoring component and the requirement of participation in training to access credit.

Lessons Learned

An important lesson learned from WtM credit is that levels of WtM lending were disproportionately lower than levels of WtM training. This phenomenon produced dissatisfaction among farmers who participated in training with the expectation of automatically qualifying for credit, not recognizing that they must still be otherwise creditworthy, and also likely resulted in inefficiencies in which farmers were trained in technologies they could not afford to adopt. To avoid this situation in future programs in which some combination of credit and training is provided, stakeholders could tailor training and credit programs to the different needs of subgroups within the program's target population. For example, subsistence-level (and likely less creditworthy) farmers could receive training in low-cost technologies that do not require credit. In contrast, more advanced (and likely creditworthy) farmers could receive training in more advanced technologies as well as the opportunity to receive credit to finance investments in these technologies. Tailoring training and credit programs to these different subgroups could avoid unmet expectations of credit, and could also avoid inefficiencies related to training subsistence-level farmers in technologies they cannot afford to adopt.

IV. EVALUATION OF THE WTM INSTITUTIONAL STRENGTHENING SUBACTIVITY

A. Overview of the WtM Institutional Strengthening Subactivity

Created by the Armenian government in 2002, Water User Associations (WUAs) are organizations established by water users to carry out the operation and maintenance of the country's rural irrigation systems. WUAs are nonprofit legal entities that operate in the public interest, often with large government subsidies to cover operational costs. Water Supply Agencies (WSAs) handle the operation and maintenance of irrigation dams and pumping stations and supply water to WUAs. WUAs pay WSAs based on their projected water usage.

The primary objective of the Institutional Strengthening of Irrigation Management Entities Subactivity (ISSA) was to improve the managerial, technical, structural, and financial capacity of WUAs (and WSAs) operating in rural Armenia. According to the ISSA design, WUAs' enhanced capacity would allow them to manage irrigation systems more efficiently and autonomously, and eventually reach financial sustainability. In addition, strengthened WUAs could more effectively operate and maintain Armenia's rural irrigation infrastructure, thus ensuring reliable water supply and supporting long-term rural agricultural development. To meet these multiple objectives, the component's implementing organizations, Mott MacDonald, Euroconsult, and VISTAA, provided technical assistance to staff from 44 WUAs (as well as 3 WSAs) on irrigation water delivery services, water service fee collection practices, budgeting and accounting processes, irrigation infrastructure maintenance, and participatory management principles. ISSA's implementing organizations also provided material assistance to WUAs and WSAs in the form of office equipment, computer software, and heavy machinery. With a budget of approximately $4.9 million, this component was launched in September 2008 and completed in October 2011.

Of the 44 WUAs receiving assistance under ISSA, MCC and MCA-Armenia selected 8 WUAs for intensive assistance. The intention of this added assistance was to create a federation of these 8 WUAs. Consultations with the targeted WUAs started in late 2008 and were conducted twice a month in 2009, as compared to one consultation every three months for nontargeted WUAs.

In addition, some WUA and WSA staff had the opportunity to participate in study tours of irrigation systems in the United States and Europe. Conducted in 2010 and 2011, these tours provided WUA staff and government officials with an opportunity to observe effective and entrepreneurial water user associations, as well as highly functional rural irrigation systems. As part of ISSA, Mott MacDonald also developed a national policy paper for the Armenian irrigation sector. This paper became the basis for the irrigation reform strategy developed by AVAG Solutions, modified through a participatory process with stakeholders and approved by MCA-Armenia's governing council.[56] Table IV.1 provides a summary of these key characteristics of the ISSA component.

[56] In the design stage, the ISSA also featured a component that would focus on providing technical assistance to help establish WUA federations, as well as a training center for WUA staff. These components were not fully developed during implementation due to several issues, namely the lack of stakeholder support and capacity to support WUA federations, as well as a lack of financial resources to establish and maintain the training center.

Table IV.1. Summary of the WtM ISSA

Objective	Improve WUAs' managerial, technical, structural, and financial capacity.
Population	44 WUAs (8 targeted and 36 nontargeted WUAs) and 3 WSAs.
Funding	$4.9 million (USD).
Implementing Parties	Mott MacDonald, Euroconsult, and VISTAA.
Time Frame	September 2008 to October 2011.
Activities/Assistance	
Consultations and MIP development	Bi-weekly consultations in targeted WUAs and quarterly consultations in nontargeted WUAs to discuss WUA needs and develop management improvement plans (MIPs). Regular technical consultations were also provided to three WSAs.
Software donations	Donations of budgeting, accounting, and geographic information system (GIS) software to WUAs and WSAs.
Equipment/furniture donations	Computers, furniture, and loading and welding equipment for WUAs and WSAs.
Irrigation policy reform	An irrigation policy and strategy document, as well as draft irrigation legislation developed by ISSA consultants.
Study tours	2 international study tours for WUA directors, WSA staff, and government officials: one to the United States in August 2010 and one to Spain and Portugal in June 2011.

Sources: Administrative data and Mott MacDonald (2011).

USD = United States dollars.

B. Research Questions and Methods

A rigorous evaluation of ISSA was not planned prior to the component's implementation, particularly due to the infeasibility of identifying an adequate comparison group for WUAs participating in ISSA. However, MCC decided in early 2011 to evaluate the implementation and effects of ISSA to the extent possible with existing data sources. Based on our common research framework among WtM components and conversations with MCC staff, we developed the following research questions for ISSA:

1. *How was ISSA implemented?* Did ISSA meet its targets in terms of the number and types of WUAs assisted? (Section IV.C.) What types of WUAs did the program target for more intensive assistance, and how were they identified? How were the irrigation policy and consultation components implemented? (Section IV.E.)
2. *Did ISSA have the intended effects?* Did the program improve WUA management, irrigation service fee collection, dispute resolution, and cost recovery? (Section IV.F.) Have behaviors among farmers and WUA administrators changed in such a way as to promote the maintenance of rehabilitated infrastructure? (Section IV.G) What types of effects might the irrigation policy generate? (Section IV.H)

The rest of this chapter is devoted to answering these research questions. To answer several questions about ISSA implementation, we used the ISSA QPA Report, published by Socioscope in 2011. That report covered the following main ISSA programmatic components: management support, consultations, equipment and software support, and policy and legal reforms. To gather additional information on implementation and intended effects of ISSA, we conducted separate in-person interviews with MCA staff, VISTAA staff, and AVAG representatives who contributed to the irrigation policy reform strategy. During the interviews with MCA and VISTAA staff, we obtained information on whether ISSA implementation targets were met and whether the program improved service fee collection, dispute resolution, and cost recovery. In meetings with AVAG representatives, we gathered information about the irrigation policy reform component, including its main objectives and how its key elements were implemented.

To describe WUAs' characteristics and outcomes before ISSA implementation, we used the 2009 WUA administration survey. AVAG Solutions administered the WUA administration survey to administrative staff in all 44 WUAs served by ISSA. The survey covered the following domains for each WUA: characteristics, infrastructure and technical capacity, human resources, office space and equipment, water intake and delivery, finances, and institutional arrangements. Because ISSA began in late 2008, WUA administrative survey data collected in 2009 (covering WUA expenses and activities in 2008) can be considered baseline data. To describe WUAs' financial and irrigation outcomes over time, we also used WUA administrative data collected by AVAG Solutions for the 2007, 2008, 2009, and 2010 fiscal years. These data provide annual estimates of service fee collection rates, WUA income and expenditures, and other important performance metrics.

To analyze changes in water users' outcomes over the course of ISSA implementation, we used the 2009 and 2010 Water User Surveys. These surveys covered the following domains: WUA membership and contracts, dispute resolution among water users, irrigation service fee collection, and WUA representative elections. AVAG Solutions conducted the survey in 2009 and 2010 among households in the geographic service area of WUAs served by ISSA. The total number of surveyed households in 2009 and 2010 was 1,420 (480 for the 8 targeted WUAs and 940 for 36 nontargeted WUAs).

Table IV.2 summarizes the data sources and research designs we used to answer our primary research questions for ISSA. In particular, WUA administrative data and Water User Surveys allowed us to make a before-after comparison of WUA and water user outcomes. This before-after design was not rigorous, but it was the only viable option given the absence of a comparison group for the 44 WUAs assisted under the project.

Table IV.2. Data Sources and Research Design Used to Address Primary Research Questions for WtM ISSA

Research Question	Data Sources	Evaluation Design
How was the WtM ISSA implemented?	ISSA Qualitative Process Analysis Report; in-person interviews with MCA, VISTAA and AVAG personnel	Mixed methods, with a focus on qualitative data
Did the WtM ISSA have the intended effects?	ISSA Qualitative Process Report; WUA administrative data from 2007-2010; 2009 and 2010 Water User Survey	Mixed methods, with a focus on pre-post comparisons of WUA and water user outcomes

C. Activities and Outputs

In implementing ISSA, Mott MacDonald and VISTAA staff first completed a needs assessment with all 44 WUAs served by ISSA. The commonly cited needs were 1) better collection of irrigation and membership fees and 2) computer software. In response, VISTAA and WUA staff composed management improvement plans (MIPs) to serve as the basis for each WUA's strengthening efforts. The MIP outlined each WUA's strengths and weaknesses and listed concrete milestones that must be completed to achieve technical, managerial, and financial self-sustainability. The full list of milestones is provided in Appendix D. With consultants' help, MIPs were further distilled into detailed action plans (DAPs). These plans prioritized the twelve most important follow-up issues identified by MIPs. Beginning in late 2008, VISTAA technical consultations were structured around WUAs' efforts to meet MIP milestones.

In addition, ISSA implementers conducted needs assessments with the three WSAs served under the subactivity. In combination with WUA needs assessments, these WSA needs assessments led to the creation of three key reports regarding WSA needs and potential self-sustainability, as well as the viability of forming WUA federations.

A few months after implementation began, MCC, VISTAA, and MCA staff agreed that incentive-based rewards were necessary to motivate WUAs to complete key MIP milestones. For this reason, they implemented a rewards system by which WUAs received a standard equipment package and GIS software upon successful completion of the first five program milestones in the MIP, which included establishing an MIP working group and a detailed work plan, installing information boards, and holding representative meetings. WUAs received an extended package (donations of equipment, including heavy machinery) upon completion of milestones 6 through 9, which included making payments to WSAs, improving membership fee collection rates, forming a working dispute resolution committee,[57] and improving service fee collection.[58]

As shown in Table IV.3, ISSA met all major implementation targets. Consultants and WUA staff completed MIPs for all 44 WUAs, all 44 WUAs completed the first five milestones, and 40 WUAs completed milestones 6 through 9. In exchange for meeting key milestones, all WUAs received computers, GIS software, furniture, and welding equipment. In addition, most WUAs received backhoe loaders, and the 8 targeted WUAs received evapotranspiration gauges, used to measure crops' water absorption. In addition, the three participating WSAs received technical training related to updated financial and tax reporting legislation and procedures, computers and printers, GIS and other software donations, and heavy machinery (including an excavator for each WSA).

[57] Established by Armenian law in 2002, the primary role of dispute resolution committees (DRCs) is to settle disputes that emerge among WUA members regarding water use and irrigation water distribution. DRC decisions do not demand compliance, and WUA members can pursue grievances in court if they are not satisfied with DRC decisions or if those decisions have not been honored by all parties.

[58] Milestone 8, which largely dealt with establishment of a dispute resolution committee, was eventually excluded from requirements for the extended package due to a lack of a legal precedent for such committees during the initial implementation period. Widespread obstacles to initiating such committees' operations—namely a lack of transportation or vouchers for committee members—also influenced implementers' decision to not require this milestone for the extended donation package.

In another development related to ISSA outputs, national irrigation policy and strategy documents were developed by Mott MacDonald and AVAG Solutions. This policy is discussed in more depth later in this chapter.

Table IV.3. Summary of ISSA Outputs and Targets

Activity	Target	Final Output
Technical Consultations Provided	452	452: 34 each for 8 targeted WUAs and 5 each for 36 nontargeted WUAs
Needs Assessments Completed	47[a]	47[a]
Management Improvement Plans (MIPs) and Detailed Action Plans (DAPs) Completed	44	44
WUAs that Completed Milestones 1-5	44	44
WUAs that Completed Milestones 6-9	40	40: All 8 targeted WUAs and 32 of 36 nontargeted WUAs
Computers with Budgeting and Accounting Software Provided	NA	180: All 44 WUAs and 3 WSAs
GIS Systems Provided	47	47: 24 new systems and 20 upgraded systems among WUAs, and 3 upgraded systems for WSAs
Office Equipment (Furniture and Computers) Provided	44	44 WUAs
Welding Equipment Provided	44	44 WUAs
Back-Hoe Excavators Provided	NA	41: 38 WUAs and 3 WSAs
Evapotranspiration Gauges Provided	NA	8: All targeted WUAs

Sources: Mott MacDonald (2011), and MCA-Armenia Indicator Tracking Table (2011).

[a] 44 assessments for WUAs and 3 assessments for WSAs were scheduled and completed.

D. Description of WUAs

In Table IV.4, we used data from the WUA administration survey to describe WUAs' basic infrastructure, human resources, membership, and representation before ISSA activities began. In 2008, each WUA had an average of nearly 5,000 hectares under its jurisdiction. Extent of land area varied highly among WUAs' land area, however, ranging from 250 hectares in Kapan to over 19,500 hectares in Shirak. In general, WUAs irrigated about half of the area under their jurisdiction, mostly though gravity schemes. Across all WUAs, most irrigation water was used for the cultivation of cereals and grains, followed by grapes and orchards, alfalfa and fodder crops, and vegetables (not shown).

Each WUA had around 120 staff members, on average, who were mostly dedicated to operational and management functions. As with land area, administrative staff size varied widely, ranging from 10 employees in Kapan to 481 employees in Vedi. In addition, WUAs had an average of 6,400 member water users in 2008 and nearly 70 representatives.

Table IV.4. Characteristics of WUAs, in 2008

Characteristic	Average	Minimum	Maximum
Infrastructure			
Land Area Under Jurisdiction (hectares)	4,904	250	19,610
Actual Irrigated Area (hectares)	2,449	111	6,217
Area irrigated by gravity (hectares)	1,598	0	5,428
Area irrigated by pumping (hectares)	851	0	5,000
Length of Secondary Canal Network (km)	48	0	199
Length of Tertiary Canal Network (km)	316	0	1,073
Human Resources			
Total Staff Positions	119	10	481
Administrative staff positions	4	1	9
Legal staff positions	1	0	1
Support staff positions	5	1	17
Operations and management staff positions	109	5	472
Membership and Representation			
Total Members	6,367	883	16,200
Total Representatives	69	26	120
Members on the WUA Administrative Council	10	5	20
Members of DRC	4	0	7

Source: 2009 WUA Administration Survey.

E. Implementation Findings

The primary finding of the 2011 ISSA QPA report was that core ISSA objectives were correlated with WUAs' needs, and ISSA implementation—including consultations and donations—was generally well managed by Mott MacDonald and VISTAA. The report highlighted the implementers' use of an adaptive management style, which involved making assessments, having team discussions, and making midcourse corrections to improve implementation once deficiencies were identified. During interviews conducted by Mathematica in mid-2011, MCA and MCC staff noted that consultations and the irrigation policy component were generally well implemented, to the extent that Mott MacDonald and VISTAA submitted expected deliverables, conducted all scheduled consultations, and distributed donations equitably.

According to the Socioscope (2011) report and Mathematica's interviews with MCA and VISTAA staff, several aspects of ISSA implementation worked particularly well. First, the design of the intervention was needs-based and participatory. During initial meetings, WUA staff expressed their needs and difficulties to VISTAA staff, and this input formed the basis for the irrigation policy document. Similarly, MIPs were developed through extensive discussions with WUA staff members and further refined with input from WUA management. In addition, ISSA consultants succeeded in winning the confidence of WUA staff after early difficulties, when delays in the implementation of ISSA and the suspension of the Rural Roads Rehabilitation Project (RRRP) resulted in initial mistrust of MCA among WUA personnel.

Another aspect that facilitated ISSA implementation was the decision on the part of MCC, MCA, and ISSA implementers to make computer and equipment donations conditional on the completion of key milestones. QPA interviews with WUA representatives indicated that this mechanism was an effective motivational tool for WUA staff members, who made efforts to complete work plans, install information boards, and hold additional representative meetings in anticipation of receiving new office equipment and software donations. This key modification to ISSA during implementation also illustrates flexibility of the implementers, MCC, and MCA, which permitted making midcourse corrections to improve program implementation and results.

Following the first few months of consultations, MCC staff noted a lack of clarity in consultations about WUAs' goals and plans to achieve them. Mott MacDonald and VISTAA staff promptly took measures to reorient the consultations toward tangible improvements in participatory management and fee collection rates. An independent consultant hired by MCC concluded after a two-week trip in 2010 that the WUA consultations had indeed been effective in providing WUA leadership with technical and moral support, and helping WUA staff better understand their roles and long-term goals (Merkley 2010). Similarly, Mott MacDonald's final report on ISSA (Mott MacDonald 2011) concluded that consultations were an effective approach to providing technical and material support to WUAs. The report cited several key positive outcomes of WUA consultations, including completed MIPs for all WUAs, increased membership payments, and a greater number of water user representative meetings organized by assisted WUAs.

Some MCC and MCA staff believed that more could have been done as part of ISSA implementation. One MCC representative stated that the consultations were not very substantive and could have been more tailored to each WUA's particular needs. Focus groups held by Mott MacDonald also commonly expressed that MIPs and DAPs were too limited to predefined issues and consultant teams were not flexible enough to address evolving WUA needs outside the scope of these plans. MCA staff expressed similar views on ISSA implementation, citing consultation team members' limited experience and limited guidance from international experts. In addition, the frequency and intensity of consultations—four four-hour visits per year to non-targeted WUAs—likely limited consultations' effectiveness, according to MCA staff.

Despite these differences in perceptions, these stakeholders shared the view that ISSA could at best enable WUAs to take ownership of their associations by removing existing obstacles—but WUAs would have to take the initiative to successfully do this. According to Socioscope (2011) and interviews with consultants, a key barrier to successful implementation and improved ISSA outcomes was a lack of willingness on the part of most WUA staff to take ownership of ISSA activities and goals. In general, WUAs' management decisions were not based on consultations for MIPs. Even midway through implementation, some WUA staff lacked a basic understanding of ISSA program logic, in which consultations and donations would result in improved WUA decision-making and participatory management practices. This lack of ownership on the part of WUA staff poses a serious challenge to the sustainability of strengthening efforts after the end of the Compact period. It is not clear whether the WUAs will use MIPs once the program is over, particularly in the absence of tangible rewards for completing milestones. Legislative reforms that are discussed later in this chapter were designed in part to empower and stimulate WUAs to assume greater responsibility for their management of irrigation systems and finances, though it is too soon to say how effective these will be.

Considering this difficulty with WUA commitment, a lesson learned from ISSA implementation was that future interventions with WUAs—including consultations and training sessions—should be designed to provide WUA staff with strong incentives to assume ownership of strengthening efforts

at the initial stages of implementation. ISSA was moderately successful in providing these incentives through study trips and its policy of making donations contingent on milestone completion. However, WUA ownership could have been further enhanced if consultations had been better tailored to WUAs' day-to-day needs or if rewards had been directly tied to improved service fee and cost recovery rates. Regarding tailoring consultations to WUAs' day-to-day needs, a stronger emphasis on building tangible skills that could be used in core WUA operations—such as how to use budgeting software to track monthly expenses and inflows—may have encouraged more buy-in and ownership from WUA staff. Regarding linking rewards to positive outcomes, offering monetary bonuses in return for increased cost recovery rates could have further enhanced WUAs' ownership of strengthening efforts as well as their financial performance.

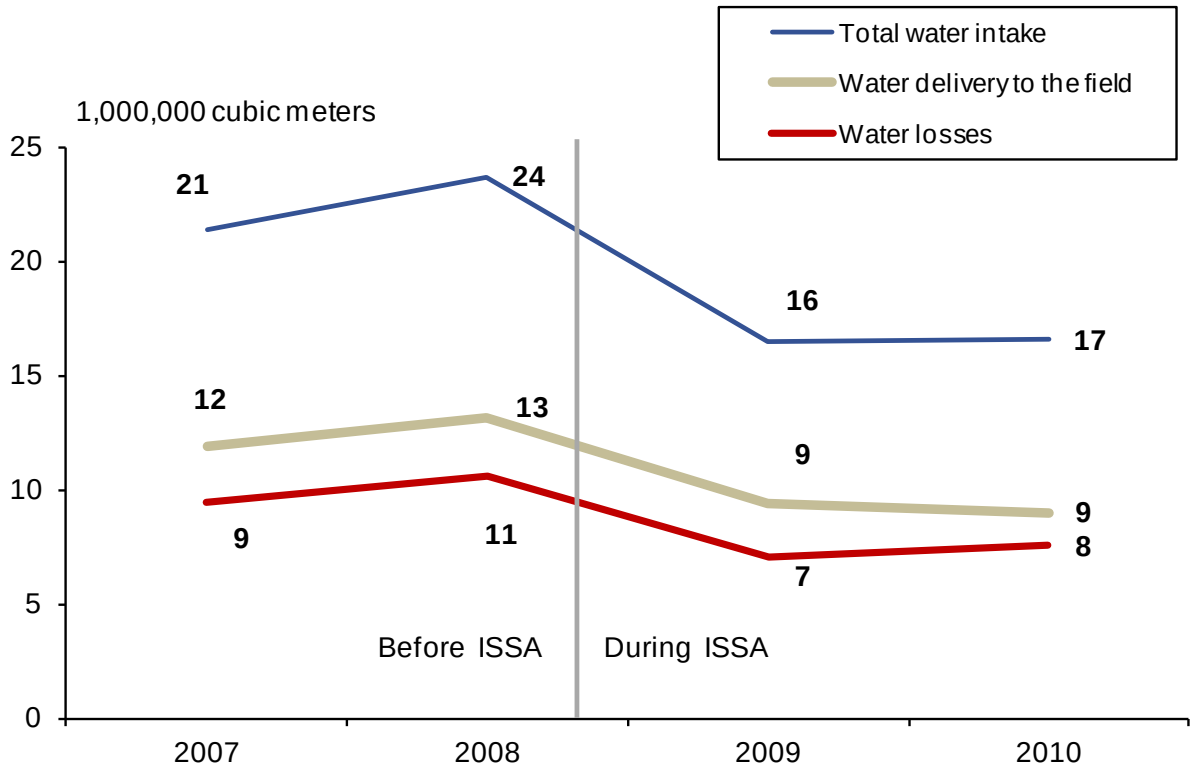
Despite overall satisfaction with ISSA assistance among implementers, donors, and outside consultants, beneficiary perceptions were mixed regarding the usefulness of such assistance. Out of several WUAs interviewed by Socioscope for the ISSA QPA report, only a very few had a high assessment of MIPs' practical value. Most interviewed WUAs personnel saw MIPs merely as documentation of their current operations, rather than a program document that could assist their management decisions. The 8 targeted WUAs, which received intensive assistance, spoke more highly of the usefulness of consultations than the 36 nontargeted WUAs. While WUAs identified some aspects of the consultations as important, particularly sessions related to new technologies and to accounting issues, WUA staff generally did not consider the consultations particularly helpful or relevant to their daily operations. MCC and MCA-Armenia staff also expressed the concern that the ISSA team of consultants needed training in consultation techniques as well as new technological and managerial approaches to water management. In contrast, equipment support—including furniture, computers, and GIS software—was considered very useful by WUA staff.

F. Changes in WUAs' Outcomes

We used WUAs' administrative data to assess changes in WUAs' water delivery and financial outcomes over the course of ISSA implementation; our analysis of that data also addresses whether these changes were related to ISSA. Because we did not have data what would have happened over time in the absence of ISSA, we could not be sure that these changes were causal impacts of the program. In particular, climatic, economic, and political developments between 2007 and 2011 likely affected most key WUA outcomes we examined below, complicating our ability to determine ISSA's contribution to these outcomes. For this reason, any observed changes in WUAs' practices and performance should be interpreted as merely suggestive that the program had true impacts. Given this concern, we do not report significance levels for these differences, as citing the statistical significance of differences between 2007 and 2010 would imply a true causal effect of the program.

As shown in Figure IV.1, water intake and delivery decreased from 2007 to 2010. In particular, the average amount of water delivered by WUAs in 2009 and 2010 was dramatically lower than in earlier years. This reduction is likely linked to heavy rains and poor agricultural conditions in 2009 and 2010, as well as unfavorable global economic conditions in these years, particularly 2009, which had a detrimental effect on agricultural production. According to the Food and Agriculture Organization (FAO), Armenian agricultural production in 2010 was particularly low to due unfavorable climatic conditions (an early spring frost, hail, heavy rains, and high levels of humidity) and insufficient supply of high-quality seeds. The decline in production was also due to limited access to credit, reduced government subsidies for agriculture, and shortages of fuel and fertilizers. According to the FAO, agricultural production was substantively lower in 2010 than in 2009. In 2010 compared to 2009, fruit and berry production declined 61 percent, vegetable production declined 14 percent, and potato production declined 19 percent (FAO 2011).

Figure IV.1. Average WUA Water Intake, Delivery, and Losses, 2007- 2010



Sources: 2007, 2008, 2009 and 2010 WUA administrative data.

In addition, from 2007 to 2010, WUAs experienced an average decrease in total cash expenditures of around $72,000, largely driven by a sharp decrease in water delivery and WUAs' water payment expenditures in 2009 and 2010 (Table IV.5). Mostly due to a modest increase in irrigation water payments from water users, average total cash revenues increased slightly by $16,000 from 2007 to 2010. This led to an average increase in net annual revenues (cash revenues minus expenditures) of over $87,000 among the 44 WUAs assisted in ISSA. However, even during their most successful year (2010), WUAs reported large spending deficits of over $309,000, on average. Compared to WUAs' sizable average yearly deficits from 2007 to 2010, the associations' average increase in net income of around $87,000 during this time period is a substantial improvement. However, this improvement does not appear sufficient to put WUAs on a path to financial self-sufficiency.

Table IV.5. Average WUA Water Delivery, Expenditures, and Revenues (thousands of USD except where indicated), 2007- 2010

	2007	2008	2009	2010	2007-2010 Change
Water Delivery					
Actual Irrigated Land Area (hectares)	2,882	2,929	2,911	2,927	44
Number of Water Users with Signed Contracts	4,542	4,657	4,464	4,218	-324
Total Water Intake (1million m^3)	21	24	16	17	-5
Water Delivered (1million m^3)	12	13	9	9	-3
Water Losses (1million m^3)	9	11	7	8	-2
Expenditures					
Total Cash Expenditures	597	613	575	525	-72
Wages and salaries	93	97	103	101	8
Water payments	166	162	113	72	-94
Repair and maintenance[a]	73	90	87	83	10
Energy costs	135	134	140	135	0
Other expenditures[b]	130	130	131	134	4
Revenues					
Total Cash Revenues	201	227	214	216	16
Membership fees	2	3	5	6	3
Irrigation water payments	198	224	209	211	12
Net Revenues (revenues - expenditures)	-396	-386	-360	-309	87
Sample Size	**44**	**44**	**44**	**44**	**44**

Sources: 2007-, 2008, 2009 and 2010 WUA administrative data.

Note: 2007, 2008, and 2009 values are adjusted to account for inflation.

USD = United States dollars.

[a] Includes routine maintenance and repair prior to the agricultural season as well as repair during the season.

[b] Includes social security expenditures, transportation, banking, communication, trips, reserve fund, taxes, and other expenses.

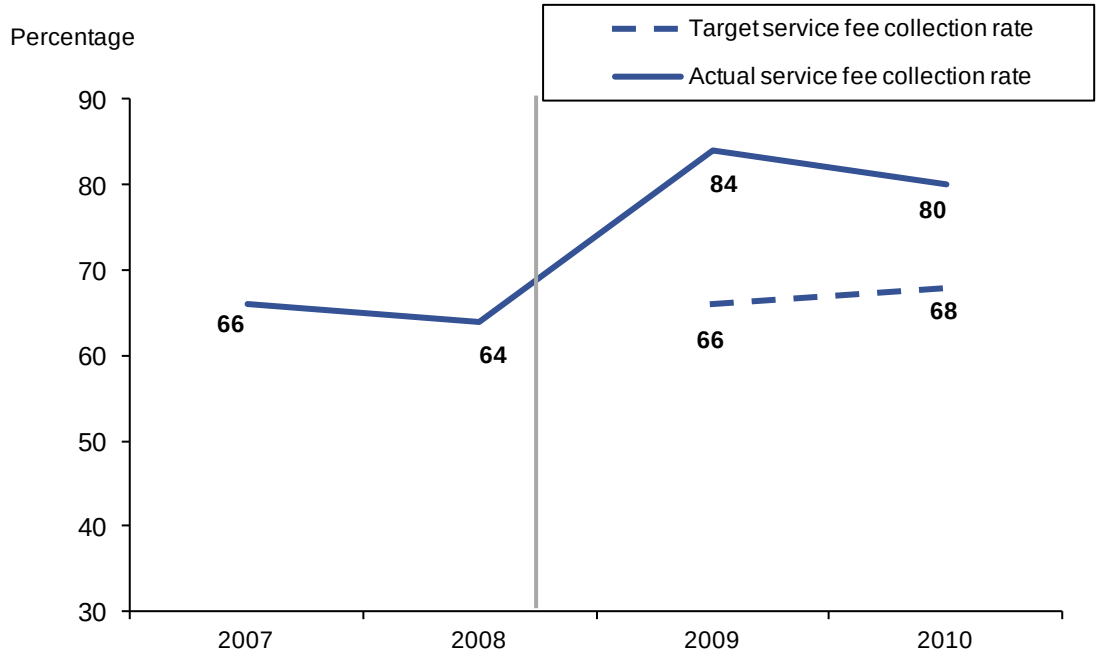
Irrigation service fee is a key outcome indicator under ISSA. Interestingly, the irrigation service fee collection rate—or the proportion of committed irrigation charges that were collected from water users—improved by 13 percentage points from 2007 to 2010, from 66 percent to 80 percent (Figure IV.2).[59] This rate was higher than the target collection rate of 68 percent set by MCA-Armenia for the period between October 2009 and September 2010.[60] According to the CCR, these

[59] This number is not the simple difference between 80 percent and 66 percent due to rounding. This finding is at odds with MCA-Armenia's Indicator Tracking Table (ITT), which reported an average irrigation fee collection rate of 69 percent in 2010. This appears to be the collection rate for the eight targeted WUAs, after excluding repayments from previously accumulated arrears. ITT target collection rates of 51, 53, and 55 percent in 2009, 2010, and 2011 also likely pertain to only targeted WUAs.

[60] This target of 68 percent was the weighted average of targets of 53 percent and 71 percent for targeted and non-targeted WUAs, respectively, found in a 2011 version of an ISSA-specific ITT.

increases in service fee collection in 2009 and 2010 reflect water users' increased propensity to pay past arrears, increased land areas under cultivation in these years, and increased general awareness that service fee payment was mandatory. According to VISTAA and other stakeholders, however, these increased collection rates were also linked to the Armenian government's decision to provide free irrigation water in April and May of 2009 and 2010 in an effort to alleviate agricultural hardship during those years. Because water users' service fee obligations were substantially lower during these years, the overall service fee collection rate increased despite an actual decrease in total revenues from water payments during this time period.

Figure IV.2. Service Fee Collection, 2007- 2010



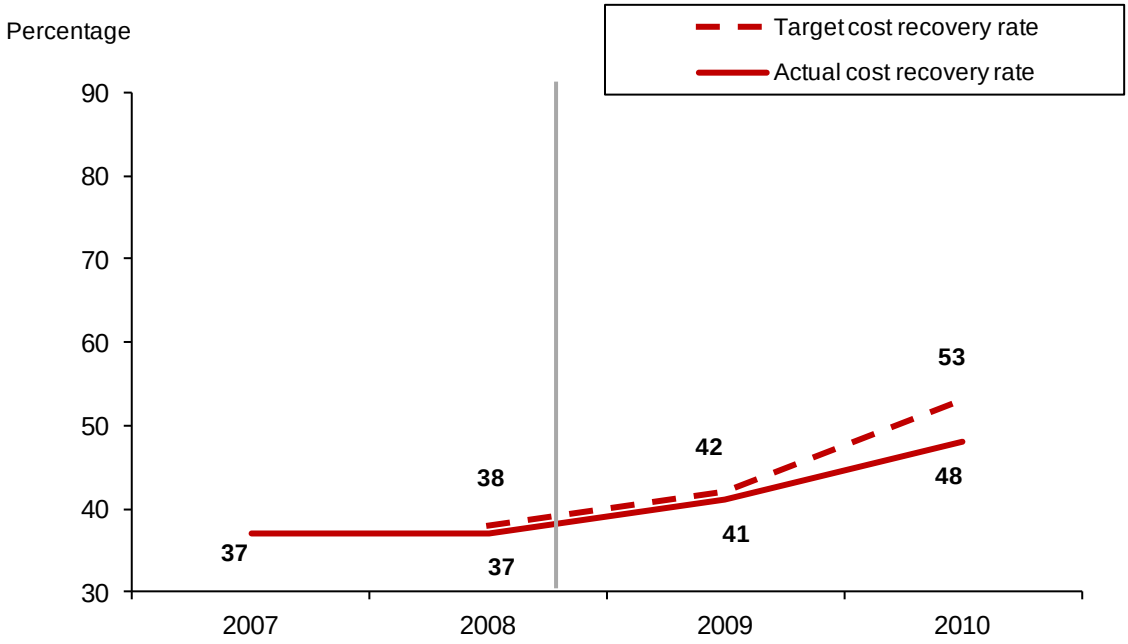
Sources: 2007, 2008, 2009 and 2010 WUA administrative data.

Note: Service fee collection rates include repayments from previously accumulated arrears. Excluding repayments from past arrears, service fee collection rates were 61, 78, and 74 percent in 2008, 2009, and 2010, respectively.

Another key metric by which we can assess WUAs' performance is the cost recovery rate, or the proportion of operations and maintenance costs recovered by revenues from water charges. The 44 WUAs in ISSA improved on this measure from 37 percent in 2007 to 48 percent in 2010 (Figure IV.3).[61] Although this improvement was substantial, the 2010 cost recovery rate was 7 percentage points below the target cost recovery rate of 53 percent for the time period between October 2009 and September 2010. Given the trend in cost recovery rates, it is unclear whether WUAs will meet MCA-Armenia's target of a 60 percent cost recovery rate for 2011.

[61] Operations and maintenance cost recovery figures are nearly identical to figures reported by MCA-Armenia monitoring and evaluation staff in the ITT.

Figure IV.3. Cost Recovery Rates for WUAs, 2007- 2010



Sources: 2007, 2008, 2009 and- 2010 WUA administrative data.

Note: Cost recovery rates are defined as proportion of operations and maintenance costs recovered with revenues from water charges.

In the context of WUAs' recent establishment in 2002 and their heavy reliance on state subsidies to maintain operations, these improved fee collection and cost recovery rates show positive trends toward improved financial self-sustainability. These moderate changes from 2008 to 2010 cannot be attributed solely to ISSA, as climatic conditions, changes in cropping patterns, or national irrigation policy reforms (outside of the scope of ISSA) could have had an effect on irrigation outcomes and WUA expenditures and revenues. In particular, the Ministry of Territorial Administration, independent of ISSA, prioritized higher service fee collection rates in recent years, and provided subsidies to WUAs that achieved service fee collection rates of at least 83 percent. The Ministry's target of a 100-percent collection rate by 2010 (for all WUAs) was much higher than ISSA goals of a 53-percent collection rate for targeted WUAs and a 71-percent collection rate for non-targeted WUAs by 2010.

One interviewed stakeholder also mentioned the importance of government grants (made outside the scope of ISSA) in improving WUAs' cost recovery and collection rates. In exchange for grants that covered their annual debts, WUAs committed to selling water at a set price, irrigating a minimum amount of land, and improving their service fee collection rates. The stakeholder estimated that government subsidies and directives to improve service fee collection outside of ISSA played a slightly larger role in improving service fee collection and cost recovery rates than ISSA consultations and incentives.

Other stakeholders stated that a World Bank intervention in the irrigation sector also played a role in improving the overall WUA cost recovery rate in Armenia in the past two years. Under the Infrastructure Rehabilitation Emergency Project, the World Bank financed technical assistance for WUAs as well as irrigation infrastructure improvements, with the goal of improving water use

efficiency in rural irrigation systems. Beginning in late 2009, this program has financed irrigation canal rehabilitation works, an irrigation subsidy policy study, and business plans for all 44 WUAs.

Given this confluence of factors, it is difficult to assess the specific contribution of ISSA to collection and cost recovery rate improvements versus the contribution of grants, political initiatives outside ISSA, and the World Bank irrigation intervention. However, it is plausible that ISSA played some role in the modest improvement in collection rates, expenditures, and revenues, as ISSA consultations and donations focused primarily on building WUAs' capacity to improve these rates. In addition, the prospect of new equipment and heavy machinery likely had some influence on WUAs' improved service fee collection rates, as improved service fee collection was the final milestone required to receive the second donation of heavy machinery and equipment.

Given the modest magnitude of these improvements, however, ISSA assistance—even in combination with other efforts—is very unlikely to have set WUAs on a path toward financial solvency. In 2010, the consultant hired by MCC came to similar conclusions regarding WUA outcomes. That consultant emphasized that WUAs would not likely achieve financial solvency in the absence of key policy changes regarding taxation, subsidies, and tariffs. Perhaps more importantly, the consultant noted that WUAs would never fully cover their operating costs until water users could fully pay for their water use through profitable agricultural production. Because increasing agricultural profitability is a long-term task, the consultant reasoned that stakeholders could not expect large improvements in WUA cost recovery at the end of ISSA implementation (Merkley 2010).

In addition to improvements in cost recovery rates, MCA and VISTAA staff reported that as a result of ISSA consultations and milestone requirements, WUA membership payments increased from 2008 to 2011. This is corroborated by monitoring figures maintained by MCA-Armenia, which found that the percentage of members paying membership fees in 2010 was 81 percent in targeted WUAs and 79 percent in nontargeted WUAs, up from below 55 percent for all WUAs in previous years. These rates far exceeded MCA-Armenia's 2010 targets of 65 percent for targeted WUAs and 40 percent for nontargeted WUAs. In addition, MCA and VISTAA reported that the WUA administrative council met more frequently after ISSA implementation began and that WUAs now held a second representative meeting every year at the end of the irrigation season. According to interviewed stakeholders, the increased involvement of the administrative council as well as this additional representative meeting have played a role in increasing WUAs' transparency and accountability to its members.

G. Changes in Farmers' Outcomes

To analyze the irrigation practices and WUA participation of water users who live in regions served by the 44 WUAs assisted under ISSA, we used data from the 2009 and 2010 Water User Surveys.[62] Because the first Water User Survey was conducted in November and December of 2009—around one full year after ISSA activities commenced—it should not be considered a true baseline survey. However, because technical and material assistance to nontargeted WUAs did not

[62] The Water User Survey did not interview the same households in each round of data collection. Rather, a unique sample of households was surveyed in each round of data collection. This contrasts with the Farming Practices Survey, which largely surveyed the same core sample of households at three points in time.

commence until early- to mid-2009, we assumed that WUA improvements related to ISSA did not affect water users until mid- to late-2009 at the earliest, and more likely would have had its first substantial effects during the following agricultural season in 2010. As such, the change in irrigation outcomes between 2009 and 2010 would include the first substantial influence of ISSA activities on these outcomes. For reasons mentioned previously, we do not report statistical significance levels for differences from 2009 to 2010.

As shown in Table IV.6, irrigation practices in areas served by ISSA did not change substantially from 2009 to 2010. For example, in 2010 only 7 percent of water users reported that the amount of land they irrigated had increased or decreased in the past year. In addition, respondents reported that irrigation supply had not changed substantively from 2009 to 2010, and 60 percent of respondents reported fully paying for irrigation water in both 2009 and 2010. Although the proportion of respondents who reported making water payments did not change substantially from 2009 to 2010, the average amount of annual payments increased from $76 to $98. However, the average value of accumulated arrears on irrigation payments also increased during this timeframe, from $105 in 2009 to $218 in 2010.

Table IV.6. WUA- Related Outcomes of Farmers in the ISSA Assistance Area, 2009- 2010 (percentages except where indicated)

	2009	2010	2009-2010 Change
Irrigation			
Irrigated Land			
Total land	66	57	-9
Arable land	44	48	5
Orchards	84	87	3
Vineyards	84	89	5
Kitchen plot	91	91	0
Other	20	13	-7
Since Last Year, Amount of Irrigated Land:			
Increased	3	2	-1
Remained unchanged	93	93	0
Decreased	4	5	1
Since Last Year, Irrigation Supply:			
Improved in terms of timeliness	17	15	-2
Improved in terms of quantity	20	16	-4
Remained unchanged	69	73	5
Worsened in terms of timeliness	9	8	-1
Worsened in terms of quantity	8	7	-1
Water Payments			
Fully Paid for Irrigation Water	60	60	0
Partially Paid for Irrigation Water	24	23	-1
Did Not Pay for Irrigation Water	16	17	1
Total Amount Paid, conditional on making water payments (USD)	76	98	22
Respondent Has Payment Arrears	8	6	-2
Total Arrears Accumulated from Irrigation Water Charges, conditional on reporting arrears (USD)	105	218	113
Sample Size	**1,420**	**1,420**	

Sources: 2009 and 2010 Water User Surveys.

USD = United States dollars.

In addition, some changes were noted in WUA membership and membership fee payment (Table IV.7). From 2009 to 2010, WUA membership increased from 38 to 48 percent, and membership fee payment among WUA members increased from 75 to 92 percent.[63] This membership payment rate of 92 percent in 2010 was higher than 2010 payment rates reported by MCA-Armenia of between 79 and 81 percent.[64] Interestingly, the average membership fee payment (among those reporting making a payment) increased from around $5 to $8. The number of respondents who reported village WUA representatives also increased in 2010, from 27 percent to 52 percent.

Regarding water users' disputes with WUAs related to water supply or payments, a slight drop was recorded between 2008 and 2009 regarding the proportion of water users who reported disputes with their WUA, from 11 percent in 2009 to 8 percent in 2010 (Table IV.7). However, there was also a drop in the percentage of respondents who reported that their disputes were resolved (36 percent in 2009 versus 11 percent in 2010) and in the portion of respondents who noted that the dispute was resolved by the WUA DRC (4 percent in 2009 versus none in 2010).

[63] The MCA CCR report had similar findings. According to qualitative interviews with water users in the last year of the compact period, these water users reported a stronger awareness of the necessity and importance of membership payments than expressed by water users in interim data collection efforts related to the QPA report.

[64] The payment rate may be higher than MCA-Armenia figures due to response bias associated with in-person interviews. Interviewed water users could have responded that they paid membership fees to avoid embarrassment at the time of the interview. In addition, MCA-Armenia membership fee collection figures represented an average of all 44 WUAs' collection rates, whereas this estimate was the number of WUA members reporting paying membership fees divided by the number of WUA members. Whereas MCA-Armenia figures give equal weight to all 44 WUAs, this figure gave more weight to WUAs that were highly represented by the Water User Survey sample.

Table IV.7. Irrigation and WUA- Related Outcomes of Farmers in the ISSA Assistance Area, 2009- 2010 (percentages except where indicated)

	2009	2010	2009-2010 Change
Membership, Contracts, and Representation			
WUA Membership	38	48	10
Currently paying a WUA membership fee, conditional on being a WUA member	75	92	16
Average WUA membership fee, conditional on paying a WUA membership fee (USD)	5	8	3
Signed a Contract with the WUA Last Year	74	69	-5
Has a Village WUA Representative	27	52	24
Participation and Disputes			
Household Member Participates in WUA Management	2	3	1
Participated in a WUA Meeting Last Year	14	19	5
Participated in Last WUA Election	10	12	2
Had a Dispute with the WUA	11	8	-4
Resolved dispute, conditional on having a dispute with the WUA	36	11	-25
DRC resolved dispute, conditional on having a dispute with the WUA	4	0	-4
Sample Size	**1,420**	**1,420**	

Source: 2009 and 2010 Water User Surveys.

USD = United States dollars.

In conclusion, it appeared that several positive changes occurred from 2009 to 2010 regarding the amount that water users paid for irrigation water, WUA membership and membership fee payment rates, and the proportion of water users who reported WUA representatives. These changes could not be attributed solely to ISSA, as climatic conditions, changes in cropping patterns, and irrigation policy reforms (outside of the scope of ISSA) could have had some effect on irrigation and WUA outcomes. However, it is plausible that ISSA had some role in improving WUA membership fee payment rates and increasing awareness of WUA operations, as these were the primary activities and outcomes outlined in ISSA milestones, and WUAs were rewarded with a wide array of donations upon completion of these milestones.

H. National Irrigation Policy Component

1. Design and Implementation

In this section, we summarize the implementation and results of ISSA's national irrigation policy component. Implemented by consultants Mott MacDonald and AVAG Solutions from 2009 to 2011, the objective of this component was to ensure that the irrigation sector fully supported the productive and sustainable development of agriculture and the economy of Armenia with specific attention to provision of income opportunities for poverty reduction within environmental constraints. More specifically, the goal of ISSA's irrigation policy component was to prepare and adopt a national irrigation policy for the Armenian irrigation sector, and secure legislative reforms outlined by the policy.

In July 2009, Mott MacDonald's core group of one international and two national experts completed a draft irrigation policy document. Reflecting key findings from WUAs' needs assessments, MIPs, and DAPs, this document defined the general goals and scope of the proposed irrigation policy reform. Commenting on this draft were several stakeholders, including an advisor to Armenia's prime minister, the Ministry of Finance, the Ministry of Agriculture, MCA-Armenia, and MCC. In October 2009, stakeholders held a roundtable meeting to discuss the most important issues in the document. After this meeting, consultants met further with stakeholders to finalize the document. Following this process, the policy document was presented and approved by the Armenian government on December 18, 2009.

When finalized, the national irrigation policy document defined the goals, scope, and legal foundations of the irrigation policy and stated the Armenian government's role in implementing the policy. It also detailed key steps in the national irrigation system's development, rehabilitation, and maintenance and defined the roles of institutions involved in the irrigation sector, the WUAs and WSAs. The document also described key irrigation management principles; set forth financing and budgeting principles, including increased transparency and accountability; and suggested changes in irrigation subsidies.

According to the ISSA QPA report and interviews conducted by Mathematica staff, stakeholders reported that the policy document was developed with a high level of input from WUA staff and water users, as well as the State Water Committee, the Ministry of Finance, the World Bank and representatives of academic institutions. Because the document was grounded in primary findings from initial needs assessments conducted under ISSA, many WUA staff believed that it adequately reflected their needs and prescribed viable solutions to several structural problems facing rural irrigation systems. In addition, stakeholders stated that MCA-Armenia took a strong leadership role in guiding the policy document through various revisions with a wide array of stakeholders.

In May 2010, MCA-Armenia signed a contract with AVAG Solutions to develop a strategic plan to secure legislative decrees and regulations related to five high-priority items detailed in the irrigation policy document:

1. WUAs' budgeting systems
2. WUAs' dual-tariff irrigation service fee
3. Establishment of WUA federations and their relationship to WSAs
4. State financial support to the irrigation sector, WUA subsidies, and irrigation service fees
5. WUA tax policy accounting system and practices

Interviewed stakeholders, including MCA and MCC representatives, lauded the performance of Mott MacDonald and AVAG consultants in developing the policy and strategy documents, respectively. However, one MCC respondent reported that contracting two separate consultants to handle the policy and strategy documents resulted in some discontinuity between the two documents, in that proposed changes in AVAG's final strategy document no longer reflected initial needs assessments conducted by Mott MacDonald.

2. Results

Based on guidance prescribed in AVAG's strategy document as well as a high degree of support from the Armenian national assembly, stakeholders including AVAG staff, MCA-Armenia, and the Ministry of Agriculture secured the passage of several key decrees and regulations throughout 2010 and 2011 related to rural irrigation reform. Table IV.8 provides a list of these decrees and regulations, as well as amendments to Republic of Armenia (RA) laws on value-added tax and profit tax approved by the national assembly.

Table IV.8. Irrigation Decrees and Regulations Approved by the Armenian National Assembly, 2010- 2011

Legislation Affecting All Five Strategy Priorities
Decree "Medium-term Strategy on State Aid to Water User Associations and on Ensuring Implementation of Certain Actions under the Strategy" (approved in the September 30, 2010. RA session)
Legislation Affecting the Strategy's First Priority, WUA Budgeting
Regulation on decree "Republic of Armenia on Appending RA Government Decree No 2052-N dated December 19, 2002 and Approving the Regulatory Process of Considering the WUA Receivables for the Provided Irrigation Water as 'Bad Debts' and Writing them off" (approved in the February 24, 2011 session)
Legislation Affecting the Strategy's Fourth Priority, State Support and Subsidies
Regulation on decree "State Financial Support by Current Grants According to Water User Associations as of the Years 2012–2016" (approved in the March 10, 2011 session)
Legislation Affecting the Strategy's Fifth Priority, Tax Policy
Amendments to law "Value-Added Tax" (passed by National Assembly and enforced into law on December 7, 2010)
Amendments to law "Profit Tax" (passed by National Assembly and enforced into law on December 7, 2010)

Source: MCA-Armenia Closure Report on Legislative Changes in the Irrigation Sector (2011).

Overall, stakeholders viewed the completion and adoption of the policy by the Armenian government, as well as legislative modifications achieved under the component, as a fulfillment of the component's primary objectives. According to AVAG representatives, the most important policy reforms resulting from ISSA were related to taxes and subsidies. As a result of the amendment to the value-added tax and profit tax laws, WUAs now face a reduced tax burden, which will in turn improve their long-term prospects for reaching financial self-sustainability. An MCC source agreed that tax reforms were a primary achievement of the policy and strategy documents, in addition to clarifications of key water management concepts and new legislation approved in late November 2011 mandating that WUAs must form DRCs (Article 19 of the approved legislation).

However, the MCC representative noted that the assembly did not pass reforms that allowed WUAs to engage in entrepreneurial activities; these reforms were originally prescribed in the policy document as a mechanism to promote increased WUA income and cost recovery. In addition, the MCC source mentioned that several important issues in the irrigation policy were not reflected in the strategy document, as the strategy considered only the highest priority items. Mott MacDonald consultants also expressed this sentiment in their final report on ISSA. Overall, stakeholders agreed that additional legislative reforms were still necessary to successfully regulate the irrigation sector.

3. Sustainability and Next Steps

By defining the passage of a final national irrigation policy by the Armenian government as a precondition for Compact disbursements, MCC and MCA-Armenia tried to ensure the permanence of irrigation reforms. However, the sustainability of new legislative reforms depends on continued stakeholder support for reforms, as well as the capacity to enforce such reforms. Regarding stakeholder support, a key finding of the QPA report was that the study tour to the U.S., in which WUA staff members and representatives of the Ministry of Finance and the Public Service Regulatory Commission participated, contributed greatly to the sustainability of the policy component because "beneficiaries were able to observe the practical application of the abstract notions contained in the policy and their possible consequences." The trip also allowed WUA staff, WSA personnel, and government representatives to establish rapport, which strengthened stakeholder relationships.

Regarding the capacity to enforce reforms, a final report by Mott MacDonald stated, "The effectiveness of any legislative reform project depends on the level of collaboration between those developing the law and those applying the law" (Mott MacDonald 2011). Because regional and local bodies are ultimately responsible for managing the irrigation system, Mott MacDonald consultants recommended that national ministries work closely with these bodies to ensure their day-to-day participation in water management and problem solving.

Nearly all stakeholders agreed that additional reforms are needed to cover key aspects in the national irrigation policy that were not codified in recent legislation. This additional work may require additional funding, consultations, and organizational efforts. A potential donor for this additional legislative work is the World Bank, which has financed large irrigation investments in rural Armenia through the Irrigation Rehabilitation Emergency Project. However, no institutional strengthening or legislative reform components are currently envisioned under the Irrigation Rehabilitation Emergency Project.

SUMMARY OF INSTITUTIONAL STRENGTHENING SUBACTIVITY FINDINGS

Implementation Findings

Institutional Strengthening SubActivity (ISSA) implementers succeeded in providing all 44 Water User Associations (WUAs) served by the ISSA with needs assessments and management improvement plans (MIPs), and nearly all assisted WUAs completed all ISSA milestones and received office equipment, computer software, and heavy machinery. The budget for ISSA was about $2.1 million USD. Overall, ISSA implementation was well managed by VISTAA, and assistance provided was appropriate to WUAs' primary needs. Several aspects of ISSA implementation worked particularly well, including the decision to tie donations to the completion of key milestones. However, several factors complicated implementation, particularly WUAs' passive participation in MIP execution and consultations. Beneficiary perceptions of ISSA implementation are mixed, with both positive and negative views of consultations and largely positive views of equipment and computer donations.

Outcome Findings

From 2007 to 2010, the greatest change was that the 44 WUAs in the ISSA substantially reduced their expenditures on water payments. They also improved their membership fee and cost recovery rates by 13 and 11 percentage points, respectively. Service fee collection improvements exceeded 2010 targets, whereas cost recovery improvements did not meet 2010 targets. WUAs appeared to have improved their financial standing during ISSA implementation. However, given their large annual deficits, WUAs did not appear to be approaching financial solvency in the near-term. In terms of water user outcomes related to ISSA, irrigation practices and water payments in areas served by the ISSA did not change dramatically from 2009 to 2010. However, from 2009 to 2010 WUA membership increased by 10 percentage points, WUA membership fee payment increased 16 percentage points, and the share of water users reporting a village WUA representative increased by 24 percentage points. These changes could not be attributed solely to the ISSA. However, it is likely that ISSA had some role in improving all three areas, as these were the primary activities and outcomes outlined in ISSA milestones, and WUAs were rewarded with a wide array of donations upon completion of these milestones.

Sustainability

WUAs' apparent lack of commitment to strengthening activities poses a serious challenge to the sustainability of moderate gains in fee collection and WUA membership during ISSA implementation. It is not clear whether the WUAs will continue to use MIPs or systematically plan in the same way once the program is over, particularly in the absence of incentive-based rewards for completing milestones. However, legislative decrees and amendments secured by the irrigation reform component will likely have some impact on WUAs' long-term cost recovery, as WUAs now face a reduced tax burden, and these changes may also spur them to take greater ownership of their associations.

Lessons Learned

Throughout ISSA implementation, WUAs took a passive role in consultations and developing and applying MIPs, which all stakeholders cited as a key barrier for WUAs' future success. Considering this difficulty, future interventions with WUAs—including consultations, training sessions, and donations—should be designed to provide WUA staff with strong incentives to assume ownership of strengthening efforts at the initial stages of implementation.

V. EVALUATION OF WTM POST-HARVEST PROCESSING AND MARKETING

A. Overview of WtM Post-Harvest Processing and Marketing

The objective of the Post-Harvest Processing and Marketing (PPM) component was to improve post-harvest handling, enhance processing enterprises' operations, and link Armenian producers to international and domestic markets. Implemented by ACDI from 2008 to 2011, PPM assistance was provided at both the enterprise level and the industry level:

- At the enterprise level, ACDI specialists trained beneficiary organizations on food safety; processing technologies and practices; sorting, packaging, and storing principles; quality management systems; and business and financial analysis. In addition, ACDI specialists provided technical assistance to improve enterprises' day-to-day operations and develop long-term business plans. ACDI staff primarily targeted small and medium-sized agribusiness processing companies for technical assistance, as these companies formed the primary link between producers and consumers. PPM implementers also organized informal groups of farmers, provided these groups with donated seeds, fertilizer, and technical assistance, and assisted them in establishing agreements and contracts with agricultural buyers.
- At the industry level, ACDI specialists facilitated a "Buy Armenian" campaign and helped develop the Armenian Marketing Information System (ARMIS). Conducted from October to December 2009, the "Buy Armenian" campaign included television commercials, press conferences, and other events to promote Armenian agricultural goods. A joint effort between ACDI and the Federation of Agricultural Associations (FAA), ARMIS provides market prices for 64 agricultural products in three large Armenian markets as well as several wholesale and retail markets. On a regular basis, ACDI staff also published and distributed a marketing newsletter to PPM participants. The newsletter provided a summary of local and international agricultural prices. In addition, ACDI sponsored agricultural exhibitions and other events in an effort to strengthen linkages between suppliers, consolidators, and retailers.

Another primary PPM activity was the establishment of collection centers—small locations where several producers could store and cool their agricultural products—and consolidation centers—larger locations where many producers could store, aggregate, and package their production for sale. According to the PPM's original design, these centers would serve a vital role in improving consistency of quality for agricultural products as well as generating higher profits through aggregated and off-season sales. ACDI specialists offered technical assistance and co-financing options to entrepreneurial individuals and groups who expressed interest in building and equipping these centers. Table V.1 summarizes these key aspects of the PPM, including its objective, target population, funding, and main activities.

MCA planned substantive interaction between the PPM and other components, as processing enterprises strengthened by PPM assistance could form stronger linkages with WtM beneficiary farmers and create greater demand for farmers' production. In addition, farmers who participated in HVA and OFWM training could access collection and consolidation centers established under PPM assistance.

Table V.1. Summary of WtM PPM

Objective	Improve post-harvest handling, enhance processing enterprises' operations, and link Armenian producers to international and domestic markets.
Target Population	Small and medium-sized agribusinesses, as well as informal farmer groups.
Funding	$4.2 million (USD).
Implementing Parties	ACDI/VOCA.
Time Frame	2008-2011.
Activities/Assistance	
Enterprise assistance	Instruction in post-harvest technologies, including preservation, processing, and marketing.
Farmer assistance	Material assistance with donated seeds and other agricultural inputs, as well as assistance in establishing contracts with buyers.
Collection and consolidation centers	Technical and material assistance to facilitate the establishment of modernized collection and consolidation centers.
"Buy Armenian" campaign	Television commercials, press conferences, and other events to promote Armenian agricultural goods.
ARMIS	Establishment of an information system that provides market prices for 64 agricultural products in wholesale and retail markets.

Source: Administrative records and Socioscope (2010).

USD = United States dollars.

ACDI staff originally planned to benefit 300 small and medium-sized agribusinesses with production, post-harvest, and marketing assistance by the end of the Compact. MCA-Armenia and ACDI also set a target of 20 collection centers during the Compact's midterm review in 2009. Envisioning a strong link between the PPM and WtM training, ACDI planned to provide PPM assistance primarily to agribusinesses with strong commercial linkages to farmers who received OFWM and HVA training.

B. Research Questions and Methods

A rigorous analysis of PPM was not planned prior to its implementation, particularly due to the infeasibility of identifying an adequate comparison group for PPM participants. However, MCC decided in early 2011 to evaluate the implementation and effects of the PPM to the extent possible with existing data sources. Based on our common research framework among WtM components and conversations with MCC staff, we developed two research questions for PPM:

1. ***How was PPM implemented?*** Did PPM meet its targets in terms of number of enterprises or groups assisted? How many consolidation centers and collection points were implemented under PPM? (Section V.C.) What types of enterprises did PPM target, and how were they identified? (Section V.D.) What midcourse corrections were made in early 2010 following the feedback from the QPA report? (Section V.E.)

2. ***Did PPM have the intended effects?*** Did PPM lead to the use of new practices by enterprises? Which practices were adopted with the most frequency among enterprises versus farmer groups? Did the program improve enterprise profitability? Will farmer groups created for the purpose of receiving technical assistance continue after the cessation of PPM? Did consolidation centers and collection points function effectively? (Section V.F.)

The rest of this chapter is devoted to answering these research questions with the most appropriate data sources available. To answer questions about PPM implementation and to gain insight into PPM's potential effects, we used the WtM QPA Report (Socioscope 2010). The QPA report covers the following domains relevant to the PPM: program objectives, beneficiary needs and service provision, beneficiary experiences and satisfaction, lessons learned, and program sustainability. In particular, we used the QPA report to document strengths and weaknesses of the program's implementation as well as beneficiaries' perspectives on the usefulness of PPM assistance.

To glean additional information on implementation and intended effects of the PPM, we conducted separate in-person interviews with MCA staff and ACDI personnel. During these interviews, we attempted to document ACDI's method of targeting participants, midcourse modifications to PPM implementation, and the component's progress toward meeting its implementation targets. In addition to these in-person interviews, we also visited and interviewed two enterprises that participated in PPM activities. In these interviews, we asked beneficiaries which training units were most helpful, which practices they adopted, and whether these practices led to enhanced business outcomes.

To answer questions about enterprises' characteristics, adoption of post-harvest practices, profitability, and sustainability, we used the Enterprise Adoption Survey (EAS). Its purpose was to measure the use of post-harvest practices by enterprises, farmer groups, and individual farmers who received PPM assistance. Administered through in-person interviews based on a standardized questionnaire, the survey covered the following domains: participants' general information, assistance provided, use of practices and business outcomes, and future plans. AREG administered the EAS once from January 2010 to March 2011, several months after most PPM participants had received PPM assistance.[65] The 2010–2011 EAS covered the entire universe of 191 enterprises assisted by ACDI by September 2010. Table V.2 provides a summary of the data sources and research design we used to answer our primary research questions for the PPM.

[65] This data collection period of over one year is longer than most field periods for comparable surveys. AREG conducted a small batch of surveys each month from early 2010 to early 2011.

Table V.2. Data Sources and Research Design Used to Address Primary Research Questions for WtM PPM

Research Question	Data Sources	Research Design
How was PPM implemented?	WtM Qualitative Process Analysis Report; in-person interviews with MCA-Armenia, ACDI, and participants	Mixed methods, with a focus on qualitative data
Did PPM have the intended effects?	WtM Qualitative Process Analysis Report; in-person interviews with MCA-Armenia, ACDI, and participants; participant survey following assistance	Mixed methods, with a focus on post-intervention quantitative data

C. Activities and Outputs

1. Beneficiary Population

To target beneficiaries for PPM assistance, ACDI compiled a list of registered small businesses operating in food production, processing, or marketing. Through this method, they found fewer than 200 possible beneficiary groups. ACDI conducted informal needs assessments with these prospective beneficiaries and supplied assistance based on the needs identified. Most needs were related to marketing, cooperation with producers, labeling, and production issues. ACDI's assistance to these enterprises largely consisted of developing business plans, providing marketing advice, and helping to improve day-to-day operations. After program implementers determined that there were likely far fewer than the original target of 300 registered enterprises that could benefit from PPM assistance, the target number of participants was reduced to 225 over the entire implementation period.

Given the dearth of registered production and processing enterprises in Armenia, MCC and MCA-Armenia decided that ACDI specialists should also organize and assist informal groups of farmers and that this assistance could count toward the revised target of 225 participants. The objective of this assistance was to strengthen farmer groups' ability to work directly with newly established consolidation centers and recently trained fruit processors, thus strengthening new links in key value chains. According to ACDI specialists interviewed by Mathematica in July 2011, most work with farmer groups originated from requests on the part of processing companies for higher quality agricultural products. ACDI staff traveled to communities near these processors and attempted to organize groups of at least five farmers. The PPM team then organized meetings with newly formed groups, provided members with inputs and packaging materials, and assisted the groups in establishing relationships with potential buyers.

Following the program's midterm review, MCA-Armenia and ACDI prioritized the establishment of 20 collection centers as a primary implementation target. With MCC's approval, MCA-Armenia introduced a cost-sharing mechanism in which MCA-Armenia would share up to 20 percent of beneficiary groups' investment costs for consolidation centers, and finance up to $10,000 USD for investments in collection centers. To determine where collection centers should be established and by whom, ACDI staff conducted an informal analysis of retailers, including where they bought their produce and what price they paid. Next, ACDI made several visits to cooperatives and individual entrepreneurs to discuss the costs and benefits of establishing collection and consolidation centers. In the interest of assisting only those organizations that could not find outside funding, ACDI targeted assistance to groups of organized small farmers and small businesses.

As envisioned in the PPM's design, small farmers and small businesses would use newly established collection centers to aggregate production closer to the point of origin, thus ensuring that farmers (and not agricultural intermediaries) would capture a large portion of price gains obtained from centers' aggregated sales.

2. Final Outputs

By September 2011, ACDI had assisted 227 enterprises, including 94 farmer groups (Table V.3), thus meeting its revised target of 225 assisted beneficiary groups. By late 2011, ACDI had also helped to establish 21 collection centers and 3 consolidation centers, thus meeting its midterm target of establishing 20 collection centers. During interviews in July 2011, stakeholders agreed that ACDI staff did a commendable job of meeting these service targets despite the high degree of difficulty involved in identifying and assisting participant enterprises.

Table V.3. Comparison of PPM Outputs and Targets

Activity	Target	Final Output
Enterprises Assisted[a]	300, later reduced to 225	227
Farmer Groups Formed	NA	94
Collection Centers Created	20	21
Consolidation Centers Created	NA	3

Source: MCA-Armenia "The Program is Over: All About Results" Report (2011).

[a] The 227 enterprises assisted includes the 94 farmer groups formed under the PPM.

D. Description of PPM Beneficiaries

We used 2010–2011 EAS data to answer questions about enterprises' characteristics, post-harvest practices, profitability, and sustainability following PPM assistance. Because of substantive differences in employees, ownership, and activities between PPM participant groups, we characterized each group type separately. As shown in Table V.4, organizations assisted by PPM include publicly and privately owned organizations, and commercial organizations that received assistance averaged more employees than nongovernmental organizations that were assisted. In addition, commercial organizations were most likely to be involved in agricultural processing and production, and nongovernmental organizations were most likely to be involved in agricultural production and consolidation activities. In contrast, individual business owners were most likely to report working in dry food production.

Table V.4. Description of PPM Beneficiary Groups (percentages except where indicated)

Characteristic	Commercial Organizations	Nongovernmental Organizations	Individual Business Owners
Average Number of Members	NA	134	NA
Average Number of Employees	56	16	NA
Ownership			
Private	97	44	NA
Public	3	56	NA
Activities			
Agricultural production	26	50	21
Agricultural processing	54	13	15
Dry food production	13	0	81
Consolidation	5	19	8
Transportation	0	6	0
Domestic retailers or wholesalers	13	0	6
Service industries	10	6	NA
Exporting	15	0	4
Other	0	31	4
Sample Size	**39**	**16**	**52**

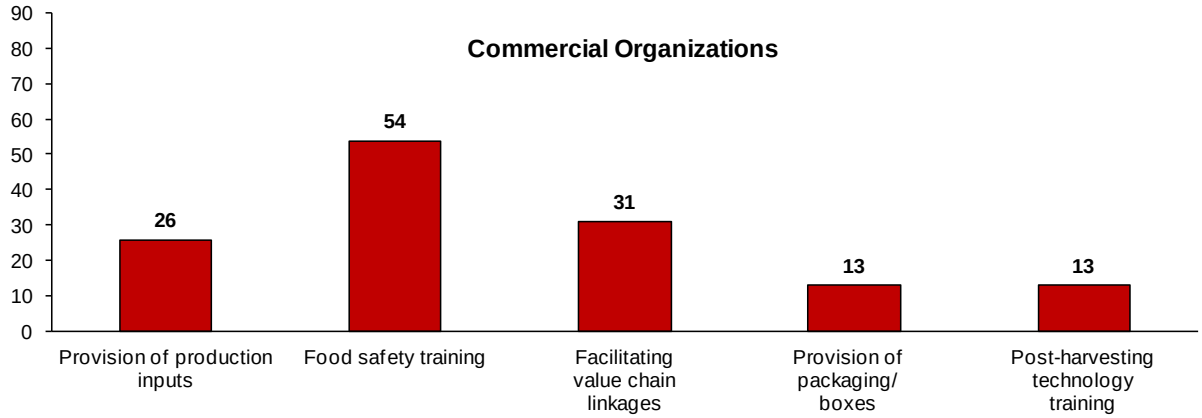
Source: 2010-2011 Enterprise Adoption Survey.

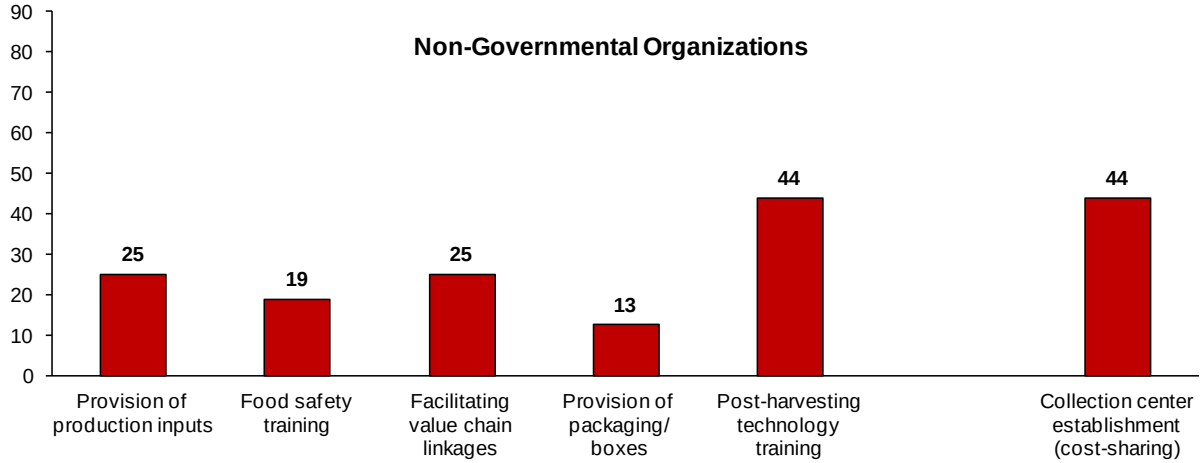
In addition, 84 farmers' groups were interviewed with the EAS (not shown in Table V.2). On average, these groups had around five members: four men and one woman. A majority of interviewed group members (73 percent) reported that the group was established in 2009 or early 2010, and over half of interviewed members reported that they cooperated with fellow members on a consistent basis, mostly in the areas of purchasing production inputs. Unfortunately, the EAS did not capture information on the specific crops grown by farmer groups or on the agricultural products produced by participant business owners and organizations.

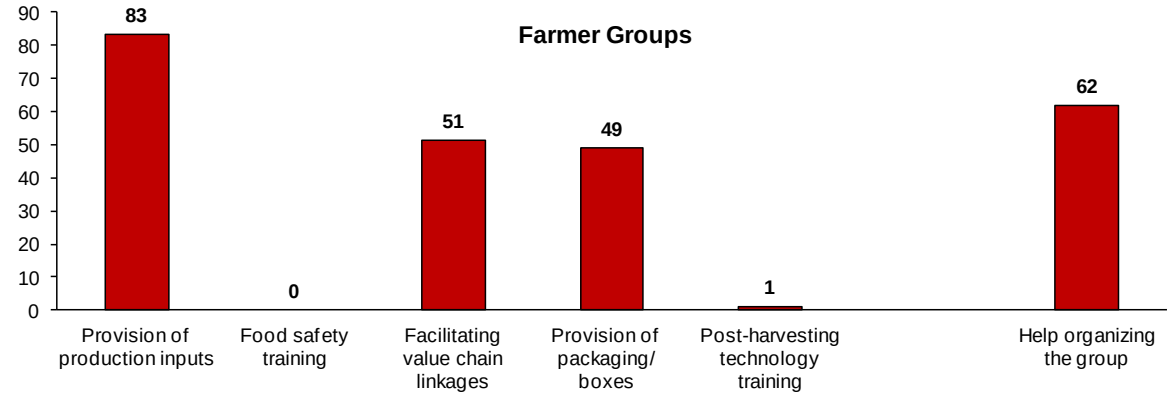
E. Implementation Findings

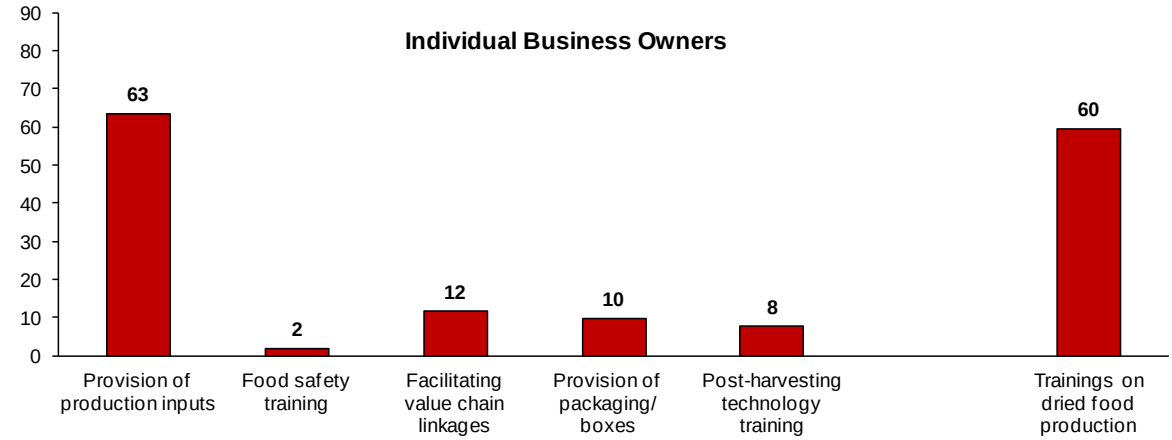
Figure V.1 provides an illustration of assistance received under PPM organized by participant type. Common forms of assistance across all participants are presented on the left of the figure, and forms of assistance largely targeted to one participant type appear on the right. As shown, no single form of assistance was delivered to a substantive portion of all participant groups, as assistance appeared to be strongly tailored to each group type. For example, 44 percent of nongovernmental organizations received assistance with establishing a collection center while no more than 10 percent of any other participant group did (not shown), and 62 percent of farmer groups received help forming their group while a maximum of 3 percent of all other groups did (not shown). The most commonly reported types of assistance among commercial organizations were food safety training and activities to facilitate value chain linkages. Among nongovernmental organizations, the most commonly reported assistance was post-harvest technology training and assistance with establishing collection centers. In contrast, farmer groups largely reported receiving help with production inputs as well as assistance with organizing the group itself. Individual business owners largely reported receiving production inputs and participating in trainings on dried fruit production and post-harvest technologies.

Figure V.1. Assistance Received under PPM (Percentage Reporting Assistance in Each Area)









Source: 2010-2011 Enterprise Adoption Survey.

Socioscope (2010) featured mixed findings regarding beneficiaries' perceptions of PPM assistance. Assisted fruit processors particularly valued training or assistance on dried fruit production and food safety. In addition, informal dried fruit producers rated training on production technologies and raw materials as quite useful. According to assisted groups, these types of assistance were directly applicable in practice, and in some cases had led to visible improvements in fruit production. In addition, technical assistance in brand development was also considered useful by several interviewed beneficiaries. However, participation in local expos and agricultural events was unanimously unpopular because such events did not directly help beneficiaries expand their access to markets and relationships with local and foreign partners. In interviews, beneficiaries stressed their continued need for assistance with local and external market access and stated that PPM assistance in this area had been deficient.

Interviews with PPM participants and ACDI staff conducted by Mathematica corroborated the WtM QPA's general findings that training in production techniques were well regarded, whereas assistance with expanding participants' access to markets often did not meet expectations. One PPM beneficiary who sold dried apricots, plums, and peaches reported that food and safety training was somewhat helpful. However, the beneficiary's primary business need was establishing relationships with potential buyers, and the respondent reported that ACDI did not provide much assistance in this area. ACDI staff remarked that establishing relationships between dried fruit producers and buyers was difficult, given systemic problems with deficient raw materials, a lack of formal contracts between producers and buyers, and difficulties with aggregating production from multiple producers. In many instances, ACDI staff said that these obstacles precluded tangible progress in establishing new commercial relationships.

Another interview with a PPM participant corroborated the WtM QPA's general finding that participants valued PPM assistance with brand development. The participant stated that ACDI's marketing and branding assistance helped him establish a successful collection center, enhance his retail outlet operations, and improve his brand logo much earlier than he would have without assistance. The beneficiary said, "If you're walking and someone is willing to give you a ride, you hop in the car." In addition, the beneficiary highly valued ACDI's prompt assistance with a business plan and help in finding cooling equipment for his new collection center.

Throughout the component's implementation period, several successes emerged from the large variety of PPM interventions. In late 2011, stakeholders touted the fruit tree nursery project as a key success of PPM. From 2008 to 2011, ACDI provided dwarf tree rootstocks and planting materials to eight nurseries serving more than 1,000 farmers. Under the project, nearly 150,000 dwarf tree saplings were planted on over 4,000 hectares of land. MCA sources described the project as successful due to high productivity rates and a high demand for the nurseries' saplings.

According to the 2010 QPA report, the most successful assistance under the PPM was ACDI's cooperation with the Federation of Agricultural Associations (FAA), whose members reported tangible results from their partnership. Jointly, the FAA and ACDI successfully established a consolidation center and several collection points through a cost-sharing arrangement with MCA-Armenia. Stakeholders reported a strong division of labor between stakeholders: ACDI staff arranged all trainings associated with the center and collection points, and the FAA handled all major infrastructure investments. According to the QPA report, the FAA's consolidation center and collection points had the most potential to continue operations in the future because these initiatives

have strong beneficiary ownership and directly serve producers and buyers' incentives and information needs.

By late 2011, however, ACDI and other stakeholders had mixed opinions concerning the value of ACDI's collaboration with FAA. By the end of the compact period, ACDI had determined that the federation was not managing its consolidation center in an effective manner, despite ACDI's continued marketing support. In addition, the closure of the ARMIS project, a joint effort between ACDI and FAA, suggested that FAA's interest in the project was not sufficient to guarantee its medium-term sustainability.

During the compact period, PPM implementation also faced several structural obstacles. During interviews, ACDI staff stated that large quantitative targets of 225 assisted groups led to less hands-on attention for each assisted group, and thus diluted the potential impact of technical assistance on participants' activities and sales. In addition, the objectives of assisted enterprises and farmers differed: enterprises were interested in buying farmers' production at lower price whereas farmers wanted a higher price. Related to this issue, a quality assurance report commissioned by MCA-Armenia in late 2008 found that many PPM interventions were not tailored to the needs of market participants, particularly buyers. Rather, specialists designed and offered assistance directly to farmers, and farmers' production was often either of insufficient quality or too expensive to be sold to processing firms and other potential buyers. In response to these findings, ACDI committed to revising its approach to assistance, so that assistance to producers would be primarily based on market demand.

The PPM also faced substantive cultural obstacles to implementation. Many farmers were not inclined to work in groups, viewing cooperation from the perspective of their previous negative experience with Soviet collective farms. As a result, they were hesitant to buy and sell jointly with other farmers and to sign collective agreements. Other farmer groups that did sign agreements with buyers did not honor these agreements, particularly when market prices exceeded prices established in the agreements. Their failure to honor written agreements further damaged commercial relationships between farmer groups and processors served by the PPM.

Based on these obstacles as well as PPM success stories, future post-harvest and marketing assistance programs may benefit from a shift in emphasis from serving large numbers of beneficiary groups to providing intensive assistance to entrepreneurs and beneficiary groups with a strong commitment to assistance and a high potential to generate positive business outcomes as a result of this assistance.

F. Assessment of PPM Outcomes

We used 2010–2011 EAS data to analyze key PPM outcomes of increased sales, income, and profit on the part of assisted individuals and groups. The majority of PPM beneficiaries reported positive business outcomes following PPM assistance (see the column reporting percentages for all groups in Table V.5). The most common positive outcomes reported were improved product and service quality, increased productivity, and increased sales (reported by 84, 69, and 67 percent of interviewed beneficiaries, respectively).

Table V.5 also shows that nearly all beneficiary groups reported improved product and service quality, ranging from 81 percent of individual business owners to 88 percent of nongovernmental organizations. In contrast, there was more heterogeneity among beneficiary groups regarding increased sales, with only around half of individual business owners and nongovernmental organizations reporting such an improvement, compared to around three-quarters of commercial organizations and farmer groups. Over half of all beneficiary groups reported higher income and profit after PPM assistance (ranging from 56 to 58 percent), whereas only 37 percent of individual business owners reported this positive outcome.

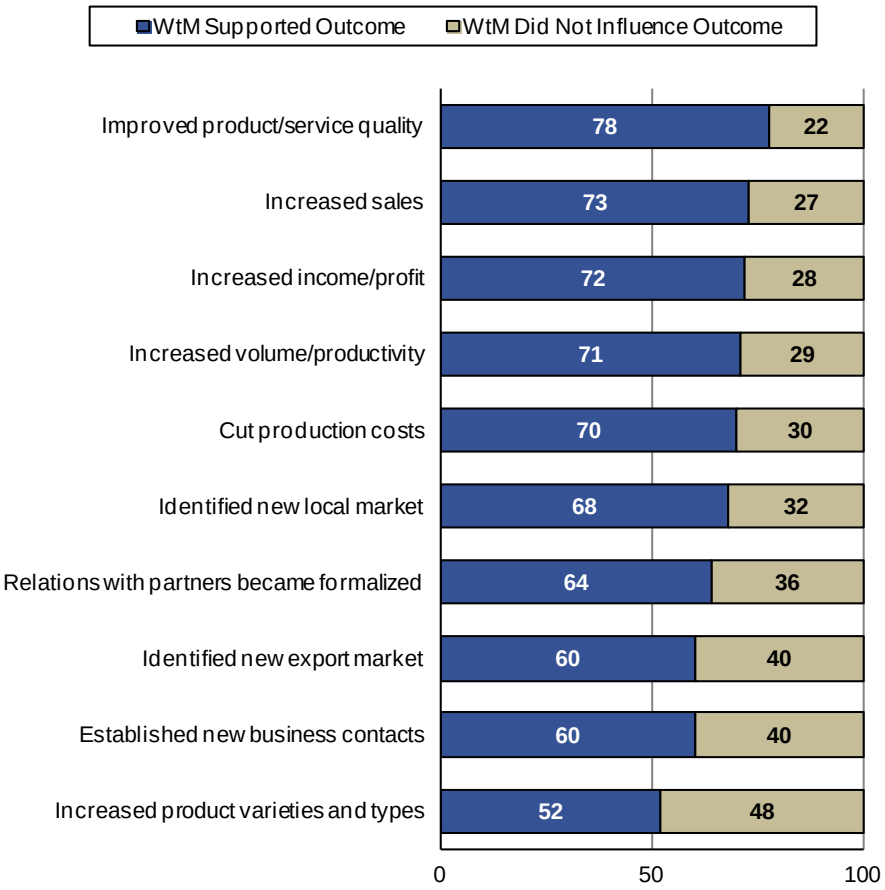
Table V.5. Self- Reported Business Outcomes and Perceptions of PPM Beneficiaries (percentages)

	Commercial Organizations	Nongovernmental Organizations	Individual Business Owners	Farmer Groups	All Groups
Improved Product or Service Quality	85	88	81	85	84
Increased Volume or Productivity	72	88	56	71	69
Increased Sales	77	56	54	73	67
Identified New Local Market	62	75	52	62	60
Increased Product Varieties and Types	82	56	54	55	60
Increased Income and Profit	56	56	37	58	52
Established New Business Contacts	64	63	38	44	48
Cut Production Costs	36	44	37	51	43
Identified New Export Market	44	25	17	24	26
Relations with Partners Became Formalized	38	25	8	26	24
Sample Size	**39**	**16**	**52**	**84**	**191**

Source: 2010-2011 Enterprise Adoption Survey.

Illustrated in Figure V.2, the majority of interviewees who reported positive outcomes attributed these outcomes—at least in part—to WtM assistance. For example, 78 percent of respondents who reported improved product or service quality stated that WtM assistance greatly or somewhat supported this outcome (Figure V.2). Similarly, at least 70 percent of respondents who reported increased sales, increased productivity, lower production costs, and increased profits attributed these outcomes at least in part to WtM assistance.

Figure V.2. PPM Beneficiaries' Perceptions Regarding the Contribution of PPM to Positive Outcomes



Source: 2010-2011 Enterprise Adoption Survey.

In addition, a substantive portion of farmer groups formed under PPM appeared to be working collectively at the time the EAS was administered. Eighty-six percent of interviewed groups reported that farmers in the group cooperate continuously or periodically. Around half of surveyed farmer groups reported working together to purchase inputs, slightly less than half reported working together to supply raw materials to processors, and less than 20 percent reported collaborating to purchase inputs and supply raw materials to processors. About one-quarter of interviewed groups reported supplying raw materials to retailers or consolidation centers. Interestingly, all 84 interviewed farmer groups reported that the group members planned to cooperate in the future.

The positive outcomes identified in this analysis of EAS data appear at odds with the QPA report, which found that PPM assistance generally did not lead to measured improvements in production or sales. The source of the discrepancy may be the different data collection methods, timeframes, and survey instruments used in the QPA versus the EAS. The discrepancy could also be related to implementer involvement in EAS data collection. When implementing the EAS, data collectors noted several cases in which respondents appeared to be coached by implementing staff (by phone or in person) to provide a "right" answer to survey questions regarding outcomes. The data collectors informed MCA of these instances, and stated that they believed a nontrivial number of survey respondents were instructed to answer questions in a positive light. If this occurred for a

substantial portion of respondents, EAS survey data are likely systematically biased toward positive outcomes.

It is also possible that PPM assistance improved from the period covered in the QPA (2008 and 2009) to the period covered in the EAS (2010 and 2011), to the extent that tangible improvements in beneficiaries' outcomes, while not present at the time of the QPA, had emerged by the date of EAS data collection. These improvements may reflect midcourse adjustments to PPM assistance reportedly made by ACDI following the 2010 QPA report (and presentation) on the WtM activity. Despite potential positive biases of EAS data, the survey's results may reflect actual positive participant outcomes that occurred after the activity was reorganized.

SUMMARY OF POST-HARVEST PROCESSING AND MARKETING FINDINGS

Implementation Findings

By September 2011, ACDI met its revised target of providing 225 beneficiary groups with technical and material assistance and had helped establish 21 collection centers and 3 consolidation centers. Despite these impressive results, a lack of intensive hands-on assistance, contradictory interests of suppliers and consolidators, and a cultural aversion to collective action undermined the success of the PPM intervention. However, there were cases of successful cooperation under the PPM, particularly a fruit tree nursery project in which ACDI provided dwarf tree rootstocks and planting materials to eight nurseries serving more than 1,000 farmers. In addition, fruit processors who received assistance particularly valued training on dried fruit production and food safety; and informal dried fruit producers rated training on production, technology and raw materials as quite useful. However, participation in local expos was unanimously unpopular. In interviews, beneficiaries stressed their continued need for assistance with local and external market access and stated that PPM assistance in this area had been deficient.

Outcome Findings

According to the 2011 Enterprise Adoption Survey, the majority of PPM beneficiaries reported positive business outcomes following PPM assistance. The most common positive outcomes reported were improved product or service quality, increased productivity, and increased sales (reported by 84, 69, and 67 percent of interviewed beneficiaries, respectively). Beneficiaries who reported positive outcomes generally cited PPM assistance as contributing to these outcomes. These EAS findings are at odds with the WtM QPA report, which found that PPM assistance generally did not lead to any noticeable changes in beneficiaries' business outcomes by late 2009.

Sustainability

It is not clear that beneficiary groups—particularly farmer groups and processors—have an incentive to work together in the future. The objectives of farmers and enterprises differ: enterprises are interested in buying farmers' production at lower price whereas farmers demand a higher price. This was a serious obstacle to creating supply chains that could function after PPM assistance has ceased. However, several strong consolidation centers and collection points have the potential to continue operations after PPM assistance. These interventions have strong beneficiary ownership and directly serve producers and buyers' incentives and information needs.

Lessons Learned

Analyzing the PPM's obstacles and success stories, future post-harvest and marketing assistance programs may benefit from a shift in emphasis from serving large numbers of beneficiary groups to providing intensive assistance to entrepreneurs and beneficiary groups with a strong commitment to assistance and a high potential to generate positive business outcomes. Under this approach, implementers would first conduct a survey of market supply and demand for a set of agricultural products. Next, they would identify products and value chains that present opportunities for assisted providers, processors, and consolidators to secure a competitive advantage. Finally, implementers would tailor assistance to participants' needs related to those opportunities.

VI. CONCLUSIONS

MCC and MCA-Armenia had envisioned an integrated and complementary set of activities designed to improve agricultural production and reduce rural poverty in Armenia, with ambitious service delivery targets for each of the four components. Implementers were able to meet or surpass all of these ambitious (albeit modified) targets, which is especially notable for training, in which over 45,000 and 36,000 farmers were trained in OFWM and HVA, respectively.

For the most rigorous evaluation, WtM training, we do not find evidence that training substantially improved long-term measures of farmers' well-being such as income, avoidance of poverty, or consumption. We also do not find evidence of impacts on adoption of new OFWM practices that might suggest that longer-term impacts could develop over time. Perhaps such practices were not adopted due to institutional factors such as lack of monetary incentives to conserve water or lack of credit to invest in technologies to increase higher-value crops cultivation. Additionally, lack of adequate irrigation infrastructure could have stymied adoption of the agricultural practices addressed in training. While the training was intended to complement rehabilitation of irrigation infrastructure, much of the rehabilitation did not happen until the end of the Compact period.

As described earlier, we attempted to evaluate each of the other WtM components but cannot conclusively assess their impacts. Despite the methodological challenges associated with the nonrigorous research designs for these components, we have some suggestive evidence that the credit component may have led to greater production, revenue, and income for beneficiaries, although only a very small fraction of trained farmers received WtM credit. In addition, qualitative evidence and observations suggest that some PPM efforts (like collection centers) may be sustained, while others—particularly support to farmer groups and processors—may not have much of an effect. Finally, while we see improvements in WUA cost recovery rates and net revenue, we cannot attribute these changes solely to the ISSA component of WtM. Furthermore, WUAs' apparent lack of commitment to strengthening activities will pose a challenge to the sustainability of the results to the extent they can be attributed to ISSA. However, legislation secured by the irrigation reform component will likely have some impact on WUAs' long-term cost recovery, as WUAs now face a reduced tax burden as result of recent reforms.

Because the evaluations of WtM credit, ISSA, and PPM were introduced after WtM was already underway, it was not possible to design a quantitative evaluation that could rigorously examine the overall effects of the combined WtM Activity. However, we can attempt to gauge the magnitude of the possible overall effect of WtM by considering the evidence available. Unfortunately, as has been discussed, the WtM components were not well integrated with each other, so there is little chance that the planned complementarities were realized. For this reason, when assessing the overall effect of WtM, we assess the possible effect of each component on its target population. WtM training was the largest and most visible component of WtM, but it had little impact on the overall WtM goals of increasing agricultural production, agricultural profits, and household income. Thus, any overall effects of WtM could only be through direct effects of the other components. There is suggestive evidence that WtM credit and PPM may have had effects on the beneficiaries who participated in these components, but little evidence to suggest that these components had broader effects beyond the direct beneficiaries. Although some participants may have benefited from these components, the overall effect of WtM on the full set of targeted beneficiaries was probably small, at least as of the end of the Compact. We note, however, that many of the potential effects of ISSA on farmers were designed to provide benefits beyond the Compact period in the form of sustained irrigation

infrastructure investments and more effective WUAs; if ISSA is successful in these goals, it would affect many farmers.

Our study suggests some lessons for future programs considering similar WtM activities:

- ***More modest training targets and better selection of training beneficiaries may help ensure that more farmers adopt practices.*** The findings from the evaluation of WtM training suggest that inducing farmers to change their behaviors is challenging, particularly when there are numerous constraints to adopting new practices. In addition, because the implementer had extremely large targets to meet in a prescribed timeframe, the recruitment of farmers may not have targeted those most likely to benefit. With smaller training targets, more time could have been spent identifying and selecting farmers and then following up with trained farmers to identify and resolve issues precluding them from adopting new practices. This could lead to a higher net total benefit even if the footprint of the program is smaller. We note that the training targets (as well as the PPM targets) were revised following interim review of the program. The findings of this evaluation suggest that those revised targets probably were not enough, but we do not believe there was sufficient evidence at the time to dramatically overhaul the program.

- ***Different types of beneficiary farmers may benefit from different types of training.*** The implementers tailored training sessions to match the agricultural conditions and needs of the different zones in Armenia. However, the training sessions in each area provided all farmers who attended training with the same type of information. While these trainings included some simple practices, they also included many costly practices (which perhaps may have better long-term results if adopted). However, it is unlikely that many trained farmers would be able to invest in these more costly practices. An alternate training strategy would be to tailor the content of training more directly to farmers' ability to invest in the practices of irrigation and cultivation being taught in the training. For example, small-scale farmers who lack investment capital could have received training that focused only on simple and inexpensive OFWM practices. Conditions of the local irrigation infrastructure could also have been taken into consideration in the training material. Such an approach could have used farmers' and trainers' time more efficiently and placed emphasis on practices that had a higher probability of being adopted.

- ***Programs may consider a more targeted approach to selecting farmers for training as well as credit that would facilitate better linkages between the two components.*** Levels of WtM lending were disproportionately low compared to levels of WtM training, and only a very small proportion of trained farmers received WtM credit. This produced dissatisfaction among farmers who participated in training with the expectation of receiving credit and also probably resulted in inefficiencies in that farmers were trained in technologies they could not afford to adopt. Future agricultural assistance programs may consider a more targeted (and perhaps joint) selection of farmers for training as well as credit. For example, if only creditworthy farmers were selected for training in more advanced methods—and credit was provided upon the successful completion of training—farmers' expectations of credit would be more realistic and a greater proportion of trained farmers would have sufficient capital to invest in technologies featured in training. This combination of advanced training and credit could be offered to one segment of the target population, whereas another segment of small-

scale (and presumably less creditworthy) farmers could receive training in simple and inexpensive practices or support in becoming more creditworthy.

- ***WUA staff may need stronger incentives to assume ownership of efforts to strengthen WUA operations.*** Throughout ISSA implementation, WUAs took a passive role in consultations and in developing and applying MIPs. Implementers were more successful in inducing participants to implement changes once they brought in the incentives of equipments. To ensure more ownership among participants, future interventions with WUAs—including consultations, training sessions, and donations—should be designed to provide WUA staff with strong incentives to assume ownership of strengthening efforts at the initial stages of implementation. For example, consultations could have been better tailored to WUAs' day-to-day needs, or rewards could have been directly tied to improved service fee and cost recovery rates. A number of legislative reforms were also enacted as part of ISSA, which broadly speaking were designed to address constraints that may have limited WUAs' ability and willingness to take greater responsibility for their irrigation systems and management operations, though it is too soon to know how successful these initiatives will be.

- ***Future post-harvest and marketing assistance programs may benefit from providing more targeted assistance.*** Rather than serving all producer groups and creating new farmer groups to meet targets, PPM implementers could have provided more intensive assistance to fewer individuals or groups that have a strong commitment to taking advantage of assistance and a high potential to generate positive business outcomes.

- ***Synchronizing implementation of training and post-harvest and marketing assistance programs could strengthen both components.*** PPM could have helped to identify broken links in agricultural value chains or the needs of Armenia's agricultural enterprises and the steps required to meet those needs. This information could have fed into the training program to help farmers change their practices and the crops they cultivate to meet market needs. The original vision for the WtM activity was for these activities to be complementary in ways such as these. However, WtM training and PPM were implemented in isolation from one another. A contributing factor to that separation was that training began well before PPM, which was necessary in order to meet the high training targets. Also, the provision of PPM services to farmer groups was not tied to WtM training, nor was the formation of farmer groups who could receive PPM services encouraged as part of WtM training.

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APPENDIX A

METHODS

A. Regression Models

This section discusses our empirical strategies for estimating impacts of WtM training and the WtM credit. We discuss the general regression model for estimating impacts in Section A, nonresponse weights in Section B, and identification and resolution of outliers in Section C.

1. Regression Specifications

a. Training Evaluation

We estimated impacts of WtM training on key outcomes using the following general regression model, applied to a sample of farmers surveyed at both baseline and at follow-up:

$$(1) \quad y_{ijk,post} = \delta y_{ijk,pre} + \varphi' X_{ijk} + \lambda_k + \beta T_{jk} + \mu_{jk} + \varepsilon_{ijk}$$

where $y_{ijk,post}$ is the outcome of interest (for example, farm profits) for farm household i in community j within stratum k at follow-up; $y_{ijk,pre}$ is the outcome for the same household at baseline; X_{ijk} is a vector of baseline characteristics that are related to the outcome of interest; λ_k is a WUA fixed effect; T_{jk} is a binary variable equal to 1 if the household is in a treatment area and 0 otherwise; μ_{jk} is a community-specific error term; and ε_{ijk} is a household-specific error term. The estimate for the parameter β is the estimated impact of a program.

Random assignment was stratified by WUA. Communities within a given WUA were randomly assigned to the treatment condition according to predetermined ratios of treatment and control households. The regression model was designed to account for these random assignment features. The WUA fixed effects were used to account for the WUA-level stratification; they had the added benefit of explaining region-level variation in outcomes. Because entire communities (or in some cases, small clusters of neighboring communities) were randomly assigned together, we also needed to account for the fact that households within these communities may have had correlated outcomes, represented by the community-specific error term in Equation (1). Community-level correlations were accounted for using Huber-White standard errors.

b. Credit Evaluation

For the credit analysis, we estimated impacts of WtM credit using a similar regression model as in Equation (1):

$$(2) \quad y_{ijk,post} = \theta y_{ijk,pre} + \gamma' W_{ijk} + \psi_k + \kappa C_{ijk} + \nu T_{jk} + \eta_{ijk}$$

Equation (2) adds to Equation (1) the credit treatment variable C_{ijk}, which is a binary variable equal to 1 if household i in community j in stratum k received a WtM-funded loan and 0 otherwise. We included T_{jk} as a control in the model for credit so that the estimated impact of credit is net of any impacts of training. Equation (2) also includes a vector of household characteristics, W_{ijk}, which differs from the vector of household characteristics used in Equation (1). Unlike the specification for training, the specification for credit did not include a community-specific error term. All other parameters are analogous to Equation (1). The estimate for the parameter κ is the estimated impact of the credit program.

In contrast to the evaluation design for training, community-level clustering does not need to be accounted for in Equation (2) because treatment status varies across households rather than only across communities. WUA fixed effects were still used because they help control for region-level variation in outcomes. We also restricted the analysis sample to those WUAs in which at least one household received a WtM-funded loan, so that the comparison group was drawn from households exposed to agricultural and market conditions most similar to those of the WtM credit recipients.

2. Selection of Regression Control Variables

The impact evaluation for WtM training used a random assignment design in which communities were randomly assigned to a treatment group (in which training was offered) or a control group (in which training was not offered). Because assignment to the treatment group was random, household characteristics were uncorrelated with treatment status, and adjusting for baseline controls was not necessary to obtain unbiased impact estimates. However, controlling for baseline measures could improve statistical precision of the impact estimates if the regression controls were correlated with the key outcome measures.

The impact evaluation for WtM credit did not leverage random assignment—it compared households that chose to apply to and were selected to receive WtM-funded loans to households that did not receive such loans. The credit evaluation relied on regression controls to adjust for observable differences between these two groups.

Regression controls have statistical advantages for both empirical models, but an excessive number of unnecessary baseline controls could overfit the models and inflate standard errors. To balance these considerations, we used a sequential variable selection algorithm to identify the household control variables in X_{ijk} and W_{ijk}. This algorithm rests on the strength of observed relationships between candidate control variables and outcome measures. The algorithm developed the regression models separately for the training and credit regression models.

The first step in our algorithm was to identify outcome measures that would represent the range of domains impacted by the training and credit programs. Selecting a small set of outcomes to use in developing the regression model ensured that the model selection process did not become computationally intensive but still selected a set of household controls that could predict outcome measures in different domains. We chose three outcome measures to use in the model selection process: adult-equivalent consumption, agricultural profits, and adoption of a simple On-Farm Water Management (OFWM) practice. To prevent outliers in these outcome measures from influencing the model selection, we censored adult-equivalent consumption and agricultural profits at their respective 98th percentiles (See Section C).

Next, we identified candidate, or potential, measures of household characteristics at baseline to explain each outcome measure at follow-up. These candidate measures included each household's baseline values of agricultural production for all crop categories, baseline agricultural costs, baseline employment income, baseline non-employment income, baseline land holdings, and the outcome measure recorded at baseline. The crop category–specific values of agricultural production were evaluated jointly as a candidate control. The outcome measure recorded at baseline was predetermined to be in the final specification, but we included it in this process to account for its correlations with other candidate variables. To limit the influence of outliers at baseline, we censored each of the candidate measures at their respective 98th percentiles in the analysis sample for the WtM training evaluation. We also censored the baseline measures for the outcomes of adult-equivalent consumption and agricultural profits.

Additionally, the regression model for training included as a candidate covariate whether the survey respondent was female; this step was taken because at baseline the training treatment and control groups were different to a statistically significantly degree on this measure. Other candidate controls included measures of household composition at final follow-up: the number of adults of prime working age (18 to 55), the number of elderly adults, and the number of children. These are preferable to using the baseline household composition measures because they should be more predictive of outcomes at final follow-up and because household composition should not have been impacted by the WtM training or credit components.

For each selected outcome, we regressed the outcome on one candidate control variable at a time, using stratum fixed effects and nonresponse weights, as discussed in subsequent sections of the Appendix. To assess the empirical strength of the predictive power of each candidate control, we looked at the *t*-test for the coefficient of the candidate control variable. Any variables with *p*-values of 0.20 or smaller from the *t*-tests were retained for the next stage of the algorithm. Variables without higher *p*-values were dropped from the selection process. The *p*-value for the crop category-specific values of agricultural production at baseline came from a joint F-test of statistical significance.

In the second stage, we sorted candidate measures by their *p*-values from the first stage. Beginning with the candidate measure that had the smallest (most significant) *p*-value, we added the remaining candidate measures one at a time to the model. If the newly added candidate measure still had a *p*-value of 0.20 or smaller, it was kept as a control in the model. If not, it was excluded. Earlier covariates were retained even if adding the newest candidate measure lowered their *p*-values below 0.20. This process was then repeated for the other key outcomes.

When this series of steps was completed for each outcome of the training or WtM credit analysis samples, we created lists of all those controls that had been identified for at least one outcome (Table A.1). The final lists of covariates for the training sample and the WtM credit sample are the same. The covariates identified by specific outcomes, however, varied more widely.

The extent to which the regression models improved statistical precision varied substantially across outcome measures, but for most of the key outcome measures, the regression R^2 was about 0.20. This number was higher for variables that did not change much over time (such as types of crops cultivated) and lower for variables that changed considerably or were not measured at baseline. We note that regression controls explained less variation than we had hoped when we designed the evaluation of training; we had expected R^2 values between 0.30 and 0.40.

Table A.1. Control Measures Identified by the Sequential Variable Selection Algorithm for the Estimation Models in the Training and Credit Evaluations

Controls	Regression Controls Identified by Each Outcome		
	Adult-Equivalent Consumption	Agricultural Profits	Adoption of a Simple OFWM Practice
Training Analysis			
Employment income (USD) at baseline	X		
Market values (USD) of crop production at baseline, by crop category	X	X	
Agricultural expenditures at baseline	X		X
Total land (hectares) at baseline	X		
Number of children at follow-up	X		X
Number of prime-age adults at follow-up	X	X	X
Number of elders at follow-up	X		X
Outcome measure at baseline	X		X
Credit Analysis			
Employment income (USD) at baseline	X		
Market values (USD) of crop production at baseline, by crop category		X	
Total land (hectares) at baseline	X		
Number of children at follow-up	X		X
Number of prime-age adults at follow-up	X	X	X
Number of elders at follow-up	X		X
Outcome measure at baseline	X	X	X

3. Regression-Adjusting Means

Although the training treatment was randomized, compositional differences could have occurred by chance. To account for these differences in observable characteristics, we present regression-adjusted means of the treatment and control groups for each outcome in the training evaluation and for the WtM credit recipients and nonrecipients in the WtM credit evaluation. Regression adjustments were made according to the following procedure, which used nonresponse weights throughout to estimate means and parameters. We describe the procedure in the context of the training impact evaluation first and then describe our modification of the procedure for the credit evaluation.

For each outcome in the training evaluation, we first estimated the parameters in the general regression model [Equation (1)]. Using the estimated parameters, we predicted the outcome measure $\hat{y}_{ijk,post}$ for every household in the analysis assuming they were all in the treatment group. This is reasonable because the households in the treatment and comparison groups are statistically comparable at baseline. We then calculated the regression-adjusted treatment mean as the average for these predicted values. To determine the regression-adjusted control mean, we repeated this process but assumed that every household was in the control group.

For each outcome in the credit evaluation, we similarly estimated the parameters in the appropriate regression model [Equation (2)]. Instead of predicting the outcome measure for every household in the analysis, however, we used the estimated parameters to predict the outcome measure for only the households that received MCA credit. We then calculated the regression-adjusted treatment mean as the average of these predicted values. To determine the regression-adjusted control mean, we subtracted the estimated impact of MCA credit from the regression-adjusted treatment mean. This modification to the procedure for the training evaluation is justified because of the differences in characteristics of households that received or did not receive MCA credit.

4. Binary Outcomes

For outcome measures that were binary variables, such as adoption of specific agricultural practices or whether a household cultivates a specific type of crop, the linear regression models just described have two theoretical problems. (A linear regression model applied to a binary outcome measure is called a linear probability model; we use this terminology hereafter.) The first potential problem with a linear probability model is that predicted probabilities may be less than 0 or greater than 1. The second problem is that the error terms in the model will violate distributional assumptions, in which case statistical inference could be incorrect. To overcome these problems, researchers often use probit or logit models to estimate impacts when the outcome measure is a binary variable.

However, probit and logit models introduce practical problems of their own. Most notably, subsamples must be dropped from the analysis sample for probit and logit models when a control variable or set of variables perfectly predicts outcomes for that subsample. However, dropping subsamples from the analysis leads to misleading impact estimates and regression-adjusted means. This is especially problematic in the present context, where a vector of WUA fixed effects must be included in the model for the training evaluation. Any outcome measure that does not vary within a given WUA will result in all observations in that WUA being dropped from the analysis for that outcome measure.

Linear probability models do not have this practical problem, and the theoretical problems are rarely realized in practice. We tested the validity of the linear probability model against a probit model in the present context using two key binary outcome measures: poverty status (relative to the lower general poverty line) and the adoption of an OFWM organizational improvement. Besides being central to the analysis, these two binary outcome measures were chosen because few WUAs were dropped when we use the probit model. No WUAs were dropped from the probit model for the poverty measure, and only two WUAs were dropped for the OFWM organizational improvements measure. In the latter case, we dropped the same two WUAs from the linear probability model we ran for these comparisons. For both of these outcome measures, the estimated impacts were identical when rounded to the nearest percentage point, and the *p*-values were similar, suggesting that statistical inference based on the linear probability model was still valid. Moreover, across all of the binary outcomes examined in this report, we did not find any regression-adjusted treatment or control means below 0 or above 1 when using the linear probability model. We have also conducted extensive validation checks for other studies and found that linear probability, probit, and logit yield very similar results (McConnell et. al 2006, Trenholm et. al 2007).

For these reasons, we used linear probability models to estimate impacts of the training and credit programs on nearly all binary outcomes included in the present report. The only exceptions were for binary outcomes with rates less than 1 percent or greater than 99 percent. For outcomes

with such little variation, linear probability, probit, and logit models become unstable, and in the present context, also would have little meaning. For these outcomes, we instead report a simple difference in means for the research groups instead of using regression adjustment.

B. Nonresponse Weights

This section describes our approach to dealing with survey nonresponse. As discussed in Chapters I and II, there was no viable sample frame initially, so the survey firm worked with village mayors as part of the baseline FPS fieldwork to develop lists of farming households who would respond to the FPS. Subsequent rounds of the FPS attempted to interview the same households as at baseline. Hence, the data for each round of the FPS were designed to be representative of the set of 4,854 households who responded to the baseline FPS. Of those 4,854 households , 4,715 were in communities retained for our impact analysis.[48] Of that number, 3,547 households responded to the final follow-up survey, representing a 75-percent response rate among communities retained in our impact analysis. Response rates by marz and research group (treatment and control) are presented in Table A.2. The numbers of respondents in the treatment and control groups within each marz are shown in Table A.3.

Table A.2. Survey Response by Marz and Research Group (percentages)

Marz	Treatment Group Percentage	Control Group Percentage	Difference	*p*-value
Aragatsotn	76	68	8**	0.05
Ararat	79	81	-2	0.44
Armavir	71	77	-6**	0.02
Gegharqunik	74	77	-3	0.69
Kotayq	73	74	-1	0.72
Lori	49	70	-21**	0.05
Shirak	86	81	5	0.34
Syunik	75	77	-3	0.64
Tavush	76	81	-4	0.30
Vayots Dzor	79	77	2	0.79
Total	**74**	**76**	**-3**	

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

*/**/*** Significantly different from 0 at the .10/.05/.01 level, respectively, two-tailed test.

[48] As described in Chapter II, 3 WUAs were dropped from our analysis because the sole treatment or control community in those WUAs refused to participate in subsequent rounds of the FPS.

Table A.3. Numbers of Respondents by Marz and Research Group

Marz	Treatment Group	Control Group	Total
Aragatsotn	303	120	423
Ararat	441	290	731
Armavir	580	364	944
Gegharqunik	83	37	120
Kotayq	290	208	498
Lori	21	30	51
Shirak	86	81	167
Syunik	113	82	195
Tavush	161	146	307
Vayots Dzor	55	56	111
Total	**2,133**	**1,414**	**3,547**

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Although response rates were reasonably high, impact estimates could be biased if survey respondents differed from nonrespondents in ways that are correlated with outcomes of interest. To adjust for differences in observed characteristics between the two groups, we created weights for each household that had responded to the final follow-up survey. Using these nonresponse weights, the analysis of the data on households who responded to the final follow-up survey was representative of the baseline survey respondents along dimensions of observed characteristics.

The first step to creating weights for nonresponse was to estimate logistic regression models of the probability that a sample member responded to the final follow-up survey. The models were estimated using the 4,715 respondents from WUAs in our analysis sample. The dependent variable was whether the household had also responded to the final follow-up survey. Any characteristic of the household that may have been correlated with survey response and was reported on the baseline survey was a candidate to be a covariate in the model. The covariates we considered included the value of total agricultural production, agricultural expenditures, total land, employment income, other income, number of prime-age adults, number of elderly adults, number of children, and whether the household's head was female. We evaluated the agricultural production values by crop category as one set of covariates.

The set of covariates for the logistic regression model was chosen systematically in a process that mirrors the development of our regression models for the impact estimation (described in Section A.2 of this appendix). First, we ran simple logistic models that predicted response propensity based on each of the candidate covariates, one at a time, along with the stratification variables. Each covariate or set of covariates (for agricultural production value by crop category) that had a *p*-value of 0.20 or less in these simple models was retained as a candidate for the response propensity model. We then sorted the candidate covariates from most significant (smallest *p*-value) to least (largest *p*-value that is still less than 0.20). Starting with the most significant covariate(s), each covariate that remained from the first step was added to the response propensity model, one at a time. If the new covariate still had a *p*-value of 0.20, it was retained in the model. If the new covariate had a *p*-value greater than 0.20, it was dropped. In either case, we then proceeded to the next covariate. The number of adults in the household at baseline and the household's total value of crop production

were important predictors that were retained in this model, in addition to WUA indicators and treatment status.

The second step in creating nonresponse weights was to use the predicted values from the response propensity models to create weighting cells. Within each research group (treatment and control), five weighting cells were created that were determined by the size of the predicted likelihood that the household responded to the survey. This resulted in a total of 10 (5 x 2) weighting cells. The same nonresponse weight was assigned within each of these 10 cells. Calculating nonresponse weights within cells defined by predicted values, rather than using the predicted values directly, avoids large design effects due to outlier weights that can arise by chance.

The third step was to create the nonresponse weight for each cell. The nonresponse weight was calculated by dividing the total number of households in each cell by the total number of households that responded to the survey in each cell. For example, consider a control group household with a predicted response propensity based on the logistic model of 0.75. This puts the household in the lowest of the five ranked cells within its research group. There were 200 households within this cell (including the household described above). Of those 200 households, 144 responded to the final follow-up survey. Hence, if the household responded to the final follow-up survey, its nonresponse weight would be 200/144 = 1.39.

Finally, the weights were rescaled such that the sum of weights for the treatment group and the sum of weights for the control group each equal the original sample size of 4,715.

C. Outliers

Our approach to address outliers distinguishes between extreme values that are inconsistent with the respondent's other reported information and, hence, likely to be errors, and extreme values that may reflect rare farmers who may truly be high up in the distribution.

We recoded several outliers in the data that were inaccurate records of farming households. The most common problem was that production amounts were erroneously reported in drams rather than metric tons, likely because in the survey instrument the fields for value in drams and quantities in metric tons are next to each other. These farmers were identified systematically based on their reported amounts harvested and sold at baseline versus follow-up using the process outlined below.

First, we identified specific crop harvests and amounts sold where the farmer's report changed by over 200 tons from baseline to follow-up. Our analysis sample contained 14 of these harvests and sale amounts for barley, grape, peach, sweet cherry, potato, red beet, haricot, and gramma. We next examined each farmer's cultivated land areas and crop revenues in more detail to check whether the dramatic increase or decrease could be justified. None of the 14 identified harvests and sale amounts were accompanied by large changes in crop land area or revenues. Finally, we replaced the outlying number based on the information about land and crop revenues. For many of these 14 harvests, this consisted of treating a reported amount sold as the revenues for that crop. Similarly, we found 7 additional records that were recoded because they implied implausible prices per unit sold.

Then, we addressed outliers for which there was insufficient evidence to conclusively determine if the reported value was accurate. Our approach was to systematically censor measures of income, production, expenses, and land holdings at the 98th percentile for each measure, separately at baseline and follow-up. We censored these outliers that are potentially accurate because their influence on the model would make the impact estimates less relevant for the typical farmer, and

because we suspect that there was some misreporting that we could not address among this small subsample. We conducted sensitivity analyses to assess the influence of these plausible outliers, as described in Chapter II.

APPENDIX B

ADDITIONAL TABLES

Table B.1. Impacts of WtM Training on OFWM Practices (percentages)

	Treatment Group Percentage	Control Group Percentage	Impact	*p*-value
Simple Improvements	45	45	0	0.94
Modification of furrow sizes	44	43	1	0.78
Plastic cover for ditch	3.3	2.9	0.4	0.78
Siphons	0.5	0.1	0.3	0.31
Spiles	0.5	0.2	0.3	0.36
Dams (metal or plastic)	0.1	0.1	0.0	0.91
Medium Improvements	0.2	0.0	0.2	--
Movable gated pipes	0.1	0.0	0.1	--
Hydrants	0.0	0.0	0.0	--
Advanced Improvements	0.5	0.1	0.3*	0.06
Sprinkler irrigation	0.1	0.0	0.1*	0.08
Micro-sprinkler irrigation	0.1	0.0	0.1	0.16
Drip irrigation	0.2	0.1	0.1	0.55
Irrigation Scheduling Improvements	0.1	0.1	0.0	0.86
Soil moisture meter	0.1	0.1	0.0	0.86
ET gauge	0.0	0.0	0.0	--
Organizational Improvements	76	79	-3	0.27
Preparation of irrigated land	60	61	-2	0.74
Water measurement at farm gate	0.0	0.1	0.0	0.71
Have copy of water supply contract from WUA	45	45	1	0.89
Updated the annex to the water supply contract	10	9	1	0.77
Presented water order to the WUA about cultivated crops	19	16	3	0.52
Placed written water order	0.4	0.9	-0.5	0.54
Sample Size	**2,133**	**1,414**		

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group percentages were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods.

*/**/*** Significantly different from zero at the .10/.05/.01 levels, respectively, two-tailed test.

Table B.2. Impacts of WtM Training on Industrial- Economical HVA Practices (percentages)

	Treatment Group Percentage	Control Group Percentage	Impact	*p*-value
Produced High-Value Crops for Budget Reasons	2.8	2.6	0.2	0.88
Produced Nontraditional Crops	0.1	0.2	-0.1	0.49
Changed Crop or Variety Based on Demand	3.7	3.7	0.0	1.00
Mixed Crops	1.8	3.2	-1.4	0.26
Produced Multiple Yields	2.3	2.2	0.2	0.86
Established or Renewed an Orchard	10	11	-1	0.73
Established or Renewed a Greenhouse	11	9	2	0.44
Improved Soil Preparation Activities (plowing, cultivation, etc.)	26	21	6	0.11
Used High-Quality, Disease-Resistant Seeds or Planting Material	5.8	5.6	0.2	0.94
Improved Post-Planting Practices (weeding, fertilization, pest control, etc.)	12	11	1	0.73
Shifted Time of Harvest by Using Plastic Tunnels or Planting Seedlings	1.4	2.0	-0.6	0.48
Sample Size	**2,133**	**1,414**		

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group percentages were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

HVA = High-Value Agriculture.

Table B.3. Impacts of WtM Training on Social- Environmental HVA Practices (percentages)

	Treatment Group Percentage	Control Group Percentage	Impact	*p*-value
Used Nonchemical Methods of Pest and Disease Management	0.3	0.6	-0.3	0.29
Used Only Pesticides Permitted in Armenia	62	56	6	0.15
Purchased Pesticide from Licensed Stores	58	50	8*	0.08
Did not Purchase Pesticides in Damaged Packaging	50	44	6	0.22
Used Safety Equipment When Working with Pesticides	49	49	0	0.91
Bought Pesticides for a Specific Problem (diseases, insects), Avoiding Residuals	57	54	3	0.46
Harvested Crops after the Pesticide's Waiting Period	55	50	5	0.26
Did not Burn or Discard Residual Pesticide into the Ditch or Mudflow Conduits	45	41	4	0.41
Did not Use Excessive Amounts of Chemical Fertilizer(s)	23	20	2	0.54
Did not Burn Organic Waste Remaining after Harvesting Crops	0.0	0.1	-0.1	0.32
Prepared Compost and Used It as Organic Fertilizer	0.1	0.2	-0.1	0.42
Used Organic Fertilizers with Appropriate Methods	12	12	0	0.95
Sample Size	**2,133**	**1,414**		

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group percentages were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

Table B.4. Impacts of WtM Training on Respondent Households' Land Areas for Crops (hectares)

	Treatment Group Mean	Control Group Mean	Impact	*p*-value
Total	1.2	1.2	0.0	0.78
HVA crops	0.4	0.4	0.0	0.50
Grape	0.1	0.1	0.0	0.18
Other fruits or nuts	0.2	0.2	0.0	0.56
Tomato	0.0	0.0	0.0	0.94
Vegetables and herbs	0.0	0.0	0.0	0.47
Potato	0.0	0.0	0.0	0.27
Non-HVA crops	0.7	0.7	0.0	0.57
Grain	0.4	0.4	0.0	0.42
Grass	0.3	0.3	0.0	0.99
Sample Size	**2,133**	**1,414**		

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group means were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

Table B.5. Impacts of WtM Training on Production of Crops (metric tons)

	Treatment Group Mean	Control Group Mean	Impact	*p*-value
High- Value Agriculture				
Grape	0.6	0.9	-0.3**	0.04
Other Fruits or Nuts	0.5	0.5	0.0	0.83
Apple	0.0	0.0	0.0	0.20
Peach	0.0	0.0	0.0	0.82
Apricot	0.0	0.0	0.0	0.35
Pear	0.0	0.0	0.0	0.95
Prunes	0.0	0.0	0.0	0.19
Plum	0.0	0.0	0.0	0.62
Fig	0.0	0.0	0.0	0.96
Pomegranate	0.0	0.0	0.0*	0.09
Sweet cherry	0.0	0.0	0.0	0.87
Cherry	0.0	0.0	0.0	0.47
Cornel	0.0	0.0	0.0	0.22
Quince	0.0	0.0	0.0*	0.08
Watermelon	0.1	0.1	0.0	0.49
Melon	0.2	0.1	0.1	0.24
Lemon	0.0	0.0	0.0	--
Malta orange	0.0	0.0	0.0***	0.00
Walnut, hazelnut	0.0	0.0	0.0	0.44
Strawberry	0.0	0.0	0.0	0.35
Tomato	0.5	0.4	0.1	0.20
Other Vegetables or Herbs	0.8	0.7	0.1	0.65
Pumpkin	0.0	0.0	0.0	0.87
Cucumber	0.1	0.2	0.0	0.65
Eggplant	0.1	0.1	0.0	0.77
Pepper	0.0	0.0	0.0	0.93
Cabbage	0.1	0.1	0.0	0.50
Carrot	0.1	0.0	0.1	0.26
Squash	0.0	0.0	0.0	0.29
Onion	0.0	0.0	0.0	0.47
Garlic	0.0	0.0	0.0	0.19
Red beet	0.0	0.0	0.0	0.22
Greens	0.0	0.0	0.0	0.67
Potato	0.4	0.3	0.1**	0.01
Other HVA	0.0	0.0	0.0	0.45
Sunflower	0.0	0.0	0.0	0.50
Haricot	0.0	0.0	0.0	0.59
Tobacco	0.0	0.1	0.0	0.59
Sorgo	3.9	0.6	3.3*	0.08
Planting stock	0.0	0.0	0.0	--

Table B.5. *(continued)*

	Treatment Group Mean	Control Group Mean	Impact	*p*-value
Non- High- Value Agriculture				
Grain	0.6	0.5	0.1	0.11
Wheat	0.4	0.3	0.1	0.19
Barley	0.1	0.1	0.0*	0.07
Maize	0.0	0.0	0.0	0.88
Emmer wheat	0.0	0.0	0.0	0.53
Grass	1.2	1.2	0.0	0.76
Natural grass	0.3	0.3	0.0	0.54
Gramma or other feed	0.8	0.9	-0.1	0.63

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group means were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods. Because of difficulties measuring the amount of flower production in a way that is comparable to other crops, we omit flowers from this table.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

Table B.6. Impacts of WtM Training on Revenues from Crops Sold (USD)

	Treatment Group Mean	Control Group Mean	Impact	*p*-value
High- Value Agriculture				
Grape	213	280	-67*	0.09
Other Fruits or Nuts	206	214	-8	0.80
Apple	1	1	1	0.13
Peach	14	13	1	0.78
Apricot	34	45	-12	0.56
Pear	3	2	1	0.79
Prunes	8	3	5	0.19
Plum	0	3	-3*	0.08
Fig	1	1	-1	0.34
Pomegranate	0	3	-2	0.11
Sweet cherry	12	9	3	0.40
Cherry	1	1	0	0.93
Cornel	2	4	-2	0.27
Quince	0	0	0*	0.09
Watermelon	13	14	-2	0.54
Melon	25	19	6	0.61
Lemon	0	0	0	--
Malta orange	0	4	-4**	0.01
Walnut, hazelnut	10	11	-1	0.91
Strawberry	22	29	-8	0.40
Tomato	150	119	31	0.14
Other Vegetables or Herbs	240	192	48	0.17
Pumpkin	0	0	0	0.91
Cucumber	41	45	-5	0.69
Eggplant	19	15	4	0.45
Pepper	17	16	1	0.73
Cabbage	19	21	-2	0.71
Carrot	17	3	14	0.15
Squash	5	2	3**	0.03
Onion	15	31	-16	0.14
Garlic	2	0	2	0.21
Red beet	1	0	0	0.55
Greens	11	9	2	0.39
Potato	72	40	32**	0.03
Other HVA	26	32	-5	0.55
Sunflower	13	4	9*	0.06
Haricot	6	10	-3	0.32

Table B.6. *(continued)*

	Treatment Group Mean	Control Group Mean	Impact	*p*-value
Tobacco	10	15	-4	0.61
Sorgo	4	1	4	0.24
Planting stock	0	0	0	--
Flowers	21	15	6	0.42
Non- High- Value Agriculture				
Grain	32	27	5	0.47
Wheat	16	14	2	0.52
Barley	4	3	2	0.34
Maize	8	13	-5	0.34
Emmer wheat	7	4	3	0.66
Grass	22	21	1	0.87
Natural grass	2	3	-1	0.45
Gramma or other feed	20	19	1	0.75
Other Non-HVA	4	1	4	0.24

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group means were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

USD = United States dollars.

Table B.7. Impacts of WtM Training on Market Value of Harvests (USD)

	Treatment Group Mean	Control Group Mean	Impact	*p*-value
High- Value Agriculture				
Grape	240	320	-80**	0.05
Other Fruits or Nuts	298	292	5	0.89
Apple	29	19	10	0.12
Peach	18	17	1	0.81
Apricot	10	8	2	0.44
Pear	4	4	0	0.72
Prunes	1	1	0	0.21
Plum	0	0	0	0.65
Fig	2	2	-1	0.52
Pomegranate	1	4	-2	0.11
Sweet cherry	2	3	0	0.70
Cherry	0	0	0	0.38
Cornel	0	0	0	0.22
Quince	3	1	3*	0.09
Watermelon	13	14	-2	0.53
Melon	25	19	6	0.62
Lemon	0	0	0	--
Malta orange	1	7	-7***	0.00
Walnut, hazelnut	16	18	-2	0.65
Strawberry	23	29	-7	0.48
Tomato	177	139	38*	0.10
Other Vegetables or Herbs	285	222	63	0.11
Pumpkin	0	0	0	0.95
Cucumber	51	55	-3	0.78
Eggplant	24	21	3	0.53
Pepper	22	21	1	0.79
Cabbage	26	27	-1	0.83
Carrot	24	2	22	0.22
Squash	6	2	3*	0.08
Onion	2	2	0	0.39
Garlic	5	2	4	0.22
Red beet	2	0	1	0.11
Greens	11	8	3	0.33
Potato	141	95	47***	0.01
Other	53	58	-4	0.72
Sunflower	15	7	8	0.12
Haricot	28	32	-4	0.61
Tobacco	10	15	-4	0.61
Sorgo	5	1	5	0.19
Planting stock	0	0	0	--
Flowers	21	15	7	0.40

Table B.7. *(continued)*

	Treatment Group Mean	Control Group Mean	Impact	*p*-value
Non- High- Value Agriculture				
Grain	180	155	25	0.21
Wheat	115	102	13	0.30
Barley	26	18	8*	0.07
Maize	1	1	0	0.97
Emmer wheat	17	12	6	0.53
Grass	117	111	6	0.63
Natural grass	24	22	3	0.61
Gramma or other feed	82	83	-1	0.93
Other Non-HVA	5	1	5	0.19

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group means were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

USD = United States dollars.

Table B.8. Impacts of WtM Training on Respondents' Annual Monetary Household Income (USD)

	Treatment Group Mean	Control Group Mean	Impact	*p*-value
Nonagricultural Income	2,275	2,276	-2	0.98
Agricultural Income				
Total agricultural sales	1,263	1,219	44	0.70
Monetary profits (sales – costs)	423	357	67	0.50
Total Monetary Income	2,792	2,697	95	0.50

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group means were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

USD = United States dollars.

Table B.9. Impacts of WtM Training on Land Owned and Irrigated (hectares), Uncensored

	Treatment Group Mean	Control Group Mean	Impact	*p*-value
Total Agricultural Land				
All	1.8	1.8	0.0	0.87
Irrigated	0.8	0.9	-0.1	0.16
Arable Land				
All	1.3	1.3	0.0	0.98
Irrigated	0.4	0.5	0.0	0.41
Orchard				
All	0.1	0.2	-0.1*	0.05
Irrigated	0.1	0.2	-0.0**	0.05
Vineyard				
All	0.1	0.1	0.0	0.29
Irrigated	0.1	0.1	0.0	0.30
Kitchen Plot				
All	0.2	0.2	0.0	0.47
Irrigated	0.1	0.1	0.0	0.48
Other				
All	0.1	0.1	0.1	0.40
Irrigated	0.0	0.0	0.0	0.53
Sample Size	**2,133**	**1,414**		

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group means were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

Table B.10. Impacts of WtM Training on Production, Revenues, and Market Value of Harvests (USD except where indicated), Uncensored

	Treatment Group Mean	Control Group Mean	Impact	*p*-value
Agricultural Production (Metric Tons)				
Total	6.7	7.2	-0.4	0.59
HVA crops	4.5	4.7	-0.2	0.77
Grape	0.8	1.2	-0.4*	0.04
Other fruits or nuts	0.8	0.8	0.0	0.93
Tomato	0.9	0.7	0.2	0.28
Vegetables and herbs	1.2	1.2	0.0	0.92
Potato	0.6	0.5	0.1	0.21
Non-HVA crops	2.2	2.5	-0.3	0.59
Grain	0.7	0.6	0.1	0.31
Grass	1.5	1.9	-0.4	0.45
Land under Cultivation (hectares)				
Total	1.3	1.2	0.1	0.30
HVA crops	0.5	0.5	0.0	0.60
Non-HVA crops	0.8	0.7	0.0	0.40
Revenues from Crops Sold				
Total	1,737	1,503	235	0.43
HVA crops	1,638	1,386	251	0.40
Grape	279	376	-97	0.11
Other fruits or nuts	268	322	-54	0.33
Tomato	231	151	80*	0.07
Vegetables and herbs	657	388	270	0.30
Potato	124	64	60**	0.03
Other HVA crops	76	88	-12	0.66
Non-HVA crops	103	112	-9	0.67
Grain	61	68	-6	0.72
Grass	39	39	-1	0.96
Other non-HVA crops	5	1	4	0.25
Market Value of Harvests				
Total	2,443	2,032	411	0.19
HVA crops	2,064	1,695	369	0.23
Grape	305	410	-105*	0.08
Other fruits or nuts	418	414	5	0.95
Tomato	287	173	114**	0.02
Vegetables and herbs	721	413	308	0.23
Potato	220	184	36	0.39
Other HVA crops	108	109	-1	0.97

Table B.10. *(continued)*

	Treatment Group Mean	Control Group Mean	Impact	*p*-value
Non-HVA crops	381	335	46	0.19
Grain	217	200	17	0.58
Grass	158	132	26	0.17
Other non-HVA crops	6	1	5	0.20
Sample Size	**2,133**	**1,414**		

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group means were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

USD = United States dollars. HVA = High-Value Agriculture.

Table B.11. Impacts of WtM Training on Annual Economic Household Income (USD), Uncensored

	Treatment Group Mean	Control Group Mean	Impact	*p*-value
Nonagricultural Income	2,359	2,333	26	0.77
Agricultural Income				
Total value of harvest	2,443	2,032	411	0.19
Agricultural profit (value – costs)	1,577	1,147	431	0.15
Total Economic Income	3,941	3,485	457	0.15
Sample Size	**2,133**	**1,414**		

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group means were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

USD = United States dollars.

Table B.12. Impacts of WtM Training on Consumption Relative to Poverty Lines (means), Uncensored

	Treatment Group Mean	Control Group Mean	Impact	*p*-value
Consumption Relative to Food Poverty Line	265	266	-1	0.89
Consumption Relative to Lower Poverty Line	183	184	-1	0.89
Consumption Relative to Upper Poverty Line	149	150	-1	0.89
Sample Size	**2,133**	**1,414**		

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group means were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods.

*/**/*** Significantly different from 0 at the .10/.05/.01 levels, respectively, two-tailed test.

Table B.13. Standard Errors and Minimum Detectable Impacts of WtM Training on Key Outcomes

	Treatment Group Mean	Control Group Mean	Impact	Standard Error	Minimum Detectable Impact
Simple OFWM Practices (%)	45.2	44.9	0.4	4.6	12.9
Established or Renewed a Greenhouse (%)	10.6	9.0	1.6	2.1	5.9
Land Under Cultivation for HVA Crops (hectares)	0.42	0.43	-0.02	0.03	0.08
Agricultural Profits (USD)	1,006	841	166	978	273
Economic Income (USD)	3,386	3,180	206	150	419
Households Below the Lower Poverty Line (%)	15.5	15.2	0.3	1.9	5.2

Sources: 2007-2008 and 2010-2011 Farming Practices Surveys.

Note: Measured at follow-up, treatment and control group means were regression adjusted for differences in baseline characteristics and estimated using nonresponse weights. Reported impact may not equal difference in reported treatment and control means due to rounding. See Appendix A for description of estimation methods. The minimum detectable impacts assume a confidence level of 95 percent, two-tailed tests, and 80 percent power, resulting in a factor of 2.8. The minimum detectable impact uses the estimated standard error multiplied by this factor.

APPENDIX C

FARMING PRACTICES SURVEY: ROUND 3 INSTRUMENT

Don't Know 96
Refused to Answer 97

FARMING PRACTICES SURVEY
Round III 2010-2011

QUESTIONNAIRE No

Marz Code	Cluster/settlement code	Sample list type 1. baseline respondent 2. baseline hh other member 3. Tier One 4. Tier Two 5. MCA-Armenia credit borrower survey	Respondent ID	Interviewer Code	Questionnaire is valid Coordinator's signature	Questionnaire is checked Quality Control Member signature

Hello, my name is **(First name, last name)**.I represent AREG SCYA NGO, which implements Farming practices survey in the RA marzes by the order of "Millennium Challenge Account-Armenia". The published research will never report your answers linked to your name and will greatly contribute to the elaboration of projects directed to the agricultural development in Armenia.

Name of respondent

_____

First Name, Middle Name, Last Name

Contacts of the respondent: phone number (code+number) _____
Mobile (code+number) _____

Date (day.month.year) _____

Start time (hh/mm) _____

Don't Know 96
Refused to Answer 97

HOUSEHOLD DESCRIPTION

A. LAND AND LIVESTOCK

A1. How many years have you been farming (excluding years in which the kitchen plot was cultivated alone)?

1. _____ years
98. Only ever cultivated a kitchen plot

A2. Did any changes take place in total area of your land in the last year.

1. Yes
2. No (then => A4)

A3. If yes, what was the main reason?

1. Purchase of additional land
2. Selling of the land
3. Divorce
4. division between other members of the family
5. ownership registration change
6. Other (specify)_____

A4.What is the total area of the land* owned and/or rented by your household and how much of your land did you actually irrigate during the last agricultural season, in 2010?

		Total agricultural land, ha	Of which:		
			Was possible to irrigate by network, sqm	Actually irrigated in 2010, sqm	of which: by irrigation network water, sqm
		1	2	3	4
1	Total, of which				
2	Arable land				
3	Orchards				
4	Vineyards				
5	The plot near the house/kitchen plot				
6	Other				

*** the rented out land should not be included in the area**

A5. What sources of irrigation do/did you use in 2010?

		Did you Irrigate by?			
		Irrigation water	Drinking water	Deep well and artesian well water	Natural sources/river/lake/collected rainwater, etc.
		1	2	3	4
1.	Arable land				
2.	Orchards				
3.	Vineyards				
4.	The plot near the house/kitchen plot				
5.	Other				

Don't Know 96
Refused to Answer 97

A6. Do you have livestock?

1. Yes, ***to the Interviewer: fill in the table* A7 *below.***
2. No (then =>B1)

A7. Information on households' livestock

N	Item	Available livestock
1	Cow	
2	Pig	
3	Sheep and goat	

B. ROSTER OF CROPS GROWN DURING THE LAST AGRICULTURAL SEASON AND CHANGES THEREIN

B1. Crop production and utilization in the field (including kitchen plot) during the last year.
To the Interviewer: Use Card 1 to fill in the table and fill the numbers in fixed format.

						Of which:		
N	Item (*Input Code using the Card 1*)	1. In the field 2.In the kitchen plot 3.Both	How much was cultivated? *Fill in the responses for each type of crops in format which is specified in Card 1 (only one column for each crop should be filled in: either sq.m, or number of trees).*	How much was irrigated/watered? *Fill in the responses for each type of crops in format which is specified in Card 1 (only one column for each crop should be filled in: either sq.m, or number of tree).*	Total amount harvested in the last season	How much was sold?		How much was bartered?
			sq. m./ number of trees	sq. m./ number of trees	Using units specified in Card 1	Using units specified in Card 1	AMD	Using units specified in Card 1
	1	2	3	4	5	6	7	8
1.								
2.								
3.								
4								
5.								
6.								
7.								
8.								
9.								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								

Don't Know 96
Refused to Answer 97

B2. During the past agricultural season, did you do any of the following practices?
To the Interviewer: Provide the respondent with Card 2. Check all applicable answers

Practice code	Used at the kitchen plot	Used at other land
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		
17.		
18.		
19.		
20.		
21.		
22.		
23.		
24.		
25.		
26.		

B3. During recent agricultural season, did you grow different crops from the previous year?

1. Yes
2. No (then =>B5)

B4. What is the main reason you changed your cropping pattern?
1. Improved irrigation
2. Lack of water
3. Weather
4. Market conditions
5. Cost of inputs
6. Government subsidies
7. Trying new varieties of crops
8. Access to training
9. Because of land resting
10. Other (specify)_____

B5. During the last agricultural season, did you bring any of your produce to a consolidation or collection center for it to be sorted and transported for selling?
1. Yes
2. No (then =>C1.)

B6. Approximately what fraction of your produce did you take to the consolidation center? (%)_____

Don't Know 96
Refused to Answer 97

C. WATER USE

C1. Do you have a personal tank, artesian well, or reservoir that you use to water crops?
1. Yes
2. No

C2. Do you have a personal pump that you use to pump water?
1. Yes
2. No

C3. What irrigation practices did you use during the last agricultural season at your kitchen plot and at other land?
To the Interviewer: Show CARD 3. Check all possible answers and fill the codes into the space below.
66. None of mentioned (then=>C5)

1. at the kitchen plot

2. at other land

C4. Did any of these practices help you save labor?
1. Yes 2. No

C5. Did you incorporate any agricultural practices that changed the way you use fertilizers or pesticides?
1. Yes 2. No

D. FARMING EXPENDITURES

D1.

N	Items	How much was spent on the mentioned items during the last season? AMD (or foreign currency expressed in AMD)	How much was spent on the mentioned items during the last season? ***To the Interviewer: If items were bartered, write down the quantity of mentioned products expressed in drams, for example potatoes for 5000 AMD***
		1	2
1	All kind of fertilizers and pesticides		
2	Irrigation		
3	Hired labor and hired equipment or tools (including spare parts, fuel etc.)		
4	Taxes and duties		
5	Seeds and seedlings		
6	Cellophanes		
7	Other major expenses (specify)		

Don't Know 96
Refused to Answer 97

E. Trainings

E1. During the past year, was any farming or irrigation training offered in your community or nearby communities?

1. Yes
2. No (then =>F1)
96. Don't know (then =>F1)

E2. Did you or anyone else in your household attend any of the trainings?

1. Yes
2. No (then => F1)

E3. What kind of training was it? (*To the Interviewer: Check all that apply*)

1. water use and irrigation
2. land cultivation and crop production
3. other (describe)_____

E4. Did the person(s) who attended receive a certificate at the end of training?

1. Yes
2. No

F. Agriculture Equipment

F1. Do you currently own or rent any of the following?

No	Equipment	Check if **Yes owner**	Check if **Yes rent/borrow**
		1	2
1	Trucks and Tractors		
2	Combine		
3	Seed planter		
4	Sprayer		
5.	Kirov 6		

55. I don't have it

Don't Know 96
Refused to Answer 97

G. Agricultural Credit

G1. Have you applied for a loan during last 5 years?

1. Yes
2. No (Go to section H)

G 2. Agricultural credit history in last 2 years or loan outstanding now that were received more than 5 years ago.

								1. Greenhouse 2. Orchards 3. Cold storage 4. Dry fruit 5. Livestock 6. Equipment (tractor) 7. Seeds/seedling/sprout 8. Land purchase/ renting 9. Non-agricultural purposes 10. Other			
N	**Source/Credit provider** ***/USE CARD 4/***	**MCA credit 1.Yes 2.No**	**Amount applied for (AMD)**	**Amount received (AMD) In case application was rejected put "0" and go to the next line/ loan**	**Date received (year, month)**	**Annual interest rate**	**Are you on schedule with your payments? 1.Yes 2.No**	**Maturity data (year, month)**	**Purposes (up to 2)**	**Collateral 1. yes 2. no⇒ go to the next loan/line**	**Collateral type: 1.Land 2.Real estate 3.Machinery 4.Car 5.Other**	**Collateral value, AMD**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1.						**%**						
2.						**%**						
3.						**%**						
4.						**%**						

Don't Know 96
Refused to Answer 97

H. CONSUMPTION AND MONETARY INCOME OF HH MEMBERS

H1. How much is spent by your family for the following purposes during a typical month?

Cost Item	*Drams*
1. Food	
2. Housing products (e.g. soup, washing powder etc).	
3. Public utilities (electricity, telephone, apartment rent, water, cell phone)	
4. Transport	
5. Other monthly costs ***(specify)***	

H2. How much was spent by your family for the following purposes last year?

Cost Item	*Drams*
1. Healthcare	
2. Education	
3. Other annual costs	

H3. How much monetary income did your household receive from the following sources last year?

Income	*AMD*
1. Pension	
2. Remittances from HH absent members (abroad or other RA cities)	
3. Giving for rent land, transport, other	
4. Other benefits (social)	

Don't Know 96
Refused to Answer 97

I 1. I would like to make a complete list of all the members of your household, both present and absent. By saying a household I mean people who usually live together, share the same housekeeping and have the same budget. At first, I would like to write down the name of the person who makes most of agricultural decisions in your household, then his spouse, their children and then other members of the household. Do not include the visitors.

To the Interviewer: Circle the number of respondent in the column of h/h members.

Questions from 5 and 6 should be asked for farmer, spouse and their children over 16 only.

No of h/h member	Household members and their relationship to the head of h/h 1.head 2.spouse 3.son/daughter 4.son in law/ daughter in law 5.grandchild 6.father/mother of head / spouse 7.sister/brother 8.other relatives of the head 9. persons that do not have any relationship to the head	Gender 1. male 2. female	Age (write down number)	If any of the household members who usually live here are currently absent, indicate by marking "**1**" in their row	During any stage of the last agricultural season, which people in the household were actively working in agriculture as their main activity? 1. Yes 2. No	What is the level of education completed? (starting from 16- year- olds) 1.non-educated 2.incomplete primary 3.primary 4.incomplete general secondary 5.general secondary 6.incomplete secondary 7.secondary (full) 8.secondary vocational 9.incomplete higher 10. higher 11. post-graduate
	1	2	3	4	5	6
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Don't Know 96
Refused to Answer 97

J. OCCUPATION AND PAID JOBS OF HH MEMBERS

J. Did any of your hh members have any paid work during last year? Please specify which of them. We would like to ask several questions about their occupation and jobs. ***Should be asked for hh members over 16 only.***

66. No one

No of h/h member having job during last year (using Codes from the first column of I1)	Mainly what kind of job it was? 1. Agricultural work for others inside the village 2. Agricultural work for others outside the village 3. Non-agricultural work inside the village 4. Non-agricultural work outside the village 5. Other (specify)	Was that job: 1. full time monthly paid job 2. one-time short-term job 3. periodical short-term job 4. Other	In which of the following sectors your hh members were mostly involved for their non-agricultural jobs? 1. Construction 2. Transportation 3. Food and service sector 4. Trade 5. Crafts 6. Education 7. Healthcare 8. Village Mayor Office/ WUA/ other community services 9. Armed Forces 10. NGO sector 11. Other	How much was earned during last year by your household members having any paid jobs in AMD?	If the HH members received any in-kind (non financial) payment for that job, how much was earned valued in AMD during last year? ***Write down the amount of in-kind payment in AMD.*** ***55. Received in-kind payment: Value unknown***
1	**2**	**3**	**4**	5	**6**

Thank you for cooperation.

End time (hh:mm)_____

CARD 1

Code	Crop	Cultivation, irrigation units	Selling units
1.	Wheat	sq.m	t.
2.	Emmer Wheat	sq.m	t.
3.	Barley	sq.m	t.
4.	Maize	sq.m	t.
5.	Apple	number of trees	t.
6.	Grape	sq.m	t.
7.	Peach	number of trees	t.
8.	Apricot	number of trees	t.
9.	Pear	number of trees	t.
10.	Prunes	number of trees	t.
11.	Plum	number of trees	t.
12.	Fig	number of trees	t.
13.	Pomegranate	number of trees	t.
14.	Sweet Cherry	number of trees	t.
15.	Cherry	number of trees	t.
16.	Cornel	number of trees	t.
17.	Quince	number of trees	t.
18.	Water melon	sq.m	t.
19.	Melon	sq.m	t.
20.	Pumpkin	sq.m	t.
21.	Lemon	number of trees	t.
22.	Malta orange	number of trees	t.
23.	Walnut, hazelnut	number of trees	t.
24.	Strawberry	sq.m	t.
25.	Tomato	sq.m	t.
26.	Cucumber	sq.m	t.
27.	Eggplant	sq.m	t.
28.	Pepper	sq.m	t.
29.	Cabbage	sq.m	t.
30.	Carrot	sq.m	t.
31.	Squash	sq.m	t.
32.	Onion	sq.m	t.
33.	Garlic	sq.m	t.
34.	Potato	sq.m	t.
35.	Red beet	sq.m	t.
36.	Sunflower	sq.m	t.
37.	Haricot	sq.m	t.
38.	Tobacco	sq.m	t.
39.	Sorgo	sq.m	bunches
40.	Greens (coriander, basil, parsley, tarragon, etc.)	sq.m	bunches
41.	Grass (natural)	sq.m	t.
42.	Planting Stock	number	number
43.	Flowers	sq.m	pieces
44.	Gramma or other special feed	sq.m	t.
45.	Other fruits (specify)	Specify	Specify
46.	Other vegetables (specify)	specify	Specify

Card 2

1. **High value crop production instead of low value based on crop budget calculations**
2. **Crop/variety change based on market (fresh or processing) demand or request.**
3. **Orchard establishment or renewing (using regular trees)**
4. **Orchard establishment or renewing (using dwarf trees)**
5. **Greenhouse (glass) establishment or renovation**
6. **Greenhouse (plastic) establishment or renovation**
7. **Mixed cropping (associated cropping - planting more than one crop at a same time on the same place) to reduce the production risks**
8. **Production of non-traditional crops**
9. **Usage of high quality, disease resistant seeds/varieties or planting material (seedlings, potato tubers)**
10. **Multiple crop production (getting more than one yield per year)**
11. **Improved practices on soil preparation (plowing, cultivation etc.)**
12. **Improved post planting practices for vegetables in the open field (weeding, fertilization, pest & disease control etc.)**
13. **Shifting time of harvesting by using plastic tunnels or seedlings**
14. **Have used only the pesticides permitted in the Republic of Armenia**
15. **Have bought pesticide from licensed stores**
16. **Have bought pesticides only for a specific problem (diseases, insects), avoiding the residuals**
17. **Have paid attention on the packaging and the tare completeness of pesticides: did not bought damaged or pesticides with flowing**
18. **Have used personal protection equipments while working with pesticides (gloves, goggles, respirator, apron, top-boots and others)**
19. **Have done harvesting following the pesticide's waiting period**

20. **Have not burned pesticides' residuals and tare, or throw them to the ditch/mudflow conduits anymore**
21. **Have used non-chemical methods of pest and diseases management (vegetal infusions, traps, seizing belts)**
22. **Have paid attention on the normalized usage of chemical fertilizers (avoid the over fertilizing (for example, saltpeter fertilizer))**
23. **Have stopped burning the plant remaining (the remaining of cereal after the harvesting), leaves and other organic wastes remained after the agricultural works (plant remaining and others)**
24. **Have prepared compost and have used it as an organic fertilizer**
25. **Have used organic fertilizers applying the right technology of manure treatment, composting, biohumus, green fertilizing (sideration), bacterial substances and others**
26. **Other (specify)**
27. **None of the above**

CARD 3

1. **Proper preparation of irrigated land (collecting stones, adjusting slopes, weeding etc.)**
2. **Modification of furrow sizes (length, width, depth and inter-furrow area)**
3. **Ditch covering with plastic cover**
4. **Siphons**
5. **Dams (metal or plastic)**
6. **Moveable gated pipe**
7. **Spiles**
8. **Hydrants**
9. **Sprinkler irrigation**
10. **Micro sprinkler irrigation**
11. **Drip irrigation**
12. **Soil moisture meter (Watermark, Tensiometer etc.)**
13. **ET gauge data**
14. **Water measurement at farm gate (through YAGYUS or V-notch weir)**
15. **Have taken my copy of water supply contract signed with WUA**
16. **Presented order to the WUA about the cultivated crops**
17. **Have updated the Annex to the water supply contract**
18. **Have placed water order in a written form**
19. **Other (specify)**

CARD 4

1. Sef international UCO
2. “AGBA LIZING” UCO
3. “AGROLIZING LIZING CREDIT ORGANIZATION” LtD
4. “Izmirlyan-Eurasia" UCO
5. “AREGAK” UCO
6. “Finka” UCO
7. “Nor Horizon” UCO
8. “NORVIK” UCO
9. “Malatia UCO” LTD
10. “GARNI INVEST” UCO
11. “Ecumenic Church Credit Foundation” UCO
12. “GFC General financial and credit company “ UCO
13. “Farm Credit Armenia” UCO
14. “Card Agro Credit” UCO
15. “Aniv” UCO
16. “Anelik Bank”
17. “AREXIMBANK”
18. “ArdshinInvestBank”
19. “ArtsackBank”
20. “Armenian Development Bank”
21. “HSBC-Armenia”
22. “Byblos Bank Armenia”
23. “InecoBank”
24. “ConverseBank”
25. “AGBA-CREDIT AGRICOL BANK”
26. “ARMECONOMBANK”
27. “ARMBISNESSBANK”
28. “VTB-Armenia Bank”
29. “AraratBank”
30. “AMERIABANK”
31. “MELLAT BANK”
32. “PrometeyBank”
33. “UNIBANK”
34. “PRO CREDIT BANK”
35. Other (specify)

APPENDIX D

ISSA MILESTONES

Table D.1. ISSA Milestones and their Measurement

	Milestone Description	Milestone Measurement
1	A working group established by the WUA.	ISSA consultants receive a written memo from the WUA board that includes the names of the MIP working group members and their responsibilities.
2	A detailed work plan developed by the WUA and agreement reached on 6 priority issues that can be implemented by the WUA.	ISSA consultants receive a signed memo from the WUA board that presents the priority issues.
3	Information boards are installed in the WUA and the communities in its capture area. These boards should present the annual budget.	ISSA consultants make checks during the consultations.
4	The WUA has undertaken steps to hold two representative meetings annually.	The WUA board in principle agrees to conduct a representative meeting in fall, during which this approach will be approved. This should be documented together with the minutes of the board meetings.
5	The WUA has undertaken steps for the farmers and their representatives to meet twice a year.	Copies of the minutes should be handed over to the ISSA consultants.
6	By the end of 2009, the WUA has made 100% of its payments to the WSA.	Assurances from the WSA that 100% of payments were made for supplied water.
7	The WUA has undertaken steps to collect WUA membership fees and the collection rate has reached 80%.	Representative meeting minutes confirming that membership fees are paid at the moment of signing water supply contracts.
8	Dispute Resolution Committees became operational; penalties are defined for non-payers.	The representative meeting approves a procedure defining the penalty size.
9	Improved water/irrigation service fee collection.	Fee collection for 2009 meets the target defined in the detailed work plan.

Source: ISSA QPA Report, Socioscope, 2011

APPENDIX E

ESTIMATING HOW MANY HOUSEHOLDS PARTICIPATED IN TRAINING

One of the key inputs into the estimated economic rates of return is the number of households that were involved in training. Accurate data on this exact measure are not available, so we instead estimated the number of households that were involved in training using databases prepared by VISTAA to track individual training participants. The databases include names, passport IDs, telephone numbers, birth dates, genders, and community and region in which the training was provided, all of which were collected when training participants registered for training. This appendix explains how we used these data to estimate how many households had a member who participated in training.

As reported in Chapter II, 45,639 farmers attended On-farm Water Management (OFWM) training and 36,070 attended High-Value Agriculture (HVA) training—a total of 81,709 person-trainings. To convert these person-trainings into counts of households who participated in at least one training session, we considered four factors that could cause a household to be counted more than once. First, and the main cause of double-counting households, many farmers attended both types of training. Second, some farmers may have attended more than one session of the same type of training (for example, two OFWM sessions), in which case they would be counted twice. Third, some farmers attended training together with other members of the same household. Fourth, sometimes one person from a household attended OFWM training while another attended HVA training. We calculated the number of trained households in three different ways, and each method is intended to address these factors.

Our first approach, which we use for the primary ERR analysis, is based on HVA attendees' self-reports on whether they had also attended OFWM training. These self-reports were collected by VISTAA when farmers registered for HVA training. Seventy-nine percent of HVA attendees reported that they had also attended OFWM training. We also used passport IDs to determine how many farmers had attended OFWM more than once and likewise HVA more than once. Ninety-seven percent of recorded attendees were attending their first session of a given type. Based on these percentages and the OFWM and HVA counts provided above, we estimate that 51,700 different farmers attended at least one training session. Finally, we did a crude calculation to determine in how many cases farmers were attending training with another family member. This calculation examined how frequently two farmers with the same surname were signed up consecutively on the sign-in sheet; in most cases, our visual inspection of names, birth dates, and genders suggested that such cases were likely to either be spouses or a parent and (adult) son or daughter. We estimated that about 8 percent of participants were attending with someone who likely lived in the same household. Therefore, using our first approach, we estimate that about 47,800 households participated in at least one training session.

A limitation of the first approach is that it relies on self-reports from HVA participants to determine overlap between the HVA and OFWM participants. Self-reports could be biased either because HVA participants remembered an unrelated training session they previously attended, or if some HVA participants misrepresented OFWM attendance because they incorrectly perceived that attending OFWM was a prerequisite. If so, our estimates of overlap between OFWM and HVA would be upwardly biased, and our estimates of total trainees would be downwardly biased. Some farmers might also report that they had attended OFWM when it was actually someone else in the household who had attended, though because we only seek to count households, this would be acceptable for our purposes. To address this possible bias, our second approach uses passport IDs to estimate the number of unique training participants. Based on passport IDs, we estimate that there were about 58,000 unique training participants, accounting for overlap in OFWM and HVA as well as participants who repeated attendance at the same type of training. We then use a similar adjustment as before to account for family members who attended together. Using our second

approach, we estimate that 53,700 households participated in training. However, inaccuracies in the passport records cause this approach to undercount the overlap between OFWM and HVA participants. In particular, the formats for the passport IDs are not consistent throughout the files; we corrected the most common inconsistencies, but others remain and lead to mismatched IDs. We also found several examples that suggest there are data entry errors creating further mismatches. Other IDs are incomplete or missing altogether. Still, this second approach is useful as a check of the first approach. It suggests that the potential biases of the first approach due to self-reporting are unlikely to cause an underestimation of all training participants.

The first two approaches may overestimate the number of trained households by underestimating how often farmers from the same household attended training. In particular, our adjustments only accounted for participants who had the same last name and registered consecutively. Some household members may have signed in non-consecutively, or one family member may have attended OFWM and another attended HVA, neither of which would be accounted for in the first two approaches. In our third approach, we attempted to account for these factors by only counting each surname once within each community. Using this third approach, we find that 23,400 households participated in training. However, because many surnames are frequent in Armenia, we suspect that this approach grossly undercounts the number of trained households. On the other hand, spouses often do not have the same last name, so there is still some upward bias present in this approach as well, though it is unlikely to offset the downward bias due to repetitive surnames for unrelated families.

APPENDIX F

ENTERPRISE ADOPTION SURVEY: INSTRUMENT

ENTERPRISE ADOPTION SURVEY
2010-2011

Q U E S T I O N N A I R E No

Marz Code	Settlement code	Unit number	Interviewer Code	Questionnaire is valid Coordinator's signature	Questionnaire is checked Quality Control Member signature

Hello, my name is **(First name, last name):** I represent AREG SCYA NGO, which implements Enterprise Adoption Survey in the framework of PPM component of Water to Market sub-activity by the order of "Millennium Challenge Account-Armenia". The research data will be reported only in generalized form and will greatly contribute to the improvement of the project. Your sincere responses are extremely important for us.

1. Assistance unit:

1. commercial organization
2. non-commercial organization /NGO, State Non-Profit Organization/
3. farmer group
4. individual business-owner/non-registered individual

2. Date (day.month.year) _____

3. Start time (hh/mm) _____

4. Respondent/s description.*/fill in the table for all persons participating in the interview/*

	First Name, Middle Name, Last Name	Contacts of the respondent: phone number (code+number) Mobile (code+number)	For Enterprises only: Respondent's status, position 1. top-management /NGO president 2. mid-level manager 3. low-level manager 4. member of marketing unit 5. general employee/NGO member 6. former employee***** 7. other **/specify/**	For farmer groups only: position in the group 1. leader of the group 2. member of the group **3.** other **/specify/**
1.				
2.				
3.				

**** If the respondent is former employee, fill in the questions B1-B6; C1-C3; C5; C7 with him. The rest of the questionnaire (Block A; B7; B8; C4; C6; Block D) should be filled in at the enterprise.***

111. Don't know
112. Refuse to answer

A. GENERAL INFORMATION ON ASSISTANCE UNIT

For enterprises fill in questions A1-A8 and go to block B.

A1. Enterprise name _____

A2. Enterprise actual address _____

A3. Year of establishment _____

A4. Enterprise size

1. Total number of employees		**2. *For NGOs/* Total number of members**	**3. Distribution by gender (write down percentage)**
Total	Number of seasonal employees during overloaded season (if any)		1. Male
			2. Female

A5. Enterprise ownership.

1. state
2. private
3. public
4. other **/specify/**

A6. Legal status.

1. CSC
2. OSC
3. LTD
4. ATD
5. producer cooperative
6. consumer cooperative
7. state non profit organization
8. NGO
9. EC
10. TC
11. CC
12. other **/specify/**

A7. Field of activity *//up to two main fields//*.

1. production of agricultural produce
2. processing of agricultural produce => Approximately how many farmers provide raw material for your enterprise?_____
3. dry food production => Approximately how many farmers provide raw material for your enterprise?_____
4. consolidation
5. transportation
6. domestic retailers, wholesales
7. service industries /hotel/
8. exporting
9. other **/specify/**

A8. Main market during 3 past years

1. domestic
2. foreign
3. both equally

For farmer groups fill in questions A9- A14 and go to block B.

A9. When was your farmer group established?

1. in 2008
2. in 2009
3. in the beginning of 2010
4. in the end of 2010

A10. Have you registered officially as a farmer group?

1. Yes
2. No

A11.Size of the farmer group

1. total number of members	2. Distribution by gender (write down number)	3. Distribution by age (write down number)
	1. Male	1. 18-40
		2. 41-64
		3. 65 and more
	2. Female	

A12. Areas of farmer group collaboration ***/up to 2 main directions/***

1. purchase of production means
2. supplying raw material to processors
3. supplying raw material to exporters
4. supplying raw material to retailers
5. supplying raw material to consolidation center
6. other /specify/

A13. How active is your farmer group?

1. the group cooperates continuously
2. the group cooperates periodically
3. the group cooperated in several specific cases
4. the group never cooperated

A14. Are you expecting to cooperate in the future?

1. Yes
2. No

For business-owners/non-registered individuals fill in questions A15- A17 and go to block B.

A15. When did you start the business? */specify year/*:

A16. Business main field */up to two main fields/*.

1. production of agricultural produce
2. processing of agricultural produce
3. dry food production
4. consolidation
5. transportation
6. domestic retailers, wholesales
7. exporting
8. other ***/specify/***

A17. How active are you in the field?

1. active continuously
2. active periodically
3. active in several specific cases
4. are not active any more

B. INFORMATION ON ASSISTANCE PROVIDED

B1. Please, remember when did you first cooperate with representatives of ACDI/VOCA in the framework of Water to Market program?

1. in 2007
2. in 2008
3. in 2009
4. in the beginning of 2010
5. in the end of 2010

B2. What kind of assistances /including consulting and information providing/ did you receive from ACDI/VOCA within the program?

98. I don't remember what it was /*INTERVIEWER: Probe with assistance list from the database.* /

1. Assistances	*2. Replyed:*
INTERVIEWER: First write down in detail all responses, filling in each option under separate code. Then compare with the list of assistances from the database. Fill in the code for assistances approved by the respondent after probing in the second column.	1. before probing 2. after probing
1.	

2.	
3.	
4.	
5.	
6.	
7.	

B3. While receiving the assistance did you mainly communicate? ***(up to 2 options)***

1. with a specific representative of ACDI/VOCA face to face
2. with a specific representative of ACDI/VOCA by phone /or other indirect ways/
3. with different representatives of ACDI/VOCA face to face
4. with different representatives of ACDI/VOCA by phone /or other indirect ways/
5. trough representatives of another third party organization /**underline which:** Dry Food Producer Association, CARD-USDA, local authorities, other/

B4. How intensive was that communication? Communicated:

1. 1-2 times
2. 2-10 times
3. more than 10 times
4. continue communicating

111. Don't know
112. Refuse to answer

B5. Who initiated your collaboration with ACDI/VOCA?

1. me/my organization
2. representatives of ACDI/VOCA
3. other third party organizations **/underline which:** Dry Food Producer Association, CARD-USDA, local authorities, other/
4. other /specify/

B6.Which of the following assistance types did you ever receive through ACDI/VOCA? *//all that apply/*

1. training
2. consulting
3. information providing
4. newsletter and other publication supply
5. short-term project implementation /expo, presentation, promotion/
6. financial assitance
7. technical supply /equipment, seeds, fertilizers, packs/
8. establishment of the business connections/sighing of a contract
9. other /specify/

B7. Did you receive any enterprise assistance during 2007-2010 from other local or international organization?

1. Yes
2. No **(GO TO BLOCK C)**

B8. If yes, who provided the assistance? *//all that apply/*

1. RA government
2. local private organization /specify/
3. charity organization /specify/
4. international donor organization /specify/
5. other

C. USE OF PRACTICES

C1. As mentioned, you had received assistances through ACDI/VOCA within MCA-Armenia Water to Market program. I'll read your options, please tell me about the practices/improvement used by you/your organization in your professional activity.

***If adoption is reported for all assistance types, go to question* C3.**
If «nothing adopted» is mentioned for any of options, fill in question C2.

1. No	*2. Code*	*3. Practices/Improvements*	*4. Will you continue using it?*
	Write down the code.	*INTERVIEWER: Write down in detail all responses, filling in improvements for each of assistance types on separate lines. Write down the code for improvement in the second column, using the numbers from B2.*	**1. Yes** *2. No*
1.			
2.			
3.			
4.			

5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			

C2. If you did not apply anything, please explain why?
INTERVIEWER: Write down in detail all responses, filling in reasons for each of assistance types provided, using data and codes from 1 column of question C1.

Code._____

_____

_____

Code_____

_____

_____

Code_____

_____

_____

Code_____

_____

_____

111. Don't know
112. Refuse to answer

Code_____

_____

_____

Code_____

_____

_____

Code_____

_____

_____

C3. ***/For former employee only/*** **Before leaving your workplace did you pass the knowledge/improvement gained from the program to any other employee?**

1. Yes
2. No

C4. ***/Only for verification of former employee's responses at the enterprise/*** **Your former employee (name, surname) named the practices/improvement applied at your organization as a result of MCA-Armenia Water to Market program assistance provided through ACDI/VOCA. Please, tell me do you continue applying them during your activity now?**

INTERVIEWER: Read the options named by former employee for question C1, filling in the table on specified lines.

Number of improvement in question C1	Do you continue applying?	
	1. Yes	2. No
1.	1	2
2.	1	2
3.	1	2
4.	1	2
5.	1	2
6.	1	2
7.	1	2
8.	1	2
9.	1	2
10.	1	2
11.	1	2
12.	1	2
13.	1	2
14.	1	2
15.	1	2
16.	1	2
17.	1	2
18.	1	2
19.	1	2
20.	1	2

C5.Please, evaluate the following aspects of assistance program using a scale from 1 to 5, where 1 is minimum and 5 is maximum.

No	Assistance aspects	Evaluation				
1.	Usefulness for your activity	1	2	3	4	5
2.	Procedures/management of assistance providing	1	2	3	4	5
3.	Staff attitude	1	2	3	4	5
4.	Impact on profitability of enterprise	1	2	3	4	5

C6. Which of specified assistance types will be most effective for improvement of your activity?*/up to 2 options/*

1. training
2. consulting
3. information providing
4. newsletter and other publication supply
5. short-term project implementation /expo, presentation, promotion/
6. financial assitance
7. technical supply /equipment, seeds, fertilizers, packs/
8. business links establishment/signing agreement
9. other /specify/

C7.Did you/your enterprise have registered any progress in the following directions during last two years? C7.1. If yes, how much that progress was influenced by MCA-Armenia WtM program assistance?
If «No» matched, go to next.

Progress directions	yes	no	C7.1 If yes			
			Did not influence at all	Hindered the progress	Somehow supported the progress	Greatly supported the progress
1. increased turnover/sales	1	2	1	2	3	4
2. identified new local market	1	2	1	2	3	4
3. identified new export market	1	2	1	2	3	4
4. increased enterprise volume/ productivity	1	2	1	2	3	4
5. established new business contacts	1	2	1	2	3	4
6. relations with partners were transferred to legal environment	1	2	1	2	3	4
	3. agreements already existed					
7. utilized new equipment, technologies	1	2	1	2	3	4
8. undertook steps to improve food safety and quality	1	2	1	2	3	4
9. improved product/service quality	1	2	1	2	3	4
10. increased product varieties and types	1	2	1	2	3	4
11. cut production costs	1	2	1	2	3	4
12. increased income/ profit	1	2	1	2	3	4
13. other /specify/	1	2	1	2	3	4

D. FUTURE PLANS

D1. What kind of developments do you plan for your/your enterprise for next 1-2 years? ***(all that apply)***

1. Invest in new technologies
2. Apply new techniques to improve product
3. Apply new techniques to improve management of enterprise
4. Expansion of activities
5. No changes in scale of the enterprise
6. Reduction of activities
7. Market products to new markets

D2. What are the main challenges that you/your enterprise are facing? (up to 3 options)

96. None

1._____

_____

2._____

_____

3._____

_____

D3. Which of specified assistance directions do you mostly need? ***/up to 2 options/***

1. marketing /market analysis
2. business plan, strategy design
3. supplier /buyer/ retailer targeting
4. organization of consolidation and collection
5. raise of quality of raw material for production
6. post-harvesting technologies
7. food safety quality
8. other (specify)

THANK YOU FOR COOPERATION

5. End time /hh:mm/ _____

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