



## Effects of Farmer Cooperatives on Expanding Agricultural Markets in Developing Countries: A Systematic Review

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Systematic Review of the Effects of Farmer Cooperatives on Agricultural Outcomes

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**Prepared by Social Impact, Inc.  
for the US Department of Agriculture**

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# EXECUTIVE SUMMARY

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The United States Department of Agriculture's (USDA's) Food for Progress (FFPr) Program contracted Social Impact, Inc. (SI) to conduct a systematic review on farmer cooperatives to help inform future FFPr interventions aimed at expanding agricultural markets in developing countries. This review synthesizes the impacts of agricultural cooperatives in developing countries on various outcomes for smallholder farmers, including: income, revenue, and prices; production and yield; market access; adoption of farming technology; land use, acreage, and cropping pattern; and poverty.

A large body of descriptive studies exists on the benefits of farmer cooperatives as forms of collective action towards economic empowerment and poverty reduction. After the United Nations declared 2012 as The International Year of Cooperatives, international interest was renewed in cooperatives, and researchers have begun conducting rigorous impact evaluations to assess other benefits of farmer cooperatives such as the expansion of markets. Based on findings from 21 relevant rigorous impact evaluations, this systematic review synthesizes the impacts of cooperative membership in developing countries on outcomes such as income, production, market access, and poverty. SI conducted the review over a period of eight months – from protocol development to drafting and finalizing the report.

Among the various outcomes studied within the cooperative literature, income-related outcomes such as total income, price, and profit were the most widely measured outcomes. Nearly all of them found that membership in a cooperative had a positive and significant effect on income and led to improvements in productivity through increased production and yield. Increased production was partly attributed to the strong and significant relationship observed between cooperative membership and farmers' adoption of input and crop technology. However, the literature did not show any notable impact on market access. There were indications of heterogeneous impacts of cooperative membership based on farmer characteristics such as wealth status and sex. The association between cooperative membership and acreage or cropping patterns was inconclusive. Finally, studies that measured poverty using asset accumulation did not find any significant effect on poverty reduction. However, one study that measured the impact of membership on poverty incidence, defined as being below the national poverty line, found a significant reduction in poverty.

Overall, the results of the 21 studies included in this systematic review show that cooperative membership leads to a moderately strong and positive impact on farmers' production and yields, a small but positive impact on farmer income, and inconclusive impacts on market access, acreage, and poverty. The limited time period over which most of these studies were conducted, particularly when looking at farm and crop related income, could have affected the results since true changes in income often take more than a few years.

SI researchers identified key gaps in the literature, which if explored could further illuminate the impact of cooperative membership and the outcome pathways. These gaps include the lack of research in certain geographical regions and on different cooperative models and the services they provide, policy frameworks conducive to an enabling environment for cooperatives, impacts on marginalized groups, including women, and on quality of outcomes.

# 1 BACKGROUND

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## 1.1 OVERVIEW

The United States Department of Agriculture's (USDA's) Food for Progress (FFPr) Program contracted Social Impact, Inc. (SI) in 2014 to conduct three systematic reviews, including one on agricultural cooperative interventions, to help inform future FFPr interventions aimed at expanding agricultural trade and markets in developing countries.<sup>2</sup> The review synthesizes the impacts of agricultural cooperatives on a number of outcomes for smallholders in developing countries.<sup>3</sup> These outcomes include: income, revenue, and prices; production and yield; market access; adoption of farming technology; land use, acreage, and cropping pattern; and poverty.

## 1.2 DEFINING AGRICULTURAL COOPERATIVES

The International Alliance of Cooperatives (ICA) and the International Labor Organization (ILO) define cooperatives as autonomous, voluntary associations meeting common economic, social, and cultural needs through a jointly owned and democratically controlled enterprise (ILO, 2002). This definition allows for a wide array of types of cooperatives, including consumer cooperatives, workers' cooperatives, student cooperatives, utility cooperatives, arts-and-crafts cooperatives, business cooperatives, credit unions/cooperatives, and agricultural cooperatives.

USDA defines a cooperative as a user-owned, user-controlled business that distributes benefits on the basis of use (American Bar Association, 2011). Agricultural cooperatives typically pool inputs and other farmer and rural-entrepreneur resources in order to maximize production and trade for their members. Agricultural cooperatives can also generally be classified into two categories: (i) production cooperatives and (ii) service cooperatives (Lerman, 2013; USDA, 2002; Deville et al, 2009).

- 1) *Agricultural production cooperatives* help farmers pool their production resources (e.g., land, machinery) to farm jointly. Examples of such cooperatives include collective farms in former socialist countries, the kibbutzim in Israel, and Nicaraguan production cooperatives.
- 2) *Agricultural service cooperatives* provide input-supply and output-marketing services to their members.

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<sup>2</sup> The other two reviews focus on the roles of Information and Communication Technology (ICT) and Road interventions in improving farmers' outcomes.

<sup>3</sup> For the purpose of this systematic review, developing countries include all low-income and lower-middle-income, and upper-middle-income countries as classified by the World Bank.



Given that USDA's definition of agricultural cooperatives is focused on the provision of services rather than on pooled production, that there is a long history of oppression and political turmoil surrounding agricultural production cooperatives or collectives, and that very few rigorous quantitative studies have been conducted on the effects of agricultural production cooperatives, conducting a systematic review on that topic was infeasible. Therefore, SI focused its systematic review on *agricultural service cooperatives*. Thus, for the purposes of this review, agricultural cooperatives refer to agricultural service cooperatives only.

There are two primary types of service cooperatives—supply and marketing cooperatives (USDA, 2002; Deville et al, 2009).

- 1) *Supply cooperatives*: These cooperatives are established to supply their members with inputs for agricultural production, including seeds, fertilizers, fuel, and machinery services. They aggregate purchases, storage, and distribution of farm inputs for their members. By taking advantage of volume discounts and utilizing other economies of scale, supply cooperatives bring down the cost of the inputs that the members purchase from the cooperative compared with direct purchases that individual members might make on their own from commercial suppliers.
- 2) *Marketing cooperatives*: Marketing cooperatives are established to undertake transportation, packaging, distribution, and marketing of farm products (both crop and livestock). The marketing cooperative model may also include a credit component that provides farmers with a source of financing for both working capital and investments. A marketing cooperative can also act as an integrator, collecting the output from members and sometimes packaging and delivering it in large aggregated quantities through marketing channels.

In many cases, cooperatives offer both types of services, and farmer members can choose to benefit from either input or output components, or both. SI reviewed both supply and marketing service cooperatives to examine how such interventions work to improve outcomes for both farm households and individual farmers.

### **1.3 THE ISSUE: HOW TO INCREASE ACCESS TO MARKETS AND TRADE FOR FARMERS IN DEVELOPING COUNTRIES?**

The establishment of agricultural cooperatives and farmers associations to increase agricultural production and expand trade and markets for agricultural products is an important foreign assistance activity for many bilateral donors (including the U.S. Government) and multilateral organizations such as the Food and Agriculture Organization of the United Nations (FAO), the International Fund for Agricultural Development (IFAD), and the World Bank, among others. However, while donors have been supporting the establishment and improvement of agricultural cooperatives for decades, few efforts have been made to date to consolidate evidence on the effectiveness of such interventions on agricultural outcomes through systematic reviews or meta-

analyses. As the Secretary General to the UN General Assembly stated “the current lack of robust and harmonized statistics, including research on cooperatives, makes it difficult to quantify and communicate their impact” (Report of the Secretary General to the UN General Assembly, 2009, A/64/132).

The International Year of Cooperatives<sup>4</sup> in 2012 revived the interest of many bilateral and multilateral donors to rigorously examine the effects of agricultural cooperatives in agricultural development. Many quantitative studies are now available that examine the economic, social, and environmental impacts of service cooperatives on members and non-members in specific contexts and that demonstrate the importance of agricultural cooperatives as an alternate to the more traditional family-farm model. Studies show that cooperatives allow farmers to collectively negotiate better contract terms and prices and to access a wide range of resources and services. Additionally, they increase the efficiency of smallholders and their use of available resources by inspiring innovation, diversification, and specialization in their members’ activities (ILO, 2001; USDA, 2002).

#### **1.4 FOOD FOR PROGRESS AS A MECHANISM TO ADDRESS EFFECTIVENESS OF COOPERATIVES FOR AGRICULTURE**

To date, there have not been any quantitative systematic reviews of cooperative interventions for agriculture. Therefore, this systematic review aims to identify rigorous impact evaluations and synthesize the impact of cooperative membership on farmers’ incomes, productivity, access to markets, acreage, adoption of inputs and crop technology, and poverty. This is accomplished through detailed analysis of rigorous impact evaluations’ findings on farmer related outcomes.

Originally funded under the Food for Progress Act of 1985 (17 USC 1736), FFPr is run by the Foreign Agricultural Service (FAS) of USDA. FFPr helps developing countries and emerging democracies modernize and strengthen their agricultural sectors. FFPr has two principal objectives: 1) to improve agricultural productivity and 2) to expand the trade of agricultural products. In order to achieve its objectives, USDA donates agricultural commodities to recipient countries through implementing partners, who are selected by FFPr through a competitive process each year and who sell the goods on the local market to obtain funding for agricultural development programs.

Since its authorization in 1985, FFPr has funded a wide variety of projects in developing countries, including projects that have trained farmers in improving animal health and the quality of crops, taught farmers effective farming methods, developed infrastructural systems, established and built

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<sup>4</sup>The United Nations General Assembly had declared 2012 as the International Year of Cooperatives, highlighting the contribution of cooperatives to socioeconomic development, particularly their impact on poverty reduction, employment generation and social integration. By raising awareness about cooperatives, the Year helped to encourage support and development of cooperative enterprises by individuals and their communities.

capacity for producer cooperatives, provided microcredit and agricultural loans, and developed value-chains for a variety of agricultural products. Program participants have included private voluntary organizations, universities, foreign governments, and intergovernmental organizations. After 2010, FFPr began to focus its funding on select countries and activities in order to ensure resources could be effectively allocated to achieve its objectives. However, prior to 2014, FFPr had not conducted a formal, rigorous country needs assessments or in-depth research to help inform its agricultural and trade development approach in the countries in which it worked. Therefore, in order to better inform its activity selection, FFPr commissioned a series of research activities through a task order with SI that began in September 2014. As part of this task order, SI completed an activity mapping of FFPr activities in early 2015 to help FFPr staff better understand the most common types of program activities implemented between 2009 and 2014. The activity mapping also examined variations in activity funding over time and across regions. Additionally, the task order included an annotated bibliography of rigorous impact evaluations completed between 2000 and 2014 on agricultural interventions with post-production and trade outcomes. These two reports informed the FFPr team's selection of farmer cooperatives for a systematic review.

FFPr selected farmer cooperatives as a topic for this review because cooperatives have been a main focus or component of many FFPr-funded activities, yet to date there have been no rigorous systematic reviews quantifying their impact on outcomes for rural farmers. SI's examination of FFPr awards made between 2009 and 2013 showed that 7.5 percent (11 out of 146) of FFPr production activities focused on the formation or improvement of producer associations/cooperatives. Furthermore, and perhaps more importantly, FFPr has supported a series of other activities that are usually supported through cooperative membership, including access to improved inputs (24 out of 146 activities) and productivity programs that target women (11 out of 144 activities). The literature also shows that cooperatives are a gateway to linking producers to markets, another major focus of FFPr activities during the 2009-2013 award period. Activities such as improving and developing post-harvest facilities, establishing/improving standardization and regulations for phyto-sanitation standards, fostering market linkages, and facilitating marketing and market information altogether accounted for 53 percent of FFPr activities. Despite all of these activities related to cooperatives, there have been no systematic reviews examining the overall impact of cooperatives on farmers' outcomes. This review is intended to better inform future FFPr activities.

## 2 OBJECTIVES

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### 2.1 BACKGROUND ON THE USE OF COOPERATIVES FOR AGRICULTURAL INTERVENTIONS

Between 2009 and 2013, FFPr funded seven projects that included a focus on developing and supporting farmer groups and cooperatives. However, FFPr has not conducted any impact evaluations on these interventions, and thus, the research team is unable to definitively determine if and how these interventions made a difference in the lives of farmers, especially in relation to trade and production.

The existing body of literature includes a number of studies that assess the effects of collective action on smallholders' income, productivity, and engagement in markets, among other outcomes. There is evidence that particular countries, such as Ethiopia, have experienced a growth in the cooperative movement, particularly due to increased government support. Despite this increasing focus on cooperatives, researchers use different indicators to measure their impact. For instance, some studies measure their impact based on income, while others look at productivity. Some studies have also begun to look at the heterogeneous impacts of cooperatives on subsets of the population including women and resource-poor smallholders (Banerjee, 2014; Bernard, 2009; Desai, 2014; Fischer 2014b).

Despite the growing empirical research, there have been no systematic reviews conducted that look at the different types of agricultural cooperatives and that use comparable measures to assess the effects on farmer outcomes. Thus, it is difficult for policy makers to accurately understand the extent to which agricultural cooperatives benefit smallholder farmers and the specific conditions under which these gains can be achieved.

### 2.2 PURPOSE

The findings and recommendations of this systematic review will inform the future work of FFPr by assisting in the making of evidence-based decisions about program funding in order to promote and support agricultural cooperatives. The findings and recommendations will help FFPr staff target interventions based on existing research about the contexts in which such interventions tend to produce positive results. Next, the review will help the FFPr team gain a better understanding of other actors involved in the creation, promotion, management, and development of agricultural cooperatives so FFPr can network with these other actors and potentially identify synergies between FFPr interventions and those of other government and implementing partners. Such networking might result in complementary or partner interventions between FFPr and these other donors or actors and may also position FFPr to become a thought leader in the promotion and support of agricultural cooperatives as a conduit towards agriculture-led development.

## 2.3 MAIN OBJECTIVES AND REVIEW QUESTIONS

The objectives of this review are:

(a) To gather, summarize, and integrate rigorous empirical research to help FFPr and other stakeholders to understand the evidence regarding cooperatives on agricultural outcomes. This will allow FFPr to make practical decisions about interventions and inform public policy related to agricultural cooperatives aiming to improve agricultural trade and markets in developing countries.

(b) To identify evidence gaps in the literature so that future research can analyze the effectiveness of interventions related to promoting and supporting agricultural cooperatives. To that end, the systematic review intends to identify trends and collective impacts of agricultural cooperatives on farmer-level outcomes in the developing world in order to inform future interventions.

The questions addressed through this review include:

### 2.3.1 Main Questions

- 1) Does membership in agricultural cooperatives impact farmers' incomes in developing economies?
- 2) Does membership in agricultural cooperatives impact farmers' productivity in developing economies?
- 3) Does membership in agricultural cooperatives have an impact on other outcomes including market access, adoption of inputs and crop technology, acreage, and poverty?

### 2.3.2 Supplemental Questions

- 4) What are the common trends and mechanisms for achieving impact?
- 5) How do country conditions or crop type influence impact?
- 6) What are the current gaps in the literature on agriculture cooperatives?

# 3 METHODOLOGY

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In conducting this systematic review, the research team searched for, reviewed, coded, and analyzed the results of rigorous impact evaluations. In doing so, SI followed the Campbell Collaboration approach to systematic reviews, as described in more detail below. SI developed the methodology to select studies to include in the review in close consultation with FFPr; FFPr approved the final protocol in July 2015.<sup>5</sup>

Per the Campbell Collaboration method, the team used a theory-based approach, relying on the theories of change described herein as the framework for the review. The theories of change informed the inclusion criteria, data extraction, and coding. Wherever available, SI extracted information about the causal chains to ensure that the theories of change held true. The team focused on higher-level outcomes and impacts but also addressed some of the intermediate outcomes so the team could identify and make recommendations to address any breakdowns in the theory of change. The research team conducted an in-depth review of all main and supplementary outcomes listed in the questions above and identified gaps in the existing body of literature. This section discusses the methodology for locating studies; criteria for inclusion in the systematic review; and information on coding and assessing quality.

## 3.1 SELECTION CRITERIA FOR SYSTEMATIC REVIEW

To be eligible for inclusion in the review, the study had to meet the criteria described below:

### 3.1.1 Subject Area

All included studies are substantially related to agriculture and agricultural outcomes linked to farm production and agricultural trade or marketing.

### 3.1.2 Type of Intervention

This systematic review includes studies involving agricultural service cooperatives that supply their members with inputs for agricultural production, including seeds, fertilizers, fuel, and machinery; services through aggregated purchases, storage, and distribution of farm inputs; and/or marketing, market linkages, and easing of transportation and trade barriers. It also includes

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<sup>5</sup> Discussion of the protocol began in early January 2015 with SI's submission of an annotated bibliography. This was followed with a proposal for systematic review topics in early March 2015. At this time, USDA selected cooperatives as one of the three topics. Based on the preliminary findings from the literature, as well as conversations between SI and USDA on FFPr's priorities, SI developed a set of three topic proposals, including details on the protocol and methodology to be used for each. The cooperatives proposal was initially submitted in June and was approved by FFPr in July 2015. SI conducted the systematic reviews between July and October, and wrote the report during the month of November 2015.

marketing cooperatives that act as an integrator to collect outputs from members and deliver them in large aggregated quantities through appropriate marketing channels.

Studies included in this review discuss the following outcomes: income, revenue, and prices; production and yield; market access; adoption of farming technology; land use, acreage, and cropping pattern; and poverty. Due to the limited number of available rigorous studies the meta-analyses focus on two outcomes: income and production.

### 3.1.3 Outcomes Defined

In order to be included in this review, studies had to include at least one of the outcomes as defined below:<sup>6</sup>

- 1) **Income** is defined as the amount of money a household earns, usually on an annual basis, unless otherwise specified. The research team used other outcome variables as proxies for income, including overall income, crop income, profit, gross margin, and prices. Income includes profit after taxes and the return on investments. Crop income refers specifically to income earned from crop sales only. Profit is defined as the amount of money that the household earns from selling a crop, livestock, milk, eggs, etc. net of input costs such as fertilizers, seeds, transport costs, and loans for financing agricultural work. Prices refer to output prices including the price for fertilizers, seeds etc. as well as product prices, producer prices (for crops, livestock, milk, eggs, etc.), and producer prices at domestic, regional, and international markets.
- 2) **Production** is defined as the volume of produce that is cultivated at the end of a growing season and is often measured by weight or size. Yield is production per unit of land. The research team synthesized and discussed the findings on production and yield together.
- 3) **Market access** is defined as participation in or at least possessing the option to participate in a local market. A review of the literature revealed that commercialization was a common indicator of market participation. Although referred differently across the literature, commercialization is generally defined as the ratio of output sold to output produced. A ratio of zero would describe pure subsistence farming, while a ratio of one would indicate that all output was marketed. SI used commercialization, defined as the share of output sold, as the main proxy outcome for market access. Another proxy for market access used in this review was the knowledge of output price prior to sale. **Adoption of input and crop technology** includes any outcomes that measure uptake of new technology. Technology includes the use of fertilizer, pesticide, insecticide, and use of improved farming practices, modern seed varieties, improved seeds, and mechanization. Studies in this review used a wide range of indicators for the adoption of input and crop technology, but found no composite indicator to assess overall adoption of input and crop technology.

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<sup>6</sup> These definitions are commonly applied in rigorous literature on agriculture.

- 4) **Poverty count or the poverty gap** refers to those with per capita consumption, expenditure, or income that falls below a nationally or internationally established benchmark. Poverty count is determined by counting the number of people that fall below those benchmarks, and the poverty gap looks at the difference between those above the benchmark and those below it. A proxy for poverty used in this review is the access to shelter.
- 5) **Acreage/ crop and land use** are associated with cropping patterns and interventions focused in these areas to shift farming from subsistence crops to higher-value crops. This systematic review assesses total land ownership, land allocated to certain crops, and herd size, in the case of dairy farmers.

In the Proposal for the Systematic Review the research team included **consumption/expenditures** and **jobs/employment** as outcomes of interest for the review. After extensive review of the literature, the research team did not find studies that reported on these outcomes that met the inclusion criteria.

### 3.1.4 Study Type

No randomized control trials exist on cooperative membership given the self-selected nature of membership. The decision to join a cooperative and the extent of participation is an economic and social choice made on the basis of many household and personal characteristics that are endogenous to members themselves (Bernard, 2008). Evaluators overcome this bias in their analysis by using quasi-experimental designs. The inclusion criteria for this systematic review required that studies use:

- Encouragement designs; quasi-experimental designs (QEDs) with controlled before-and-after (CBA) studies and control groups; regression discontinuity designs; panel studies; and natural experiments with clear counterfactuals.
- Techniques for controlling for selection bias such as statistical matching (for example, propensity score matching (PSM) or covariate matching), regression adjustment (for example, difference-in-differences (DD) and single difference regression analysis, instrumental variables (IV) estimation, and Heckman selection models), cross-sectional, or longitudinal models.

### 3.1.5 Timing and Duration

The review includes only studies published or made available to SI after the year 2000, and that have an end line at least one full growing season after the baseline due to the fact that shorter timelines do not result in significant changes in yields.



### **3.1.6 Population**

The population under study must be from developing countries. This includes countries classified by the World Bank as low, lower-middle, and upper-middle income countries. Participants include farmers, agricultural households, women and men, agribusinesses, and cooperatives.

### **3.1.7 Study Exclusions**

SI has excluded studies of credit unions, credit cooperatives, savings and credit associations, and groups that only provide financial services and conduct transactions in cash and not in-kind from the review. However, we included cooperatives that offer members cash-based financial services if those services were in addition to other services provided by the agricultural cooperative. For example, the review includes studies of marketing cooperatives that primarily engaged in aggregating produce from their members and selling that produce in bulk at a national trading center even if such cooperatives also offered credit and savings facilities to their members. The SI research team did not, however, include studies of pure credit cooperatives that only or mainly provided loans to farmers. The prime reasons for the exclusion were the following: financial services cooperatives are promoted by most donors and national governments to improve access to finance for farmers, and literature on financial service cooperatives is vast and already well examined in several reviews (Plan International 2013, Duvendack 2011, Van Rooyen 2012 to mention a few). Moreover, in order to diversify their risks and intermediate financial resources efficiently and effectively, financial service cooperatives typically serve all types of members and do not limit membership to farmers only. Since cash is fungible, farmers who obtain loans or withdraw their savings from cooperatives could (and often do) use that money for various purposes not related to production or marketing, thus making it difficult to track impacts on agricultural trade-related outcomes. Finally, the structure and governance of pure financial service cooperatives differ greatly from typical marketing and supply cooperatives included in this review such that comparability of results becomes limited.

The review also excludes studies that had poor methodology such as weak or absent counterfactuals, weak or non-random sampling techniques. Also, as per FFPr's suggestion, qualitative studies were excluded.

## **3.2 THEORY OF CHANGE FOR OUTCOMES**

As reflected in FFPr's results framework, increases in agricultural production and expansion of agricultural trade can be achieved through the improved capacity and management of agricultural supply and market cooperatives that support increased availability and use of improved inputs and agricultural techniques, and efficient and effective marketing of agricultural products and increased income.

The literature illuminates a hypothesis for how cooperatives facilitate trade and production outcomes. Many studies have shown that smallholder farmers are unable to compete in high-value

markets on their own, but are able to do so through collective action and with institutional support (Narro et al., 2009). Agricultural organizations or cooperatives help farmers reduce high transaction costs on both the production and market side that prevent their entry into such high-value markets (Markelova, Meinzen-Dick, Hellin, & Dohrn, 2009; Valentinov, 2007). Agricultural cooperatives have also been shown to increase the adoption of technology amongst members; increase member production; link small producers to markets; promote savings, credit, and banking services; and capture high-value markets (Narro et al., 2009; DFID, 2005; World Bank, 2008).

### 3.3 STUDY SEARCH STRATEGY

The research team began its search for relevant studies by first mining the bibliographies of the eight studies identified in the proposal and coding them into Database 1. In an iterative process of “snowballing” they continued mining the bibliographies of each relevant study they found until the new bibliographies yielded no new, relevant studies. Next, the research team used the websites, journals, and databases selected for the search (listed in Appendix 1). They used specific keywords to search for relevant articles on each of these websites. Keywords followed PICOS (Population, Intervention, Comparison, Outcomes, Study design) format. Each search was conducted by entering a combination containing one word from each PICOS category. A complete list of these search terms is displayed in Appendix 2. Relevant studies were then coded into Database 1.

Since complete PICOS format would have resulted in upwards of 7,000 word combinations to search, and because these searches tend to overlap, returning irrelevant or repetitive hits, SI adjusted searches according to the format of each website’s search engine. Some websites had search filters that allowed for a more targeted search. The World Bank website, for example, had a filter for “Agriculture.” Other common filters included “date range,” “field,” and “study type.” Using these filters resulted in much more precision, but less overall retrieval of studies in the search process. As such, many fewer studies were retrieved and coded into the databases, but those that were coded were much more likely to be useful for the systematic review. To ensure that no useful studies (studies that met the systematic review inclusion criteria) would be missed using this technique, the research team also tried searching without using the filters for a few of the search terms to ensure no relevant studies were missed. The team found that the use of the filters only improved the efficiency of the process but did not eliminate any relevant studies. The filters used and the number of searches conducted for each website are recorded in Appendix 3.

The searches, particularly those in websites that did not have filters, returned a very large number of hits. In order to maximize efficiency and minimize extraneous information, the research team continued coding each consecutive page of hits until they reached a page with no additional hits eligible for the review. Certain word combinations were omitted in cases where similar search patterns were only returning irrelevant and/or repetitive hits. In cases where a particular search returned no relevant hits, based on the above-listed selection criteria, no articles were coded into

the database. Many hits were easily excluded because they were not relevant to the proposed review.

### **3.3.1 Search for Unpublished Studies**

In order to reduce publication bias, SI intended to include both published and unpublished documents. In order to locate unpublished studies, SI contacted lead researchers and organizations in the field of cooperatives and also all authors of publications included in the systematic review asking for additional studies, including studies in languages other than English, and unpublished studies. Unfortunately, no unpublished studies or studies in other languages fitting the inclusion criteria were obtained through this method.

### **3.3.2 Studies in other Languages**

SI searched for studies in Spanish, French, and Portuguese in addition to English in order to avoid language bias. The SI research team found that English was the most common language for impact evaluations, particularly for those pertaining to cooperative interventions. Some impact evaluations initially written in English were later translated into other languages, but the research team did not find any impact evaluations fitting the inclusion criteria written in only Spanish, French, and Portuguese.

## **3.4 DATABASE CONSTRUCTION**

In line with the Campbell Collaboration approach to systematic reviews, the team developed three databases to compile literature searches and analysis, as described below.

### **3.4.1 Database 1 (Search Database)**

Based on the search strategy above, this database contained details on all publications that SI retrieved, including whether the study was included in the systematic review.

In Database 1, the SI research team recorded basic information on search results, including search terms, search source, study title, year of publication, author information, type of study, study design, topic, type of intervention, population, country, language, and outcomes. Lastly, the researchers made recommendations for whether the study should be included or excluded from the systematic review based on the selection criteria listed above. A full 30 percent of all studies were double-coded by two separate researchers to ensure that both agreed on whether the study should be included in the systematic review or not (based on the inclusion criteria described above).

### **3.4.2 Database 2 (Systematic Review Database)**

The researchers read the publications determined to meet the criteria for inclusion in the systematic review (based on Database 1) in full and further coded them for additional details pertaining to quantifying the effect sizes, statistical significance, quantitative rigor, and reliability.

Specifically, they recorded country information; crop types; unit of assignment to beneficiary and comparison groups; method of assignment to treatment and control groups; method of sampling; whether there was a balance test; effect size, t-statistic, pooled standard deviation for each outcome; numbers of observations in beneficiary and comparison groups; and key moderators. All studies in Database 2 were also double-coded to ensure consistency and agreement on key indicators used in the qualitative analysis for the systematic review.

Each of the studies was coded for key moderators, including the percentage of country budgets dedicated to agriculture, the World Bank country wealth designation, region, level of international funding, and overall state of fragility. SI used these moderators later in the process to examine whether impacts varied based on country-specific characteristics. The data sources for these moderators are listed below:

- 1) Percentage of Country Budgets Dedicated to Agriculture:** FAO's data on agricultural expenditure as a proportion of government expenditure for the year 2011 (United Nations Food and Agriculture Organization). Where data were unavailable for the year 2011, data were drawn from the most recent year available for the particular country.
- 2) Country Region and Wealth Designation:** World Bank's List of Economies as of July 2015 (The World Bank).
- 3) Level of International Funding:** Official Development Assistance as a proportion of Gross National Income as listed for the year 2013 in the World Bank's World Development Indicators.
- 4) State Fragility Index:** The Center for Systemic Peace's 2013 index, which is a composite of states' effectiveness and legitimacy in terms of security and political-, economic-, and social-wellbeing.

### 3.5 CODING RELIABILITY

As described above, to ensure that the decisions made for inclusion/exclusion in the systematic review were unbiased and consistent for Database 1, the research team used double-coding. Two primary coders first coded all the documents, and a third coder randomly selected and reviewed a sample of 30 percent of the above. Any discrepancies in coding were closely examined and reconciled. In all cases, the decision to include or exclude the study in the systematic review was consistent.

All studies (100 percent) selected for inclusion in the systematic review (Database 2) were double-coded using the same method to ensure accurate effect sizes. Coders discussed and reconciled discrepancies to ensure reliability. All decisions on whether to include studies in the systematic review were consistent, and coders were in agreement.

The above search and coding strategies resulted in the following number of studies in each database as displayed in Figure 1.

**Figure 1. Databases Used to Develop the Systematic Review**



### **3.6 EXAMPLES OF STUDIES INCLUDED IN THE SYSTEMATIC REVIEW**

In order to be included in the systematic review, studies had to meet all six of the PICOS-based criteria discussed earlier in this review—subject area, type of intervention, outcome, study type, time/duration of the study, and study population. As such, all studies included in this systematic review include a discussion of the impacts of agricultural cooperatives on rural populations in developing countries<sup>7</sup> for at least one of the listed outcomes (income, production, crop yield, prices, market access, adoption of inputs and crop technology, or poverty). Furthermore, the studies needed to be rigorous in design and analysis, they needed to include a counterfactual to attribute effects to the intervention, use an adequate sample size and length of the study, analyze data using appropriate statistical methods, and be published or made available after the year 2000.

### **3.7 EXAMPLES OF STUDIES EXCLUDED FROM THE SYSTEMATIC REVIEW**

Studies that failed to meet SI’s established inclusion protocol discussed above were excluded from the systematic review.

SI came across many qualitative and quantitative, albeit methodologically weak, studies that looked at one or more of the outcomes analyzed here. However, USDA requested that SI exclude studies that were qualitative in nature and quantitative studies that failed to identify a clear counterfactual from the systematic review, which eliminated the vast majority of papers found during the search.

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<sup>7</sup> For the purposes of this review, we included studies on countries classified to be low, lower-middle, and upper-middle income based the World Bank’s 2015 classifications.

Nonetheless, SI reviewed these papers in search of references to rigorous quantitative studies and to examine how such studies were referenced in the literature.

Examples of papers that were excluded comprise of non-agriculture-related interventions, interventions not in middle to low income countries, qualitative studies, quantitative studies lacking counterfactuals, and studies that did not seek to identify attribution of outcomes.

The requirement that all studies recommended for inclusion in this review be rigorous quantitative evaluations with a clear attribution severely limited the number of studies and eliminated many studies that are often referenced in cooperative literature. Given the endogeneity of cooperative membership, due to self-selection, several studies included in this review aimed to understand the determinants of cooperative membership and the extent to which cooperatives could be considered as inclusive social and economic structures, rather than the effects attributable to membership. (Bernard, 2008, 2009; Fischer 2012a; Ito, 2012).

Several studies that acknowledged the relationship between cooperatives and the outcomes of interest failed to apply econometric methods or provide a counterfactual to attribute changes in the outcomes to cooperative membership. This was particularly true of studies that looked at adoption and continued use of improved inputs and production technology (Tura, 2010). Other studies focused on outcomes outside of the scope of the review. For example, Wollini (2007) assessed whether participating in a cooperative had a positive impact on the probability that a farmer chose to grow a specialty crop. Although the choice to enter a specialty market may lead to higher prices for output, the relationship is not direct. Furthermore, the study did not construct a strong counterfactual to compare outcomes and thus, measure impact.

The research team excluded studies that had poor methodology. The team came across several examples of cross-sectional studies that claimed to employ econometric methods. However, upon closer review, these studies either had poor or completely absent counterfactuals, or employed weak or non-random sampling techniques.

### **3.8 DETERMINATION OF INDEPENDENCE OF FINDINGS**

Some studies included the same outcome measured using various definitions or techniques. In other cases, studies included multiple measures of profit for different crops or at different points in times. Verhofstadt (2014a, 2014b) for instance included outcome measures for farm income, farm income per worker, and gross farm revenue to capture the impact of membership on farmer income. Furthermore, the study estimated the effects of using four different models in order to test the robustness of the results. SI used the following protocol, approved by USDA, to determine which outcome to use in such instances.

When there were multiple points in time for measurements of the same outcome in the same study, the team selected the latest measurement using the most rigorous methodology. When there were

multiple measures of the same outcome, the team chose the most rigorous measure. If none was clearly more rigorous, the factor identified by the study authors as more rigorous was selected.

To illustrate the application of the selection criteria to assure independence of findings, we provide some examples here. While Negri (2008) reported changes in the value of sales per acre as well as in the unit value (price), the review reports only on the value of sales per acre. Although both measure revenue/income in some way, value of sales per acre is more similar to the broader income outcome we attempt to capture than is output price. Furthermore, Negri also uses an IV design to calculate effects on outcomes. However, the design was deemed insufficient and flawed in its assumptions. Therefore, the review includes results from the more reliable PSM design.

Additionally, in cases where the same author had written multiple papers, the following criteria were used to avoid redundancy or misrepresentation: If an author wrote multiple papers on the same outcomes using the same dataset, the review chose only the most recent one with the most rigorous methodology. Bernard, for instance, wrote several papers on Ethiopia using the same dataset, but the research team chose two rigorous studies that assessed different outcomes of the same intervention. For the purpose of meta-analysis, only one outcome can appear in each meta-analysis. Additionally, Francesconi (2007, 2012) conducted separate analyses of a dairy cooperative in Debre Zeit, Ethiopia. Although both studies included production related outcomes, SI chose to report the production variable (liters per farm per day) from the 2012 study because the author used slightly different models, which led to a more robust finding. Nevertheless, the review makes note of the 2007 study's measure of productivity (liters per cow) as well as of market access using percentage sold, both not included in the 2012 analysis. Similarly, Cavatassi (2009, 2011) wrote two rigorous impact evaluations on the *Plataformas* in Ecuador. However, the research team included the most recent paper in this analysis as the outcomes more closely resembled the outcomes of interest for this systematic review.

### 3.9 ANALYSIS METHODS

Using the 21 studies identified for the review, the SI research team summarized the findings on effects of cooperative membership on several farmer outcomes and presented the results with summary discussions supported by relevant data shown in tabular and graphical formats. Some systematic reviews additionally include quantitative analysis, called meta-analysis. For each of the farmer outcomes examined, we found that only a few studies met the criteria for inclusion in meta-analysis.<sup>8</sup> Meta-analysis requires at least five studies under each category such that data can be summarized into a single statistic to represent effect sizes, and many more studies to run regressions to quantitatively examine differences in effects due to moderators such as regional/country context, income status, etc. The research team found enough studies to meet this minimum threshold for two of the outcomes of interest. Therefore, we conducted meta-analysis on

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<sup>8</sup> Most studies did not include data needed to calculate the pooled standard deviations, which are needed to conduct a meta-analysis.

income and production/yields. Due to the limited number of studies, the meta-analysis results in this review should be interpreted with caution. As more rigorous studies are conducted and published on the effects of cooperative membership on the outcomes of interest, such meta-analysis could be expanded to arrive at generalizable conclusions on the effect sizes associated with membership in a cooperative.

## **3.10 METHODOLOGICAL LIMITATIONS**

### **3.10.1 Standardized Mean Differences Bias**

Information about the average standardized mean difference and the variance of standardized mean differences are valuable to understanding the effectiveness of the interventions. However, standardized means differences assume that the differences in standard deviations among studies reflect differences in measurement scales and not real differences in variability among the possible effects on cooperatives on study populations. This assumption may be problematic in some circumstances where researchers expect real differences in variability between the effects in different studies due to contextual factors.

### **3.10.2 Selection Bias**

Selection bias exists in both the placement of cooperatives and participation in them. The studies demonstrated that farmer organizations tend to exist in less remote regions and are more likely to be centered near established markets and farmer centers and near households with greater human capital (Fischer, 2012a, 2012b; Bernard, 2008). Many of the studies also found differences between cooperative participants and non-participants. Cavatassi (2011) found that cooperative members were less likely to be credit-constrained and more likely to own agricultural equipment. A literature review conducted by Desai (2014) found that educated and wealthy women were more likely to understand the benefits of participation in agricultural extension programs. Given that substantial differences in baseline characteristics exist between participants and non-participants of cooperatives, PSM was one commonly used design in these studies. It is possible that differences in outcomes between participants and non-participants in cooperatives may be attributed, not only to participation, but also to the characteristics of those who choose to participate. PSM ensures similar distributions in observable characteristics between participants and non-participants so we may construct a viable counterfactual and accurately estimate the causal effect of cooperatives. However, the method is limited since it cannot account for unobserved characteristics – for instance, intrinsic motivation. IV was another commonly used design among these studies. The IV method is useful when there are naturally occurring situations (an instrument) that can be used to explain the relationship between cooperative membership and the outcomes of interest. The instrument must be related to the endogenous explanatory variable (cooperative membership) and related to the outcomes only through cooperative membership. Each of the studies included in this review used different instruments. For example, Fischer (2012b) assessed the following variables as potential instruments since they were significantly correlated with cooperative membership but



not correlated with the outcome of interest: i.e., mobile phone ownership and participation in other social groups such as church or savings associations.

SI carefully reviewed all the papers for the design and statistical analysis methods used by the authors to minimize the bias and only included those that were found to be sufficiently rigorous. This, however, reduced the number of studies included in this review.

### **3.10.3 Spill-over**

The literature also demonstrates evidence of spillover or diffusion effect between cooperative members and non-members. For instance, the presence of one of the larger scale cooperatives may attract extension services as well as traders and industries that may affect, if not benefit, individual farmers (Francesconi, 2007). Therefore, it must be taken into account that the difference between members and non-members might be larger than estimated. Cooperatives are often implemented at the village level and include a wide range of communal activities, which may be exposed to non-members. Very few of the studies included in this systematic review detail how spillover may affect their findings.

### **3.10.4 Multiple-Treatment and Departure Bias**

Cooperative membership is a catch-all treatment status that stands in for a series of sub-treatments provided to members in the form of cooperative services. Unfortunately, the literature does not clearly account for all the services provided to members, as well as the services that are available to non-members. A few of the studies included in the systematic review may have been biased due to confounding variables otherwise known as multiple-treatment bias. In these studies, there was an additional component to treatment other than cooperative-provided services that confounded findings. Furthermore, there was some evidence of bias due to departure from intended intervention. Since most of the studies focused on cross-sectional data, thus looking at treatment effects at a single point in time, this is not as much a concern (Cavatassi, 2011). In the cases where panel data were analyzed, the bias was acknowledged but not necessarily addressed (Bachke, 2009; Francesconi, 2012).

### **3.10.5 Missing Data Bias**

In terms of missing data, there were two main issues that may have led to some bias. At the study level, some studies acknowledged that full information, especially on production cycles from planting to harvest was incomplete (Cavatassi, 2011). Nevertheless, in these cases, authors tended to conduct separate analysis to ensure there was no significant difference in the findings between observations with missing and complete data.

At the meta-analysis level, missing data limited the extent and depth of our analysis. First, many authors listed the overall number of observations but did not report on the breakdown between the treatment or comparison groups. While the research team contacted all authors to obtain this

information, not all authors responded. In cases of non-response, the researchers assumed that the total number of observations was split equally between beneficiary and comparison groups, since this is the most commonly used sampling strategy. Any bias arising from this issue would be small and not likely to substantially alter outcomes. In addition, a number of studies did not provide sufficient information to calculate the pooled standard deviation, and thus, the research team contacted the authors of these studies. When these data could not be obtained, the researchers used the overall standard deviation, which is a very close proxy for the pooled standard deviation. Nevertheless, this limited the research team from conducting a robust meta-analysis.

### 3.10.6 Missing Studies

In order to minimize publication bias and language bias, the research team conducted a wide search of all relevant websites and also contacted lead researchers to locate relevant published and unpublished studies in four major languages (English, Spanish, Portuguese, and French) to include in the review. However, the team could have missed some studies that are yet to be completed and in languages other than the four above and that may tilt the findings reported in the review. Many of the studies could also be missing since the studies have not yet been conducted and may merely represent gaps in existing literature.

## 4 FINDINGS: TYPES OF INTERVENTIONS AND EVALUATIONS

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A total of 21 studies were included to arrive at the findings presented below. All 21 studies used quasi-experimental designs since experimental designs (randomized control trials) would be especially challenging to carry out due to the generally endogenous nature of cooperative membership. The primary study design used was propensity score matching (PSM). Other quasi-experimental designs included: instrumental variables (IV) and difference-in-differences (DD).

In terms of regional breakdown of studies, this systematic review contained many papers from Sub-Saharan Africa (fifteen), with additional papers written on Latin America and the Caribbean, (three) South Asia (two), and East Asia (one). The systematic review also included studies of interventions in low, lower-middle, and upper-middle income economies, as classified by the World Bank in 2015, with the majority of studies (54 percent) conducted in low-income countries. The most commonly studied country was Ethiopia with a total of eight published studies on cooperatives, followed by Kenya, Rwanda, and India, each with a total of two published studies. The clustering of papers in a few countries indicates a gap in the literature, which is discussed below.

## **4.1 INTERVENTION TYPES**

In all of the studies examined for this review, the intervention was cooperative membership. Cooperative membership as a treatment status, however, does not capture the nuances specific to each cooperative. Cooperatives differ across various dimensions, including value-chain, size, external partner, governance, and package of services. This section discusses these dimensions of cooperative interventions.

### **4.1.1 Value-Chain Activity**

Farmer cooperatives and similar forms of collective marketing tend to form around the demands of a particular value-chain and agricultural activity. Studies included in this review examine a wide range of value-chains including milk, maize, horticulture, banana, grain/cereal, coffee, tobacco, cocoa, and Babaçu nuts. The review also included five studies that looked at cooperatives that serviced various, unspecified value-chains.

In addition, cooperatives may operate at different stages of a particular chain. Some of the studies reviewed assessed cooperatives that aimed to link farmers to high-value or international value-chains (Banerjee, 2014; Gitter, 2012; Ito, 2012; Vicari, 2014) while other cooperatives focused exclusively on short, lower-value-chains (Bernard, 2008; Fischer, 2012a).

### **4.1.2 Size, External Actors, and Governance**

The size and geographical coverage of cooperatives were also important characteristics in cooperative models. In some cases, cooperatives included a relatively small number of farmers, while in other cases, cooperatives operated at the national level.

In addition, external actors also played a significant role on the impact cooperatives had on their members. Most cooperatives represented in the studies were externally created- that is, the cooperative was formed with the assistance of an external entity (e.g., government or NGO), but managed by members. The extent to which external actors play a role in the management and support of a cooperative must also be considered when assessing its structure.

Furthermore, in terms of the internal management of cooperative activities, governance structures played a role on the overall effectiveness of the group's activities as well as the extent to which members individually benefited from and were able to influence group activities. Cooperatives tended to have governing bodies and committees made up of members. Several studies in our review looked at the question of inclusion within cooperatives. They examined inclusion in terms of both general membership and internal dynamics which could favor a particular subset of members (i.e., larger farm-holders, men, committee members) (Bernard, 2009; Fischer, 2012b; Ito, 2012).

### 4.1.3 Package of Services

The main differentiator across cooperatives came in the packages of services they provided to members. We have identified the general components of these packages. In addition to collective marketing – the main activity of interest for our review, cooperatives tended to provide some sort of combination of the following services:

- *Input Procurement*: Supply of or facilitated access to traditional or improved inputs such as seeds, fertilizers and pesticides.
- *Finance*: Facilitated access to credit, adapted to the needs of the particular value-chain.
- *Training*: Technical training on crop management and farming technique; access to extension services.
- *Market Information*: Dissemination of information on markets and prices via posting or information communication technology channels.
- *Market Linkages*: Provision of processing infrastructure and assistance on standardization/certification regimes.
- *Farmer Centers*: Provision of a physical space for cooperative members to meet and house other services.

It is important to note that individual cooperatives do not necessarily provide all the services listed above, and the studies do not always explicitly describe the services provided, so treatments vary.

## 4.2 STUDY DESIGN TYPES

All 21 studies used quasi-experimental designs. Due to the endogenous nature of cooperative membership, to date, there have been no experimental designs used to examine the impacts of cooperatives. Furthermore, longitudinal studies were rare, perhaps due to the relatively recent interest in rigorously evaluating how cooperative membership affects farmer outcomes. Among the 21 studies, the most popular method was propensity score matching (PSM) followed by instrumental variable (IV). PSM is a particularly apt design due to the widespread interest in gaining insight into the determinants of group membership. The observable characteristics are used to analyze the probability that a farmer is a cooperative member. This probability is then used to construct a suitable comparison group with non-member individuals who are similar to group members in all relevant observed characteristics. As noted by Banerjee (2014), although a PSM design attempts to account for all determinants of membership, the estimation method is still subject to endogeneity due to omitted variable bias and selection bias. The use of the IV helps to account for these biases by utilizing an instrument, that is a factor correlated to the treatment (participation in a cooperative) but that is not directly related to the outcome variables. We found four studies that used both PSM and IV methods presumably to address the inherent biases in both.

A total of 13 of the 21 studies included in this systematic review used a PSM design only to determine the impact of cooperative membership on farmers' outcomes, another 4 used IV, 3 employed a combination of PSM and IV, and 1 study combined difference-in-differences (DD) with PSM. Although the DD/PSM study (Bachke, 2009) was one of the few studies we found using

longitudinal data to analyze cooperative membership impacts, we found it to be among the weakest in terms of methodology and data. Therefore, it was included in the narrative synthesis but was omitted from the meta-analysis. The author did not explain the sampling procedure well. However, the study was included in this review for narrative analysis since it focused on an outcome of interest (agricultural profits) and applied both PSM and IV. Overall, 11 different studies were included in the meta-analysis, of which 8 applied PSM only, 2 applied both PSM and IV, and 1 applied IV only.

### 4.3 GEOGRAPHIC COVERAGE

As displayed in Table 1, Sub-Saharan Africa accounted for 71 percent of all studies included in the review. Latin America and the Caribbean followed with 14 percent of the studies, and South and East Asia accounted for the remaining 10 percent and 5 percent of the studies, respectively. At the country level, Ethiopia's cooperative systems are by far the most studied. This is not a surprise due a general consensus that the government of Ethiopia (GoE) has made great efforts to organize and promote cooperatives at the national level. In 2002, the GoE laid out an ambitious strategic plan aiming at providing cooperative services to 70 percent of the rural population by 2010, increasing the share of cooperative input marketing up to 90 percent and increasing the share of cooperative output marketing to 60 percent (from an estimated 10 percent in 2005). Although these levels have not been achieved, growth is considered rapid (Bernard, 2008).

Table 1. Studies by Region and Country

Region/Country	Number of Studies	Percentage of Studies
<b>East Asia &amp; Pacific</b>	<b>1</b>	<b>5%</b>
China	1	
<b>Latin America &amp; Caribbean</b>	<b>3</b>	<b>14%</b>
Brazil	1	
Ecuador	1	
Mexico	1	
<b>South Asia</b>	<b>2</b>	<b>10%</b>
India	2	
<b>Sub-Saharan Africa</b>	<b>15</b>	<b>71%</b>
Cameroon	1	
Ethiopia	8	
Kenya	2	
Malawi	1	
Mozambique	1	
Rwanda	2	
<b>Total</b>	<b>21</b>	<b>100%</b>

## 4.4 COUNTRY WEALTH

Table 2 displays the studies according to country wealth. More than half of all the studies discussed in the systematic review examined low-income countries as classified by the World Bank. Twenty-four percent of the studies examined lower-middle income countries and the remaining 19 percent looked at upper-middle-income countries.

Table 2: Studies by Country Wealth Designation

Country Wealth Designation	Number of Systematic Review Studies	Percentage
Low income	12	57%
Lower-middle income	5	24%
Upper-middle income	4	19%
Total	21	100%

## 4.5 TIMING OF PUBLICATION OF STUDIES

Figure 2 depicts the number of studies included in this systematic review published or made available during the search period (2000 – present). Although the timeframe began in 2000, the research team did not find any studies published earlier than 2007 that fit our inclusion criteria. The number of studies published on the subject steadily increased, peaking in the year 2012, and presently remains high, with five studies published in 2014. It is worth noting that the peak in published studies coincided with the UN’s declaration of 2012 as the Year of the Cooperative. The SI team also found pre-study announcements of relevant studies,<sup>9</sup> indicating continued research interest in this field.

Figure 2. Number of Studies included in the Systematic Review by Year Published



Table 3 displays the number of studies that reported on each type of outcome included in this review. The table also lists the authors’ names and years of publication for each of these papers in addition to the type of treatment, crop/activity, statistical design, sign and significance of outcomes. Of the studies included in this systematic review, the highest number focused on income, followed closely by production/yield and market access. Fewer papers reported on the adoption of input and crop technology and poverty.

<sup>9</sup> Of particular interest is an ongoing Impact Evaluation funded by International Initiative for Impact Evaluation (3ie) on the [Impact of Aggregation Centres on Smallholder farmer Market Power in Mali](#). The study uses a randomized phase –in design to measure and determine the impact of an association’s support of smallholder farmers aggregated through cooperatives. The project intervention under assessment aims at improving smallholder farmers’ access to both factor and product markets via their linkages to cooperatives and private agro-enterprise dealers operating within specified geographical areas.

**Table 3: Number of Studies by Outcome**

Study Name	Location	Treatment	Crop/Agricultural Activity	Income, Price, Profit	Production/ Yield	Market Access	Adoption of Technology	Poverty	Acreage/Cropping Pattern	Statistical Design
Abate 2014 (M-A)	Ethiopia	Cooperative Membership	Varies		Increase ***					PSM
Abebaw 2013	Ethiopia	Cooperative Membership	Varies				Increase **			PSM
Bachke 2009	Mozambique	Cooperative Membership	Varies	Increase ***						DD/PSM
Banerjee 2014	Cameroon	Cooperative Membership	Cocoa			Increase *** / **				IV
Bernard 2008	Ethiopia	Cooperative Membership	Grain/Cereals	Increase **		Non-significant				PSM
Bernard 2009	Ethiopia	Cooperative Membership	Grain/Cereals			Non-significant				PSM
Cavatassi 2011 (M-A)	Ecuador	Cooperative Membership	Potato	Increase ***	Increase **		Increase **		Non-significant	PSM



Study Name	Location	Treatment	Crop/Agricultural Activity	Income, Price, Profit	Production/ Yield	Market Access	Adoption of Technology	Poverty	Acreage	Statistical Design
Desai 2014 (M-A)	India	Women's Association Membership	Varies	Non-significant	Increase *	Non-significant				PSM
Fischer 2012a (M-A)	Kenya	Collective Marketing through Cooperative	Banana	Increase *	Non-significant		Increase ***		Increase ***	PSM
Fischer 2012b	Kenya	Cooperative Membership (Female)	Banana			Non-significant				IV
Francesconi 2007	Ethiopia	Marketing Association Membership	Milk			Increase **			Increase *	PSM/IV
Francesconi 2010	Ethiopia	Marketing Cooperative Membership	Cereals			Increase **				PSM
Francesconi 2012 (M-A)	Ethiopia	Marketing Association Membership	Milk		Increase **					PSM/IV

Study Name	Location	Treatment	Crop/Agricultural Activity	Income, Price, Profit	Production/ Yield	Market Access	Adoption of Technology	Poverty	Acreage	Statistical Design
Getnet 2012 (M-A)	Ethiopia	Cooperative Membership	Varies	Increase *					Non-significant	PSM
Gitter 2012	Mexico	Fair Trade Organic Cooperative Membership	Coffee						Non-significant	IV
Ito 2012 (M-A)	China	Cooperative Membership	Watermelon	Increase ***						PSM
Negri 2008	Malawi	Cooperative (Club) Membership	Tobacco	Increase ***	Increase ***				Increase *	PSM/IV
Vandeplas 2012 (M-A)	India	Cooperative Marketing channel	Milk	Increase ***	Increase ***					IV
Verhofstadt 2014a (M-A)	Rwanda	Cooperative Membership	Maize and Horticulture	Increase **		Increase ***	Increase ***			PSM
Verhofstadt 2014b	Rwanda	Cooperative Membership	Maize and Horticulture					Decrease **		PSM

Study Name	Location	Treatment	Crop/Agricultural Activity	Income, Price, Profit	Production/ Yield	Market Access	Adoption of Technology	Poverty	Acreage	Statistical Design
Vicari 2014	Brazil	Cooperative Membership	Babaçu Nuts					Non-significant / + Increase *		PSM
<b>Number of Studies</b>				<b>10</b>	<b>7</b>	<b>7</b>	<b>6</b>	<b>2</b>	<b>6</b>	<b>21</b>

Note: \*\*\*, \*\* and \* represent statistical significance of the results at 1, 5 and 10 percent levels, respectively. NS represents that results were not statistically significant at the 10 percent level.

+Disaggregated outcome: Female only – In addition to reporting outcomes for the entire sample, the study reported the effect size for female participants only.

PSM = Propensity Score Matching; IV = Instrumental Variable; DD= Difference-in-Differences

(M-A) = Studies included in the Meta-analyses

# 5 FINDINGS: EFFECTS OF COOPERATIVES ON FARMER OUTCOMES

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The research team synthesized the findings from the 21 studies included in this systematic review by individual and farm household-level outcome. In discussing effects, the research team defined each outcome and categorized study findings as statistically significant if the study author stated that results were significant at a 90 percent confidence interval level or higher.

## 5.1 INCOME

**The majority of the studies found a significant and positive association between cooperative membership and farmers' income.** Ten studies analyzed the impact of cooperative membership on an income-related outcome (Figure 4). Not all ten studies used a standard indicator to measure income effects. Therefore, the researchers identified a series of proxies for income that captured farmer-level money flow. The proxies included: household income, crop income, output price, profit, revenue, and gross margins to capture effects on income. These outcomes are defined above in section 3.1.3. Nine of the ten studies that examined an income-related outcome found a positive and statistically significant effect. In seven of these nine studies, authors identified a strong, statistically significant (at the 5 percent or 1 percent levels) positive association between cooperative membership and an income-related outcome.

The 10 studies examined different types of cooperatives and attempted to find effects on farmer income and market prices, generally regarded as an intermediate outcome of cooperative activities for its member-base as described in the Theory of Change, captured by SI in

Figure 3. In the path to expanding trade, membership facilitates improved market access and information flow and reduces transaction costs thus increasing unit price and overall income.

Figure 3: Theory of Change for Effects of Agricultural Cooperatives on Agricultural Trade

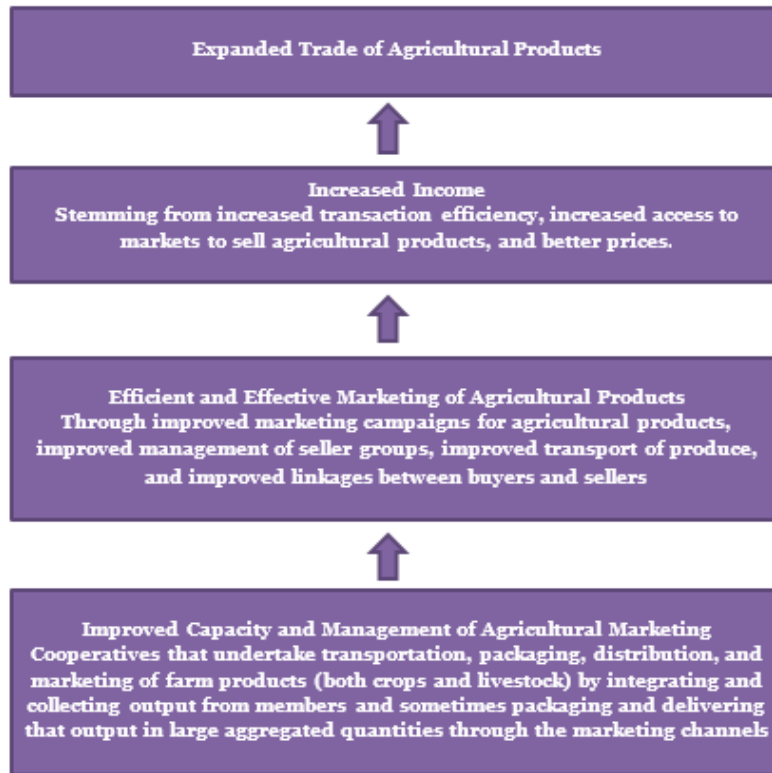


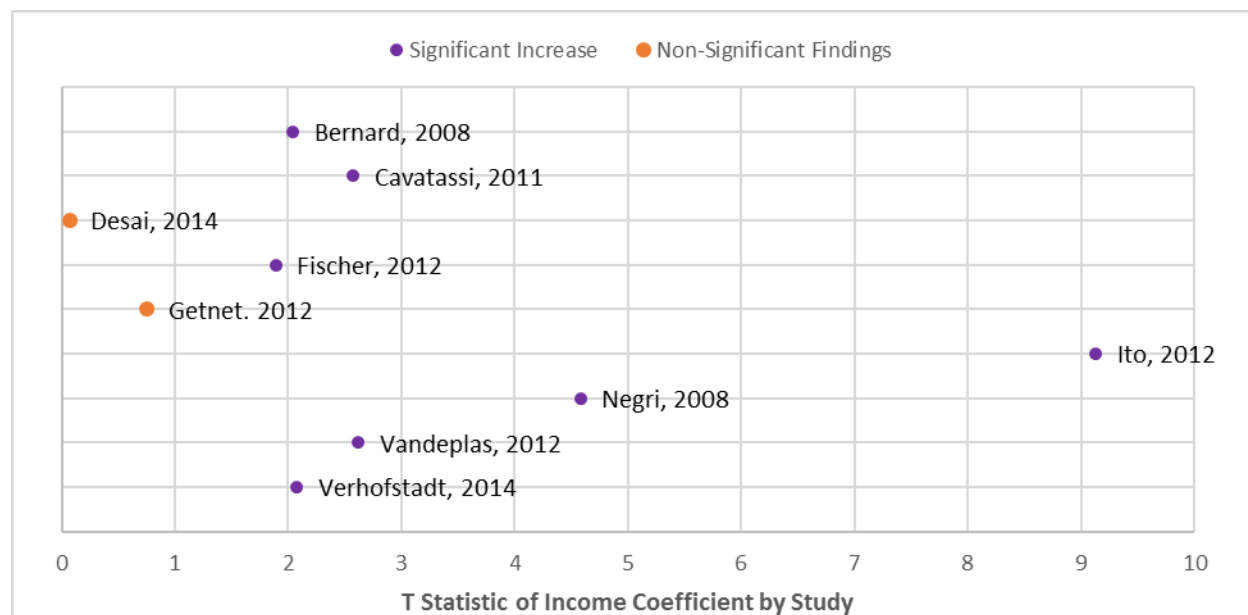
Figure 4 displays a scatter plot of the *t*-statistics obtained from each study.<sup>10,11</sup> It is not a standard practice to compare *t*-statistics directly across different studies because study designs and populations vary greatly, but the statistics help to display findings from the individual studies. An absolute value of a *t*-statistic of about 1.8 or above indicates a significant change in the outcome after the intervention. Therefore, the chart provides a good depiction of the findings for each of the studies. The plots should be considered to be a descriptive display of the significance of the results rather than a quantitative metric of the results. Nonetheless, it is clear that there is a tendency

<sup>10</sup> In statistics, the *t*-statistic is a ratio of the departure of an estimated parameter from its notional value and its standard error. It is the calculated difference represented in units of standard error. It is used in statistical hypothesis testing, and in the computation of confidence intervals. The greater the magnitude of the *t*-statistic (it can be either positive or negative), the greater the evidence for rejecting the null hypothesis that there is no significant difference between two groups. Also, the larger the absolute value of the *t*-value, the smaller the *p*-value, and the greater the evidence against the null hypothesis. Mostly, a *t*-statistic value of two and above translates to a smaller *p*-value. The key property of the *t*-statistic is that it is a pivotal quantity. Therefore, while defined in terms of the sample mean, its sampling distribution does not depend on the sample parameters, and thus it can be used regardless of what these may be.

<sup>11</sup> Note that only nine of the ten studies reporting income-related results are included in the scattered plot due to concerns over the rigorosity of Bache (20). The results of the study are discussed in the corresponding outcome sections.

towards positive differences in the average income between cooperative members and non-members. Thus, cooperative membership is correlated with higher income.

**Figure 4: Strength of Findings on Cooperative Membership’s Impact on Income**



*T statistics are not directly comparable across studies, but they show whether findings are significant within each study. This scatterplot shows that 7 out of 9 authors found cooperative membership associated with higher incomes with statistical significance.*

The results were the strongest in Ito’s 2012 study, which assessed one of China’s member-created watermelon producer cooperatives. Researchers conducted a survey in March 2009 in Hengxi Township, a major watermelon producing area. The study used PSM to estimate the total farm income of cooperative and non-cooperative members. The treatment effects of cooperative membership on farm income ranged from 28 to 31 more Yuan per day (USD 4.38- USD 4.85), suggesting that cooperatives contributed substantially to an increase in farm income. Additionally, Ito assessed how cooperative membership affected small and large-scale farms. Treatment effect for small-scale farms amounted to 40 to 41 Yuan per day (USD 6.25- USD 6.41) while it was 23 Yuan per day (USD 3.59) for large-scale farms. Ito also found that small-scale farms earn nearly twice as large a benefit from the cooperative system as large-scale farms. This indicates that effects were heterogeneous in favor of small-scale farms.

Similarly, Verhofstadt (2014a), Getnet (2012), and Desai (2014) measured the effect of cooperative membership on farm and crop income. Verhofstadt (2014) looked specifically at members of several maize and horticulture cooperatives in Rwanda and found that cooperative membership had a positive effect on gross farm revenue, net farm income, and farm income per worker. Taking the most conservative results, cooperative members had a farm income that was 29 percent higher

than that of non-members. This supports the conclusion that cooperative membership in general had a strong positive effect on farm performance. However, when analyzing maize and horticulture cooperatives separately, he found that positive findings were mainly driven by maize cooperative membership – that is, horticulture cooperatives were less successful in creating gains for their members. Specifically, cooperative membership had no effect on farm income for horticulture members. This is an interesting finding, given the prevailing view in the literature that cooperatives are most successful for higher-value products (Barham et al., 2009). This finding demonstrates that characteristics of cooperatives, such as the type of crop, do matter and must be examined when explaining observed heterogeneity in impact.

Getnet (2012) similarly found a positive, effect on crop income (defined as the sum of incomes generated from annual crops and perennial crops produced and sold to cooperatives) for cooperative members in Ethiopia. Ethiopia is widely regarded as being supportive of cooperatives and cooperative membership. The present review of the literature includes eight studies that focused on cooperatives in Ethiopia.

Desai (2014) was the only author who evaluated a female-only cooperative, and he found no significant impact on income. The program, which organized female farmers into rural producer associations and is called the Self-Employed Women's Association (SEWA), was established in 300 villages in four districts in Gujarat, India. Implemented through a partnership between an NGO and the private sector, SEWA provided members with supports in markets for inputs, credit, labor, and outputs between the years 2008 to 2010. Applying PSM on a cross-sectional dataset, the study matched association members with non-members. Overall the study achieved strong balance between the two groups indicating similarity in characteristics between the two groups. But, it is worth noting that there were some key differences between members and non-members. Members and their spouses had 0.7 years more schooling than non-members, they were less likely to reside in temporary or semi-permanent housing, and they had more land, suggesting wealthier and more educated women were more likely to join SEWA farmer groups. The authors observed that SEWA membership was associated with an increase in total farm income levels, but the effect was not statistically significant when controlled for demographic characteristics. However, even after controlling for demographic characteristics, SEWA membership for more than six months increased non-farm income by 70 percent, which was statistically significant. The authors stated that these results should be interpreted cautiously since effects on income may be limited due to the short duration of the program (less than 18 months) at the time of the survey.

In addition to crop income, Fischer (2012a) focused on total annual income effects of banana cooperatives in Kenya. The cooperatives studied were part of an NGO intervention aiming to create self-sustaining farmer groups. The intervention provided members with non-market services (i.e., access to technical innovations and extension services) as well as market services which eventually aimed at linking farmers to high-value markets, including supermarkets, processing companies, or exporters. Although the high-value linkages had not materialized by the time data were collected, there was already a distinct differentiation between members who marketed output individually



and members that marketed output collectively. Therefore, Fischer looked at the average treatment effects of membership for those who marketed collectively, as well as those that marketed individually and compared them to non-members using PSM. Results showed a positive and statistically significant effect on total annual income as well as on banana income for members who marketed collectively. On average, members that sold collectively made 73,910 KShs (USD 857.36) more than non-members. Interestingly, there was no statistically significant effect on income for cooperative members who decided to market individually. Although the authors found positive income effects, they were relatively weak for collective marketing for bananas in Kenya. Researchers hypothesize that differences in income effects between non-members and members who marketed collectively were due to reduced transaction costs and intermediary costs. However, these efficiency gains were marginal since the banana supply chain is shorter relative to other crops. Thus, positive income effects are believed to be associated indirectly with the expansion of banana production due to improved access to better production information and planting material (see adoption of technology) rather than a price premium.

Negri (2008), Cavatassi (2011), Vandeplass (2012) and Bernard (2008) examined gross profit and price premiums effects, which served as proxies for income effects. Negri looked at burley tobacco producer clubs in Malawi that gave members market access to better quality inputs, higher output prices, lower credit prices, more stable and consistent labor supply, and helped achieve higher tobacco quality. The clubs fostered supportive networks and facilitated collective action and the realization of economies of scale. Through PSM, the study compared members and non-members. The study found that the club premium in sales (per acre) was 45 percent. The author used this finding as a proxy for increased income due to higher sales but noted that there was no statistically significant difference between members and non-members on unit prices and an increase in productivity drove the increase in sales.

This is not the case in Bernard's 2008 study in Ethiopia which finds a significant and positive difference in price between members and non-members. The study looked at state-sponsored cereal/grain producer cooperatives in Ethiopia and compared output prices for members and non-members by creating a price difference indicator equal to the acreage-weighted sum of the difference between the price received by the household member for each type of cereal sold and the corresponding average price. Results indicate that members on average were able to sell output at a price that was 7.2 and 8.9 percent higher than non-members. Cooperatives were effective at providing marketing services to their members, including greater bargaining power and reduced transaction costs. It is worth noting that the study assumed the decision to become a cooperative member was not subject to self-selection bias because cooperatives were created through a targeted state intervention in which whole communities in certain villages were entered into cooperatives. This was a unique quality of this study because usually coop-members self-select into these unions. Similar to other studies, Bernard found that cooperatives tended to be located in areas with relatively good market access.

Cavatassi (2011) analyzed the Plataformas de Concertación (Plataformas) in Ecuador, which was both a marketing and supply cooperative. The program began in the central Sierra of Ecuador in 2003 and was made up of alliances between small-scale farmers and a range of agricultural support service providers. Plataformas provided members with a range of services including training to help them meet the demands of high-value markets, education on pest management strategies, and access to new technologies, high-quality seeds, and high-value potato markets by directly linking smallholder potato producers to restaurants, supermarkets, and processors who were willing to pay a premium for potatoes that met their standards. This study assessed the impact of Plataformas on gross margins (\$/hectare) and concluded that members had on average USD 292 higher gross margins per hectare than non-members. The change was driven by an increased use of modern production technology, which led to higher yields and thus, higher prices received from potato production.

Vandeplas (2012) examined the milk-producer cooperative in India. The Milk Producer Federation Ltd. (Milkfed) was created under the dairy cooperative framework in the Punjab state and it was comprised of hundreds of milk unions. Interestingly, the study looked at the cooperative in a context where there was a viable multi-national marketing channel (Nestle). However, based on the selection criteria of this systematic review, we will only report on the study's comparison of cooperatives' effects in areas where producers did not have the option of joining the multinational channel. Vandeplas found that informal channels (i.e., cooperative non-members) had significantly lower profitability as measured by the percentage difference in dairy profits per animal. Similar to other measures of profitability, the study aimed to capture changes in margins for a given set of inputs, in this case dairy producing input, and found that cooperative members had 117 percent higher profits per animal than did farmers that marketed through informal channels.

Bachke (2009) looked at the long-term effects of membership on smallholder income in Mozambique. Using panel data collected in 2002 and 2005, Bachke assessed members' agricultural profit over time and concluded that although membership shifts income upward, once a farmer becomes a cooperative member, income does not keep growing faster than other farmers. Bachke did not provide details on the cooperatives studied. This lack of context makes it difficult to analyze the implications of these findings.

## 5.2 PRODUCTION AND YIELDS

**The majority of the studies found a significant and positive association between cooperative membership and farmers' productivity and yield.** Figure 6 shows that the eight quantitative studies on productivity and yield included in this review. However, two of Francesconi's papers used the same dataset and looked at the impact of the same cooperative on production. Thus, only the findings from the author's most recent paper are included in this review. Of the seven studies, six studies found a statistically significant and positive association between cooperative membership and farmers' production or yields, and one study found a non-significant and negative association.

Although the majority of studies report on yield effects (output per unit of land), other studies look at production per farm per day, or production per animal in the case of dairy farms. We also review studies that report effects on technical efficiency (defined as the ratio of output to input) and total amount harvested.

As demonstrated in the theory of change of farmer cooperatives on productivity and yields in Figure 5, Figure 6 farmer cooperatives provide members with access to improved inputs and technologies. The studies reviewed also point to increased access to information and extension services. Here we focus on reviewing findings on productivity gains as a final outcome of farmer cooperatives.

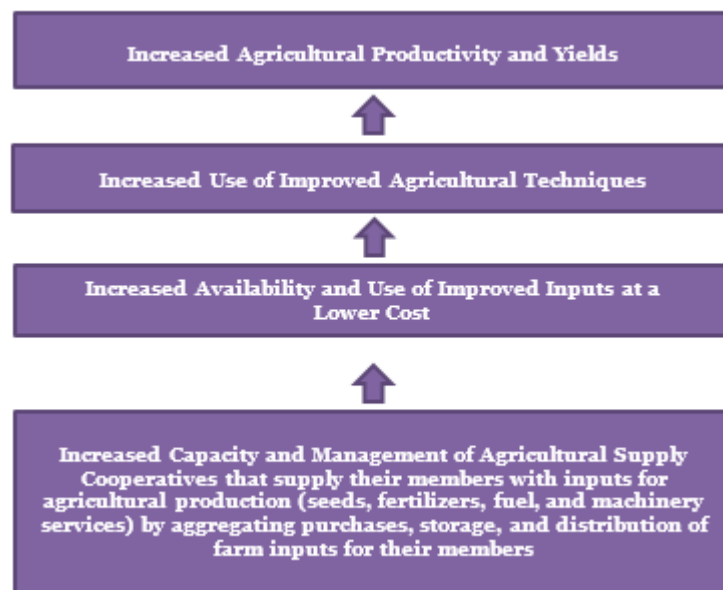


Figure 5: Theory of Change for Effects of Farmer Cooperatives on Agricultural Productivity and Yields

Francesconi conducted two studies in 2007 and 2012 in Ethiopia and found the strongest positive effect of cooperative membership on milk production, defined as liters per farm per day. Created and still organized by retired military personnel, the Ada'a Liben Woreda Dairy and Dairy Products Marketing Association was established in Debre Zeit in 1997-98. As both a supply and marketing cooperative, membership allowed access to a particular milk market, price information, and inputs. Both the 2007 and 2012 studies concluded that participation in dairy cooperatives increased milk production. Results from the 2012 study also showed that the average cooperative household produced 13.6 liters of milk per farm per day, which was significantly higher than non-members. Like most Ethiopian dairy cooperatives, this cooperative provided smallholder farmers with access

to subsidized inputs from the government, which was mainly used to obtain artificial insemination services and live exotic cows. Thus, high-yielding crossbred cows make up most cooperative herds, whereas non-cooperative farmers mainly have local breed (*zebus* breed). Additionally, the study looked at the quality of the milk produced by comparing the protein and fat content of the milk produced by cooperative and non-cooperative members and found that although cross-bed cows produced larger volumes of milk, protein and fat contents were significantly lower than in the milk produced by the zebus cow.

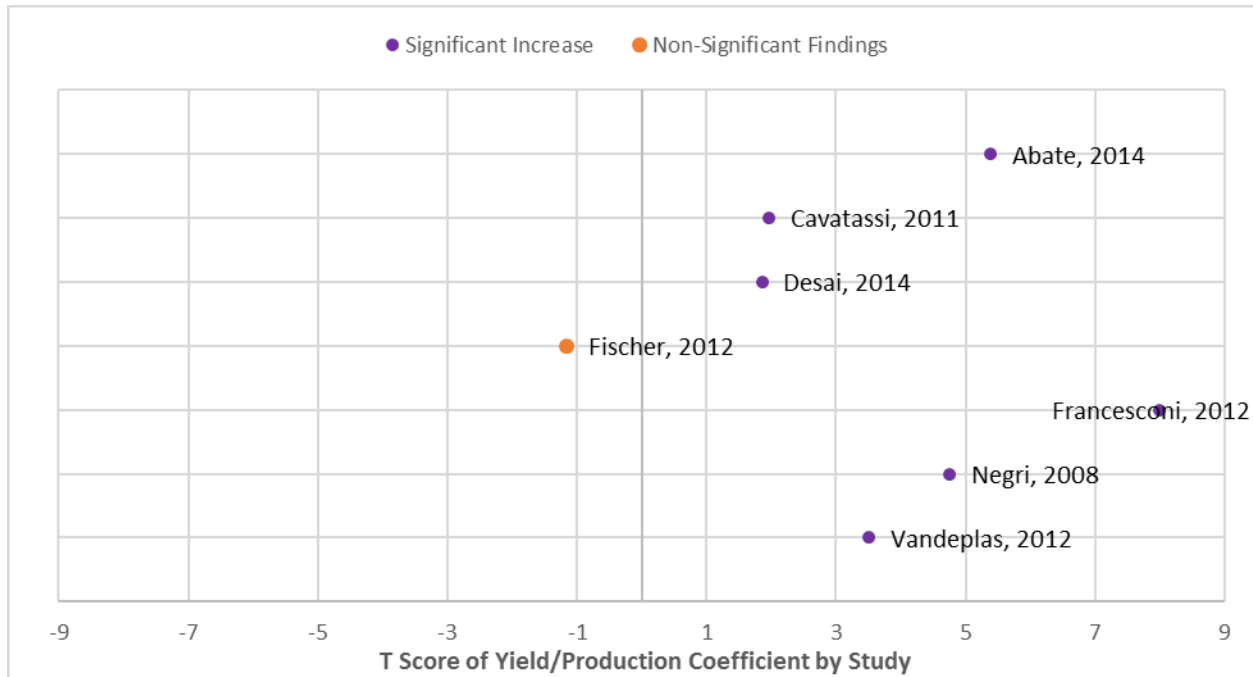
Likewise, Desai's (2014) study of the SEWA cooperative in India found that in addition to increased total farm income, members with at least six months in the cooperative also saw a significant 32 percent increase in total amount harvested. Thus, even though the study found no significant differences in income between cooperative and non-cooperative members, a critical step in eventually having higher income had been achieved. Similarly, Vandeplass (2012) found that cooperative members had 67 percent higher yield per buffalo than non-members in one of India's largest milk producer cooperatives.

Cavatassi (2011) and Negri (2008) assessed the effect of cooperative membership on yields. Cavatassi found that in addition to higher gross margins, members of the Plataformas farming cooperative in Ecuador experienced an increase in yields. Plataformas producers applied significantly more traditional inputs as well as insecticides and insect traps. It was found that a 1 percent increase in seeds utilization increased output by 0.75 percent while a 1 percent increase in labor utilization increased output by only 0.2 percent. Additionally, members had increased access to tractors and irrigation. Overall, the results point to input intensification and neutral technological change as the drivers of impact of the Plataformas on yields. Negri (2008) similarly found a 40 percent increase in yields for burley tobacco club members in Malawi. Similar to Cavatassi, he found that cooperative membership effected utilization of inputs, especially of fertilizer. Cooperative members tended to use a higher quality fertilizer more often than non-members. Furthermore, tobacco club members benefited from more visits from agriculture field assistants. As mentioned in the discussion on income effects, the study found that the increase in productivity drove the increase in sales.

Abate (2014) measured technical efficiency among cooperative members in Ethiopia. Technical efficiency departs from traditional measures of productivity; however, it aims to capture the ability of households to obtain maximum possible outputs from a given set of inputs. In doing so, technical efficiency is intended to capture whether agricultural cooperatives enable their members to gain better access to productive inputs and services including training on better farming practices that enhance their productive efficiency. The study found that on average, farmers belonging to agricultural cooperatives were more efficient than independent farms. The results suggest that member households were in a better position to obtain maximum possible outputs from a given set of inputs used, by about 5 percent, in line with the expectation that cooperatives likely made productive technologies accessible and provided embedded support services, including training, information, and extension linkages.

Figure 6 displays a scatter plot of the individual t-statistics found in the regression analysis of seven of the eight studies.<sup>12</sup> As previously mentioned, the plots should be considered as a descriptive display of the significance of the results rather than a quantitative metric of the results. Quantitative summary statistics are discussed in the section on meta-analysis.

**Figure 6. Strength of Findings on Cooperative Membership’s Impact on Production or Yields**



*T statistics are not directly comparable across studies, but they show whether findings are significant within each study. This scatterplot shows that 6 out of 7 authors found cooperative membership associated with an increase production or yield with statistical significance.*

As the chart above shows, all but one of the production and yield studies found a statistically significant increase in production and/or yields. Fischer (2012a) was the only author who found a negative but statistically non-significant effect on yield for cooperative members that marketed collectively. Fischer suggested that one explanation for the insignificant results was the short time-frame of the evaluation. A substantial number of cooperative members in this study expanded their banana plantations and adopted new Tissue Culture (TC) planting material (discussed in-depth under Adoption of Input and Crop Technology). They had not harvested from the new plant because bananas have an especially long growing season that extends beyond a year.

<sup>12</sup> Francesconi (2007) was not included in the scatter plot since Francesconi (2012) utilizes the same methodology on the same dataset and reports the impact of the same cooperative on production. As per the inclusion criteria, findings from the most recent studies are included.

### 5.3 MARKET ACCESS

**The association between cooperative membership and market access is inconclusive with only three out of seven authors who found statistically significant increases in market access.** The SI research team reviewed seven studies fitting the inclusion criteria that examined the effects of cooperatives on market access. While three studies found a statistically significant and positive relationship between cooperative membership and market access, four found a non-significant relationship.

Bernard (2008) examined market participation of cooperative members in the cereal market in Ethiopia by measuring the share of the cereal production that was sold by each household. Using PSM, Bernard did not find a statistically significant effect on production sold, that is, cooperative members did not market a higher proportion of the output when compared to non-members. This finding was somewhat surprising given that, as discussed with regard to income, cooperative members, on average, manage to secure higher prices for the output marketed. Given that the estimates are an average for all farmers, the authors attempted to capture potentially important differential impacts (heterogeneity) across farmers' response to their participation in cooperatives. By interacting the treatment dummy (member versus non-member) with selected household-level variables, the authors found that the percentage of production sold increased significantly with the size of the landholding, indicating that larger farms gained better market access through cooperative membership than smaller farms. One possible explanation is that when they achieve higher output prices through membership, smaller farmers tended to sell less on the market and increased household consumption. The study hypothesizes that price variations are likely to positively affect the own-consumption of output by poorer households and that this effect is likely to be larger than the corresponding positive effect on the production of such a household. The net impact is thus to be a negative marketed output response to the price incentives that cooperative membership afforded poorer households while it was positive for large-scale farmer members. In a separate study, Bernard (2009) also looked specifically at the market access afforded to the rural poor through rural producer organizations in Ethiopia. Findings suggest that the poorest households tended to be excluded from membership in marketing cooperatives. Even when afforded membership, poorer members had less access to decision-making processes.

Francesconi (2010) also examined the impact of cooperative membership on member commercialization rates. The results were similar to those of Bernard (2009), who found impacts on production to be non-significant when all types of cooperatives were aggregated together. However, the study further distinguished cooperatives into marketing and livelihood organizations. In marketing cooperatives, members commercialized collectively through the organization while in livelihood cooperatives members marketed individually. Furthermore, livelihood cooperatives depended mainly on external support to exist while marketing cooperatives were self-sustaining. Marketing cooperative had significantly higher rates of commercialization, 11 percent higher, when compared with individual farmers. The results suggest that collective commercialization provided was more beneficial than individual commercialization. Nevertheless, similar to Bernard (2008,

2009), Francesconi (2012) suggested that cooperative members were usually still middle-level landholders, located in areas with high-potential for agricultural commercialization, signaling that cooperatives should not be seen as a means to ensure the participation of the poorest farmers. In Rwanda, Verhofstadt (2014a) found a positive and significant effect on commercialization rates among maize and horticulture cooperative members, on average selling 10 percent more of their output than non-members.

Desai (2014), Fischer (2012b), and Banerjee (2014) all examined the impact cooperatives had on expanding market access for women. Desai (2014) did not find a significant effect on the fraction of harvest sold on the market or in the farmers' knowledge of output prices prior to making a sale, another proxy for market participation, for SEWA members in India. Using instrumental variables, Fischer (2012b) conducted her analysis of banana cooperatives and found that farmer groups contributed to male control over banana production output by 13 percent and revenues by 11 percent which led to the conclusion that cooperatives only improved outcomes for male farmers even though bananas were traditionally a women-dominated crop. However, findings showed that the negative gender implications of farmer groups were reduced or avoided entirely when women were also members of the cooperative.

In the poorest income quintile, group membership had a positive effect on female-controlled income. Banerjee (2014) also conducted a gendered analysis of Cameroon's cocoa producers looking specifically at the impact of collective marketing on market participation and control over revenue of women regardless of membership. The study found that a large number of female farmers were producing cocoa, a major cash crop, but very few of them took up marketing activities. Female farmers had a 33 percent to 22 percent lower probability of market participation compared with men. In short, while males were producing and marketing, most females were only producing. Next, using an IV approach Banerjee looked at how cooperative membership among men impacted the access to markets for females, membership notwithstanding. By using the percentage of male farmers who sold collectively through Common Initiative Groups or CIGs (government- and NGO-promoted farmer cooperative) as an instrument for price discrimination, Banerjee posited that in regions where male participation in collective marketing is higher price discrimination for women is lower. Lower rates of male market participation in collective action led to significant gender discrimination as reflected in a significant gender gap in prices, discouraging women from participating in the cocoa market. It followed that higher rates of male participation in collective marketing rendered the gender price gap insignificant. The study thus concluded that male participation in collective marketing had a general positive impact on female market participation, regardless of membership, which in turn gave females more control over proceeds.

## 5.4 ADOPTION OF INPUT AND CROP TECHNOLOGY

**All of the six authors who examined adoption of input and crop technology found that it had a significant and positive association with cooperative membership.**

Each of the studies assessed input and crop technology differently and some analyzed multiple indicators. For example, Cavatassi (2011) measured seven indicators including the use of a tractor, organic fertilizer, preventive fungicide, etc. Although the causal links between increased adoption of input and crop technology and the final outcomes of increased productivity and higher levels of income differ slightly across studies, all six studies found that cooperative membership had a positive and significant impact on the intermediate outcome. Abate (2014) found that cooperative membership had a strongly significant impact on the adoption of fertilizer and improved seeds. Members used on average 30.42 more kilograms of fertilizer per hectare and 4.52 more kilograms of improved seeds than non-members. The result falls in line with the finding that agricultural cooperatives likely make improved production technologies accessible and provide embedded support services. Cavatassi's (2011) analysis of the Plataformas intervention in Ecuador similarly found significant positive effect on input intensification.

Furthermore, the program increased the use of pesticides and decreased the use of toxic or damaging inputs. Fischer (2012) also found a significantly greater adoption of Tissue Culture (TC) planting material for banana among cooperative members. The TC plantlet offered a new way to propagate bananas (in lab, rather than by suckers which carry pests and disease), which directly impacted productivity and output quality. The TC banana adoption rate among group members ranged between 72 percent and 73 percent compared to 14-20 percent among non-members. Verhofstadt (2014a) found that cooperative membership resulted in large and significant positive effects on the value of inputs, with effects ranging between 6 and 8.6 thousand RWF (approximately 8 to 12 USD), significant at the 5 percent or 1 percent level, and on the likelihood of using improved seeds, mineral fertilizer, and irrigation (21 to 31 percentage points). Related to the technology adoption, membership also increased access to market and production information, which in turn improved plantation management. Findings consistently showed the positive effects of cooperative membership on the adoption of technology. Abebaw (2013), however, found that although membership in an agricultural cooperative in Ethiopia was associated with a strong impact on the adoption of fertilizers and the use of pesticides, it does not have a statistically significant impact on the adoption of improved seed. Although the impact on technology adoption is generally strong and positive, depending on the context (i.e., type of cooperative, services provided) uptake of certain technologies may be weaker than others.



## 5.5 POVERTY

**Very few studies assess the relationship between cooperatives and poverty, and the limited studies indicate coop membership reduces poverty, especially for women.** The SI research team reviewed two studies fitting the inclusion criteria that examined the effects of cooperative membership on poverty. While one study showed no significant result for all farmer members, it showed a significant improvement in wealth status for female cooperative members. Another study indicated a reduction in poverty with statistical significance. Similar to the other outcomes, poverty was defined and measured differently across the literature.

Vicari (2014) found that cooperative membership did not have a significant association with poverty. , Vicari examined access to shelter, defined as the possibility of having a decent house, which according to the local standards means a mud or brick house with tiled, not straw, roof, and having electricity and piped water as a measure of economic freedom, and thus a suitable proxy for poverty. In this case, greater access to decent shelter suggests a decrease in poverty. Results do not show a significant difference in shelter between members and non-members. However, it is very important to note that when the authors analyzed only females in their sample, they found that cooperative membership was significantly and positively associated with access to shelter.

Verhofstadt (2014b) defined poverty as being below the extreme poverty line, set in Rwanda at 83,000 RWF per adult equivalent per year. The study found a significant and negative relationship between membership and poverty; cooperative membership reduced the likelihood of being poor by 10 to 14 percentage points. The results indicate that marketing cooperatives in Rwanda were effective in improving farmers' welfare.

## 5.6 ACREAGE AND CROPPING PATTERN

**The association between cooperative membership and acreage or cropping patterns was inconclusive.** The research team reviewed six studies fitting the inclusion criteria. While three studies found positive and significant associations, three found insignificant associations.

Fischer (2012a) analyzed the amount of land in acres allocated for bananas, Negri (2008) analyzed the amount of land allocated to tobacco, and Gitter (2012) analyzed the amount of land allocated to coffee. Cavatassi (2011) and Getnet (2012) both analyzed overall land ownership among farmers. Francesconi (2007) analyzed herd size, a proxy used for cropping pattern given the limited literature on this topic.

Both Fischer and Negri found positive associations. Cooperative members had 0.11 more acres of land allocated to tobacco compared to non-members. Additionally, cooperative members allocated 0.16 more acres of land to banana plots than non-members. However, Gitter found a non-significant relationship between cooperative membership and land allocated to coffee. Both Cavatassi and Getnet found non-significant relationships between cooperative membership and land ownership.

Getnet hypothesized that the lack of a positive increase in land might be attributable to household preferences for fulfilling basic needs before investing in acquiring more land. Getnet and Bachke suggested that land tenure laws were also a major factor influencing, if not determining, landholding decisions. In Mozambique, for instance, it was not possible to own land privately. Rather, the government focused much of its agricultural policy on increasing yields, through better technologies, and improving market access. Smallholders were therefore subject to laws that greatly restricted their access to land (Bachke, 2009).

# 6 FINDINGS: META-ANALYSES

## 6.1 INCOME SUMMARY STATISTICS

Six studies were available for inclusion in the meta-analysis on income. These studies are included in Table 4, below, along with their effect sizes expressed in standardized mean differences as Cohen's d values and confidence intervals. The standardized mean differences were calculated using the methodology discussed in Appendix 5. These figures are shown in Table 5. The confidence intervals are based on an inverse weighting of the pooled standard deviation within each study. This means that the more precise outcome measurements were weighted more heavily than those that were less precise.

Table 4. Impacts of Cooperative Membership on Farmer Incomes: Meta-Analysis Statistics

Study	Standardized Difference in Means (Cohen's d Values)	Standard Error	Confidence interval Lower Limit	Confidence interval Upper Limit
Desai 2014	0.005	0.055	-0.102	0.112
Fischer 2012a	0.187	0.096	0.000	0.375
Getnet 2012	0.180	0.138	-0.090	0.450
Ito 2012	0.497	0.114	0.273	0.720
Vandeplas 2012	0.686	0.155	0.383	0.989
Verhofstadt 2014	0.217	0.106	0.009	0.426
<b>Summary Statistic</b>	<b>0.276</b>	<b>0.100</b>	<b>0.081</b>	<b>0.472</b>

Interpretation of Cohen's d value can be a little bit ambiguous. Unlike t-statistics, which have a definitive interpretation related to standard deviation, Cohen's d values have no such direct interpretation. As a rough rule of thumb, Cohen (1978) suggested the following interpretation:

- Greater than or equal to 0.8 = large effect
- Between 0.79 and 0.5 = moderate effect
- Between 0.49 and 0.2 = small effect

For the purposes of the discussion in this report, SI researchers have used this interpretation. It should be noted, however, that this approach might not always be appropriate since in certain fields, a Cohen's d value of 0.2 may in fact be considered very large for some types of interventions

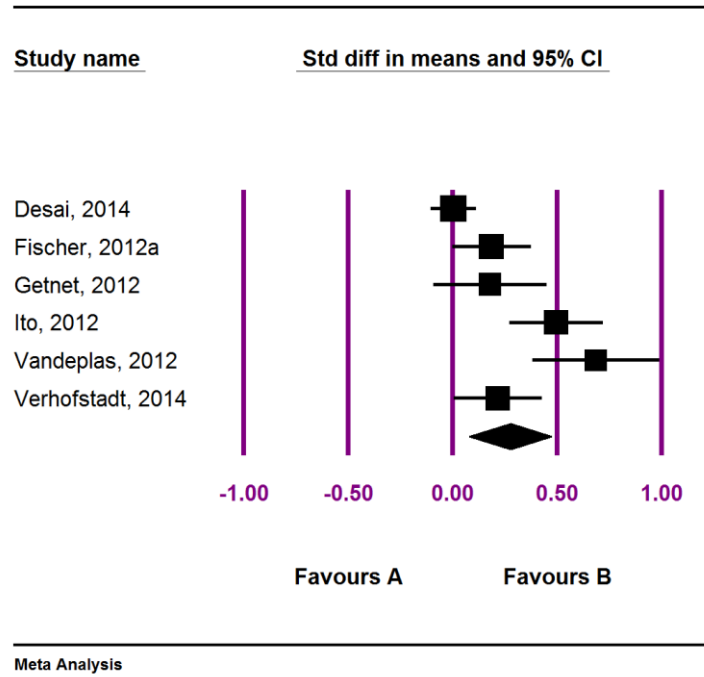
such as those related to primary education reading outcomes. For this reason, researchers additionally discuss the confidence interval of the Cohen's d values to determine whether they are significantly different from zero.

CMA generated the forest plot depicted in

Figure 7, which shows changes to income outcomes due to cooperative membership. The plots reflect effect sizes as the standardized mean differences. As specified in the Campbell Collaboration method, all meta-analyses were based on random effects models due to the high degree of heterogeneity.

Overall, cooperative membership appeared to increase income with an effect size of 0.276 that could be considered as small, but with a small confidence interval band that does not encompass zero. All six of the studies displayed positive effect sizes; however, two of the studies, Desai (2014) and Getnet (2012) had confidence intervals that included zero. Results were strongest in Vandeplass' (2012) study, which had an effect size of 0.989. Vandeplass suggested that the increased profitability was due to the higher village-level milk price and a further distance to the nearest town, which increased profitability for cooperative members that were able to enter these markets with greater ease. The impact was less extreme in Desai's study of an all-female cooperative in India. The reason for this smaller effect on farm income may be due to the short duration of the program (less than 18 months) at the time of the survey. Many of the income-related benefits, such as significant increases in farm income, take more than a season to manifest. Similarly, Getnet's study also found a relatively small effect on crop income. As noted, the research team used various outcome measures to capture impact on income. Both Desai and Getnet measured farm or crop income, for which, as noted by Desai, impact may lag when compared to other income measures in the literature (i.e., total income, gross margins, output price). SI researchers conclude that, on average, cooperative membership had a small but positive impact on farmer income. Part of the reason for this small effect size could be the limited time period over which most of these studies were conducted, particularly when looking at farm and crop related income. True changes in income often take more than a few years. However, to know whether the short time frames are resulting in underestimated results, further research is needed.

Figure 7. Effects of Cooperative Membership on Farmer Incomes: Forest Plot



## 6.2 HETEROGENEOUS IMPACTS ON INCOME BASED ON MODERATORS

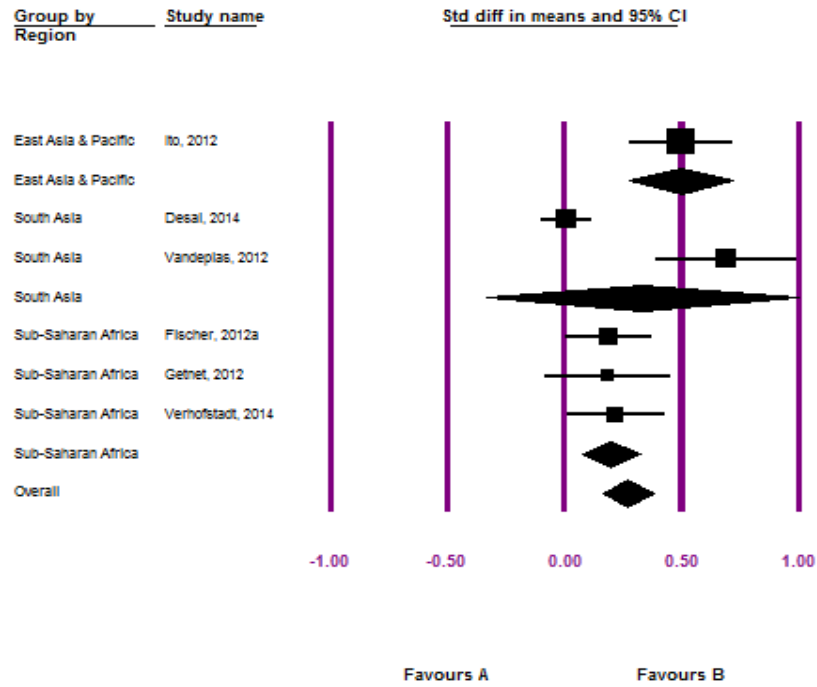
Because the contexts of the different studies vary widely, SI researchers expected heterogeneous impacts. As such, the team applied moderators to the meta-analysis to see how they affect the impact of cooperative membership on incomes.

Based

on

Figure 8, cooperative membership appears to have had the largest impacts in East Asia (d value of 0.497) and South Asia (Cohen's d value of 0.330) (the diamonds represent the overall results for each region). Although the impact looks large for East Asia and the Pacific, this observation carries less weight since there was only one study from that region. Interestingly, all three regions had positive effect sizes. The confidence intervals did not include zero with the exception of South Asia where in spite of a positive effect size, the confidence did include zero. Overall, the summary statistic is positive indicating that cooperative membership likely causes positive impacts on farmers' income in all three regions represented.

Figure 8. Effects of Cooperative Membership on Farmer Incomes by Region



Meta Analysis

As

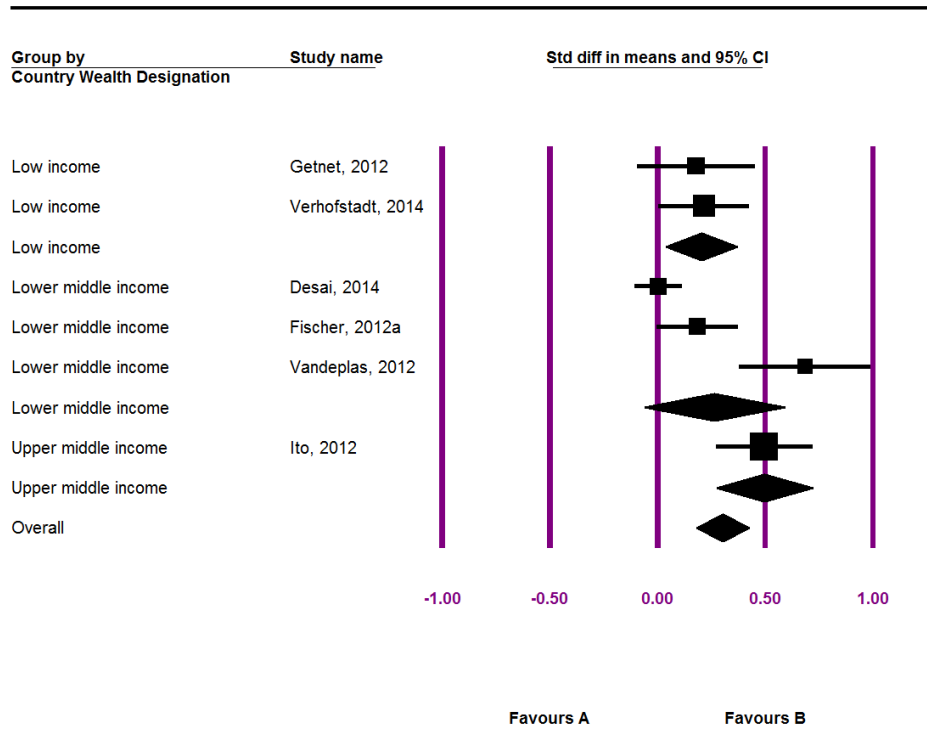
shown

in



Figure 9, all three country economic levels included in the study were associated with positive effect sizes. The Cohen's d value for low income countries, however, is the lowest, but has a confidence interval that does not include zero. The Cohen's d value for lower-middle-income countries is greater than for low-income countries. However, the confidence interval includes zero, which makes results inconclusive. The impact is greatest for upper-middle income countries (Cohen's d value of .497). Again, this finding cannot be considered robust since the analysis only included one upper middle income study. Additional research is needed to determine the causes for this differential impact.

**Figure 9. Effects of Cooperative Membership on Farmer Incomes by Country Wealth Designation**



**Meta Analysis**

### 6.3 PRODUCTION AND YIELD SUMMARY STATISTICS

SI found five studies that met the criteria for meta-analysis of production-related cooperative membership outcomes. These studies are listed in Table 5 along with their effect size and confidence intervals:

**Table 5. Effects of Cooperative Membership on Production and Yield: Meta-Analysis Statistics**

Study	Standardized Difference in Means (Cohen's Values)	Standard Error	Lower Limit	Upper Limit
Abate 2014	0.331	0.052	0.229	0.434
Desai 2014	0.123	0.061	0.003	0.243
Fischer 2012a	-0.194	0.097	-0.383	-0.004
Francesconi 2012	1.652	0.246	1.171	2.134
Vandeplass 2012	1.377	0.132	1.119	1.635
<b>Summary Statistic</b>	<b>0.614</b>	<b>0.225</b>	<b>0.173</b>	<b>1.054</b>

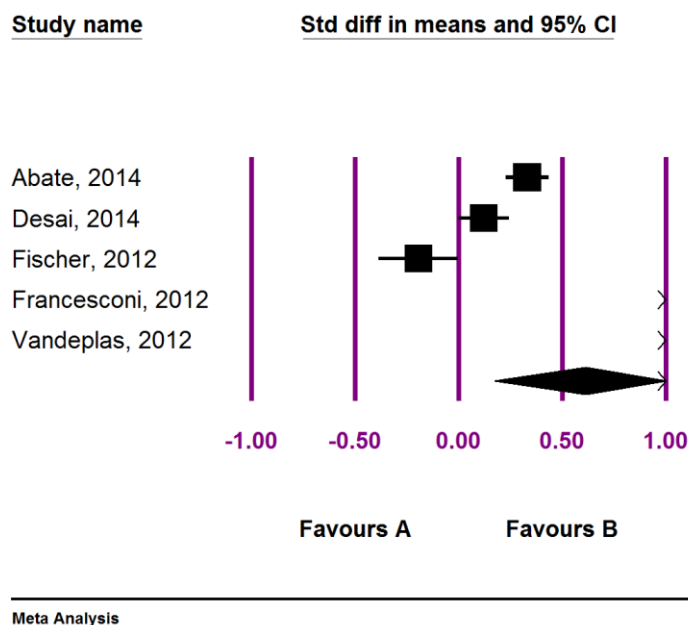
The research team used CMA to generate the forest plot depicted in Figure 10, which shows changes in farmer productivity due to cooperative membership. The overall summary statistic for effect size was 0.614, which may be seen as significant and could be considered a moderate positive change in production due to membership. The confidence interval for the summary statistic ranged from 0.173 to 1.054. Because this interval does not encompass zero<sup>13</sup>, SI researchers conclude that, on average, cooperative membership programs had a moderate positive impact on farmer productivity. Results are strongest in Francesconi with an effect size of 1.652, indicating a strong positive effect on milk production as measured in liters per farm per day. The cooperative studied, like most Ethiopian dairy cooperatives, provided farmers with access to subsidized inputs. These

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13 Here the confidence interval provides an estimate range for the overall effect size of an intervention on the outcome of interest based on the effects reported in the studies included in the review. A confidence interval that includes zero suggests that it is possible that the effect size is zero and that the intervention does not have a discernable effect on the outcome. When the confidence interval does not include zero, we can conclude that the intervention has an effect on the outcome – positive, if the confidence interval is above than zero or negative, if the confidence interval is below zero.

subsidies were mainly used to pay for artificial insemination and exotic cows. Consequently, cooperative herds were dominated by higher-yielding crossbred cows. Vandeplas (2012) also looked at a dairy cooperative in India, which had similarly strong results. Results were weakest in Desai's (2014) and Fischer's (2012) papers with effect sizes 0.123 and -0.194 respectively. Moreover, Fischer (2012a) found a negative effective on yield. One explanation for the unexpected result is that a number of cooperative members who had recently expanded banana plantations and adopted new crop technology had not harvested from the new plants at the time the survey was administered. Bananas have a particularly long growing season, taking more than one year until newly planted bananas bear fruit. In addition, in 2009, at the time the survey was carried out, bananas had been subjected to a long drought. SI researchers therefore conclude that, on average, cooperative membership programs had a moderately strong and positive impact on farmer's production and yields.

Figure 10. Effects of Cooperative Membership on Productivity: Forest Plots



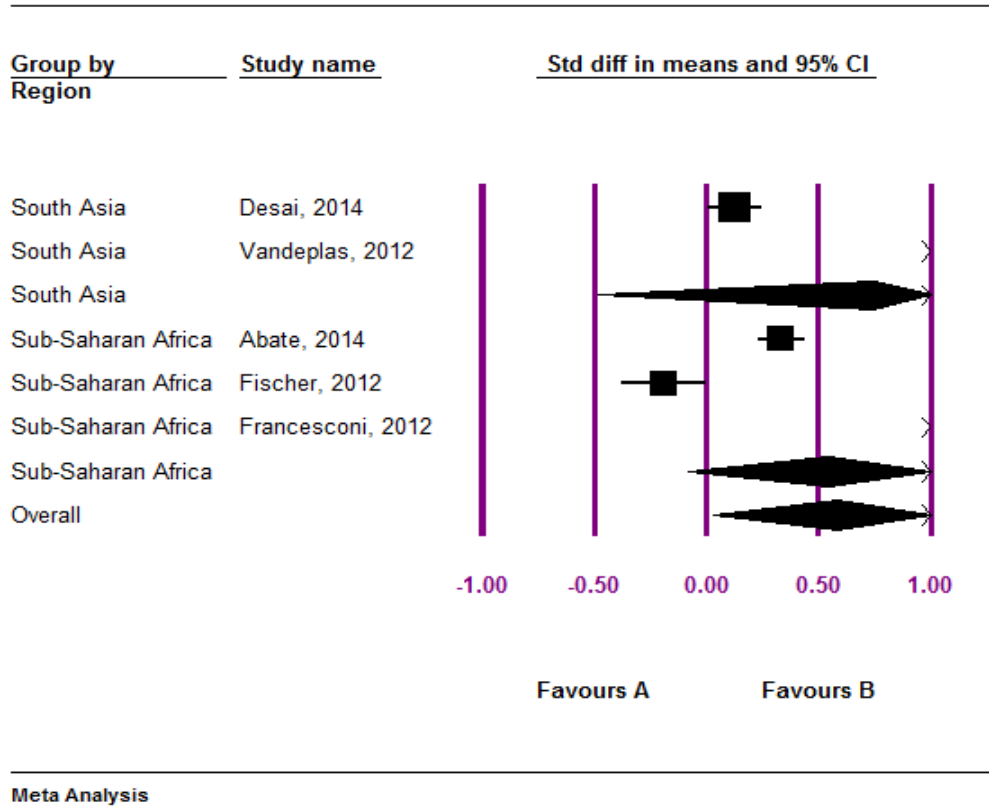
## 6.4 HETEROGENEOUS IMPACTS ON PRODUCTION AND YIELD BASED ON MODERATORS

Similar to the analysis performed for the heterogeneous impacts on income, the research team applied similar moderators to this meta-analysis to see how moderators affect the impact of cooperative membership on production and yield outcomes.

Based on Figure 11, cooperative membership appears to have had the largest impacts in South Asia (d value of 0.745). Impacts were similarly strong for Sub-Saharan Africa (Cohen's d value of 0.540).

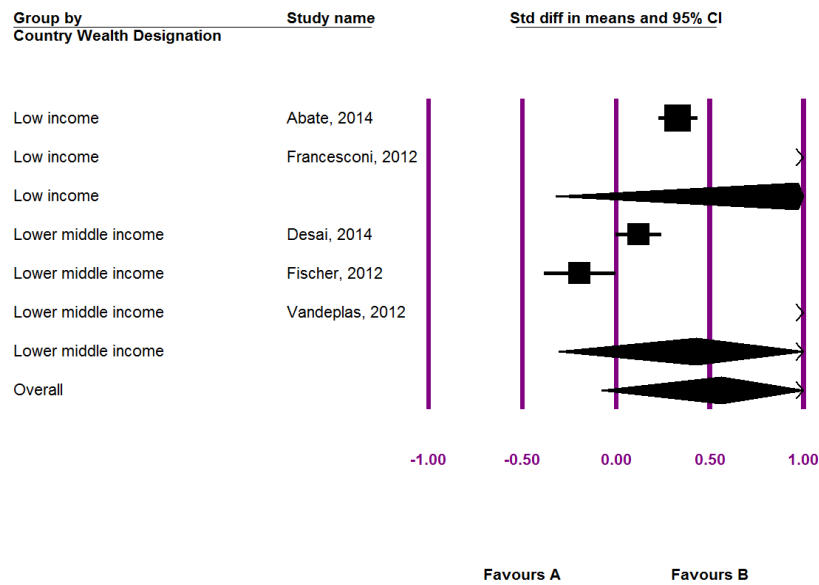
Although the impacts are positive for both regions, both effects have confidence intervals that include zero, making it difficult to infer impact.

Figure 11. Effects of Cooperative Membership on Production and Yield: Meta-Analysis by Region



As shown in Figure 12, **Error! Reference source not found.** only two country economic levels were represented in the analysis and were associated with positive effect sizes (Low income Cohen’s d value: 0.970 and Lower-middle income Cohen’s d value: 0.428). In both cases, however, the confidence interval includes zero indicating that it harder to infer impact for either group from cooperative membership. Additional research is needed to understand the conditions in these two economic levels that can account for widespread impact of cooperatives.

**Figure 12. Effects of Cooperative Membership on Production and Yield by Country Wealth Designation**



Meta Analysis

## 6.5 PUBLICATION BIAS

Publication bias arises when deviation occurs between what research is published among what is available to be published. While bias towards rigor and some specific outcomes is desirable, preference for results showing a significant finding leads to bias in the published literature resulting in overestimation of the impacts.

In order to identify possible publication bias, Figure 13, below, displays a funnel plot of the results from the studies included in meta-analysis on income. Figure 14 displays a funnel plot of the results from the studies in meta-analysis on production and yield. Based on Figure 13, there seems to be a slight asymmetry in which there are few published studies with low standard errors and results that are lower than the summary statistic, suggesting that there may be slight bias in the results SI

presents in this paper. It appears that this systematic review may be missing studies with small sample size and less significant results.<sup>14</sup>

Figure 13. Funnel Plot of Studies on Income

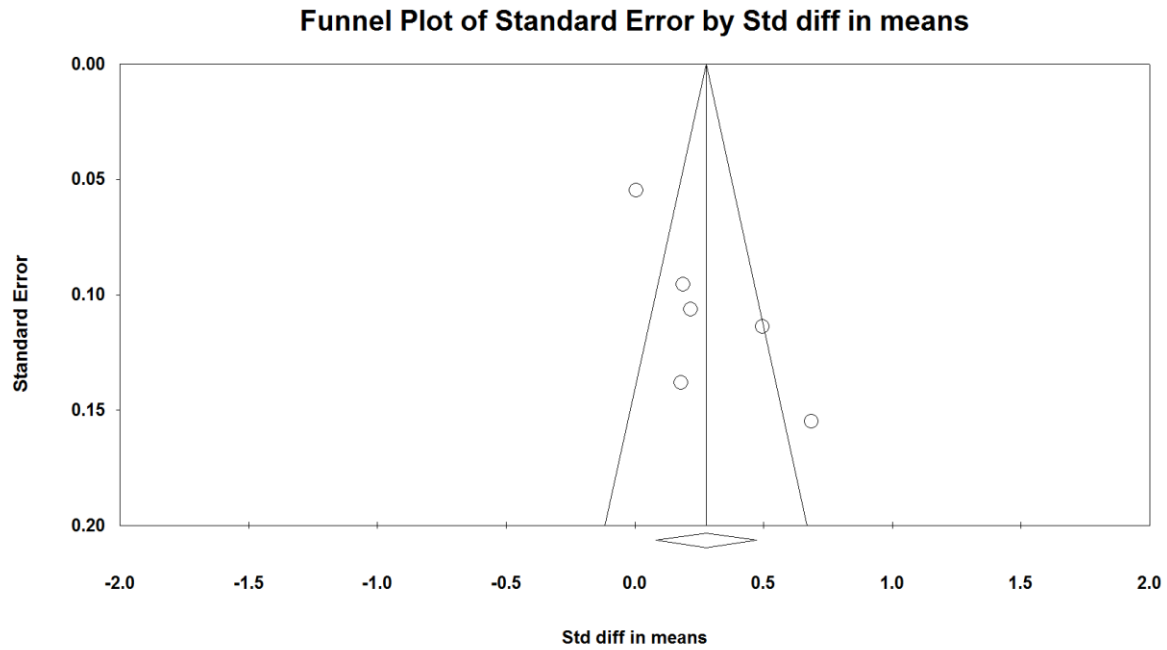
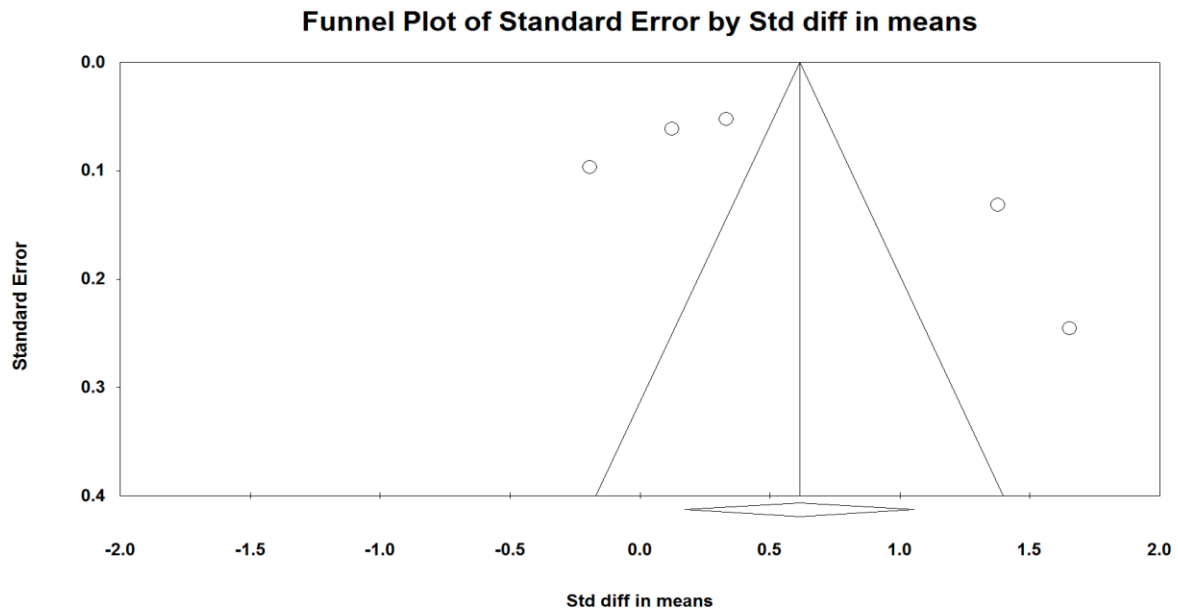


Figure 14. Funnel Plot of Studies on Production and Yield

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<sup>14</sup> Statistically significant results have been shown to be three times more likely to be published compared to papers with insignificant results, although not all statistically significant studies are of high relevance for policy makers.



This hypothesis is further strengthened by the information provided in Table 6 and



Table 7, below, which show that the studies with the smallest sample sizes also have the greatest effect sizes, suggesting some publication bias against publishing small studies with low or insignificant effect sizes.

In order to investigate whether publication bias threatens the integrity of the findings, we applied Duvall and Tweedie's Trim and Fill to impute the results due to lack of studies with small sample size and small effect size. Using the assumption of random effects, the Trim and Fill function suggested that there were no missing papers, and the findings were not brought into question due to publication bias. This means that much of the variability in study findings may be attributed to actual differences in the effect size in different populations. While publication bias is still possible, the imputations suggest that it is not so large as to significantly bias the findings of this study.

**Table 6. Sample and Effect Sizes for Studies with Income Impact Outcomes**

Study	Effect Size	Units	Sample Size	Standardized Difference in Means (Cohen's d)	Standard Error	Lower Limit	Upper Limit
Desai 2014	0.012	Log total farm income (%)	1341	0.005	0.055	-0.102	0.112
Fischer 2012a	73.91	Total Income (annual, KShs)	444	0.187	0.096	0.000	0.375
Getnet 2012	1095.77	Crop Income (Birr)	212	0.180	0.138	-0.090	0.450
Ito 2012	29.2	Farm Income (Yuan/day)	318	0.497	0.114	0.273	0.720
Vandeplas, 2012	1.170	Log dairy profit per animal (%)	177	0.686	0.155	0.383	0.989
Verhofstadt 2014	0.290	Log farm income (%)	389	0.217	0.106	0.009	0.426
<b>Summary Statistic</b>	-	-	-	<b>0.276</b>	<b>0.100</b>	<b>0.081</b>	<b>0.472</b>

Table 7. Sample and Effect Sizes for Studies with Production and Yield Impact Outcomes

Study	Effect Size	Units	Sample Size	Standardized Difference in Means (Cohen's d)	Standard Error	Lower Limit	Upper Limit
Abate 2014	0.053	Technical Efficiency index	1638	0.331	0.052	0.229	0.434
Desai 2014	0.322	Log Total amount harvested (%)	1112	0.123	0.061	0.003	0.243
Fischer 2012a	-1.790	Yield (Tons/ha)	434	-0.194	0.097	-0.383	-0.004
Francesconi 2012	13.6	Production (ltr/farm/day)	89	1.652	0.246	1.171	2.134
Vandeplas 2012	0.67	Log Yield per buffalo (%)	288	1.377	0.132	1.119	1.635
<b>Summary Statistic</b>			-	<b>0.614</b>	<b>0.225</b>	<b>0.173</b>	<b>1.054</b>

# CONCLUSIONS

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## 6.6 KEY FINDINGS

Overall, most of the studies examined in this review concluded that cooperative membership does have the potential to improve farmers' livelihoods by increasing income, increasing yield/productivity, expanding access to markets, and increasing the adoption of input and crop technology. In some cases, cooperatives also have the potential to decrease poverty, though these studies were rare.

Cooperatives achieve these benefits by providing a variety of different service packages including training, access to extension services, improved inputs, and processing capacity. These services are the pathways to high-level outcomes such as income and yield. Studies show that cooperative membership has a significant positive impact on farmers' adoption of inputs and crop technology – that is, member farmers are more likely to use improved inputs and technology. This uptake plays a large role in improved yields and increased production. Emerging research is currently under way to assess the precise extent to which continued use of newly adopted inputs and technology effect production and quality (Tura, 2010; Francesconi, 2007).

Almost all studies found that membership in a cooperative was linked to increased yields and/or production. The overall summary statistic for effect size was 0.614 standard deviation, which could be considered a moderate positive change in production due to membership. There was one exception in a study that focused on bananas that showed a negative effect since bananas have especially long growing cycles but the timing of the study may have been too short to capture significant changes to income that could take several years to appear. Although market access is by definition the main objective of marketing cooperatives, only half (three out of seven) of the studies demonstrated significant positive effects on access. The remaining four studies, found no significant effect. A closer look at the analysis suggests that membership might have heterogeneous impacts based on farmer characteristics.

Income related outcomes, including total income, price, and profit, were the most widely measured of the outcomes of interest in the literature reviewed. All but one study found that membership in a cooperative had a positive and significant effect on income. The one study that did not find a significant effect, focused on an all-female cooperative, suggesting that participation in cooperatives may have heterogeneous impacts on different types of members based on sex. Overall, cooperative membership appeared to have a small effect in increasing income-related outcomes with an effect size of 0.276 standard deviation. Finally, only two studies assess the relationship between cooperatives and poverty. In spite of overall positive effects on income and productivity, while one study showed no significant result for all farmer members, it showed a significant improvement in wealth status for women cooperative members. Another study indicated a reduction in poverty and

results were significant. Additional research is needed to pinpoint the impacts of cooperative membership on poverty, including what types of cooperatives have the most impact on women.

## **6.7 GAPS IN THE LITERATURE**

In conducting this systematic review, SI found a number of gaps in the existing body of research on the impacts of cooperative membership on income, production and yields, market access, adoption of input and crop technology, acreage, and poverty.

### **6.7.1 Determinants of Cooperative Membership and Cooperative Models**

Given the self-selective nature of cooperative membership, a few of the studies included in this review attempt to identify the determinants of cooperative membership (Bernard, 2008; Fischer, 2012). Understanding what drives membership is particularly important when assessing the impact that can be attributed to cooperative activities. Further research on the determinants of membership can help to inform the service packages cooperatives offer as well as how cooperatives might target the populations that are most in need of these services.

On a related note, because the services provided by cooperatives vary widely, additional literature on the context-specific structures and services provided by existing cooperatives could help inform future programs, especially if researchers examine differential impacts based on service.

### **6.7.2 Favorable Policy Frameworks**

When identifying potential impacts, it is important to take into account the legislative and policy environments that cooperatives are subject to. Identifying whether or not a state respects the autonomy of cooperatives, puts in place the appropriate support structures to regulate common resources, and provides services is key in determining potential effects. Ethiopia is an excellent example of a country that has prioritized promotion of cooperatives in its agriculture and rural development strategy. The country has strongly promoted agricultural cooperatives to encourage smallholders' participation in the market (Bernard, 2008). The legal framework employed by the Ethiopian government has been critical in the relative success of its renewed cooperative movement. This demonstrates that although cooperatives are usually externally prompted structures, the policy environment can have a large influence on their efficacy (Abate, 2014). But, few studies incorporated such factors in the analysis and included them in interpretation of impacts.

### **6.7.3 Heterogeneous Impacts on Farmers Based on Socio-economic Status and Sex**

As discussed in the findings, some conflicting results on the direction and significance of impacts on the outcomes of interest indicated that it would be useful to measure impacts on different subsets of a cooperative's membership base to better understand where impact pathways deviate. Few studies focused on identifying heterogeneous impacts based on demographic characteristics.

Additional research in this field could help researchers and policy makers understand how social dynamics translate into cooperative structures (Fischer, 2012b; Desai, 2014). Another area for future research would be to explore how cooperative membership may have an impact in changing social dynamics outside the cooperative (Fischer, 2012b).

Of particular interest would be to compare outcomes for lower and higher income members as well as to assess differential impacts for men and women. Some findings suggest that poorer farmers tend to be excluded from membership in marketing cooperatives in Ethiopia and even when allowed to join, participation was limited. None of the studies included in this systematic review analyzed how cooperative membership affects male and female farmers differently with regard to the specific outcomes of interest. Only the study by Vicari (2014) explicitly stated the sex breakdown of cooperative membership. Women, in particular, may have different opportunities, motivation, and capabilities than men to engage in collective action. For instance, women are often neglected by extension workers, and due to their reproductive responsibilities have a higher opportunity costs of time affecting their participation in a cooperative (Fischer, 2012a). One important first step would be to know the proportion of cooperative participants who are male and female, which is largely missing from these impact evaluations.

#### **6.7.4 Quality and Food Security**

In assessing general economic and livelihood benefits, research can probe deeper into questions regarding the effect of changes due to cooperative services, particularly those related to the adoption of inputs and improved technology, on the quality of the product produced and on the overall nutritional and environmental implications of new production and marketing processes. Besides measuring the impact of cooperative membership on market access and productivity, Francesconi (2012) compares the quality of the milk produced by cooperative members and non-members. He concludes that although members produce more and sell more milk through cooperative membership, the nutritional quality of the milk produced is of poorer quality in terms of fat and protein quality. Similarly, Fischer (2012b) looks at the food security and dietary quality implications of cooperative membership on member households.

#### **6.7.5 Long-term and Experimental Evaluation Designs**

Most impact evaluations are done over short time frames that rarely exceed a few years. This is a problem in studying agriculture-related outcomes because many crop cycles are long, and it can take a long time to realize outcomes, especially outcomes related to income. Additional research on the long-term effects of cooperative membership might reveal even greater or perhaps diminishing impacts on beneficiaries, or at the very least, would allow researchers to examine the sustainability of membership-related effects.

Additionally, in spite of the logistical challenges and potential biases, research on the impacts of cooperative membership would benefit from an experimental evaluation design. SI's search confirmed that only quasi-experimental studies have been completed to date, although it is our

understanding that there are experimental design studies currently in progress. These will help shed light on the how much impact can truly be attributed to cooperatives.

### **6.7.6 Geographical Coverage**

The research team discovered a geographical clustering of studies. Most of the literature on cooperatives focuses on Sub-Saharan Africa and specifically on the country of Ethiopia. This does not necessarily indicate a higher prevalence of farmer cooperatives in this region, but rather, a lack of research in other regions. Ethiopia has experienced an increase in cooperatives from 1991 to 2006 as the percentage of kebeles<sup>15</sup> with cooperatives rose from 10 percent to 35 percent (Francesconi, 2010). However, cooperatives play a major role in agricultural activities in other countries too. According to the Food and Agricultural Organization (FAO), in 2015, 37 percent of Brazil's agricultural GDP is produced through cooperatives. Over 16 million liters of milk are collected every day in India from 12 million farmers in dairy cooperatives. Four million farmers in Egypt earn their income through cooperative membership. However, the research team found limited research and even fewer rigorous quantitative studies that fit the inclusion criteria from Brazil and Egypt. We did not find any relevant studies from the Middle East. To fully understand the effectiveness and impact of cooperatives, it is necessary to understand how they work in different contexts. Therefore, future research must be conducted in regions with understudied cooperatives.

### **6.7.7 Language of Publication**

Lastly, despite searching for studies in four different languages, SI found that almost all impact evaluations on the effect of cooperative membership on agricultural outcomes were written in English. Increasing the number of impact evaluations published in other languages could make them more useful to local policymakers. The excessive publication in English may indicate that researchers are presenting to the academic community that generally use English more often than local policy-makers in the countries where evaluations are conducted.

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<sup>15</sup>A kebele is the smallest administrative unit, below the municipality-district level, in Ethiopia.

# 7 POLICY IMPLICATIONS

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Lessons from the review that are of policy relevance to donors are discussed below:

## **7.1 WORK WITH GOVERNMENTS TO ESTABLISH AN ‘ENABLING ENVIRONMENT’ FOR COOPERATIVES**

The extent to which cooperatives can effectively flourish and lead to positive effects in the livelihoods of smallholder farmers depends heavily on government’s willingness to establish a favorable legal and policy framework for cooperative development. As our case study example of Ethiopia indicates, government support is an integral component integrating cooperatives into the market system. An ‘enabling environment’ may find its roots on already existing guidelines provided by the International Labor Organization Recommendations (n. 193) for a new legal and policy framework for cooperative development as well as from continued research and the application of lessons learned (Vicari, 2014; ILO, 2004).

## **7.2 PROMOTE MEASURED INCLUSIVENESS**

The literature suggests that many smallholder farmers who stand to benefit the most from cooperative membership are not able to join, either due to membership restrictions or due to lack of paved roads, communication technology, and remoteness. Clustering of cooperatives around established markets may be linked to the positive impacts experienced by members. However, it also means that smallholders who are not near these market and cooperative centers, are not afforded the opportunity to market collectively with other farmers participating in the same value-chain (Bernard, 2009; Ito, 2012). Likewise, women are typically underrepresented in cooperatives, even though women benefit more from the positive impacts of membership (Fischer, 2012b). Furthermore, members must have a certain minimum threshold of resources, including land ownership and other agricultural assets to be able to reap the benefits of membership (Fischer, 2012a; Bernard, 2009).

In order to be effective, members of the marginalized groups must be fully integrated into the organization. Group membership in itself does not matter as much as participation in certain group activities.

### **7.3 Invest in Long Term, Experimental Research and Indicator Standardization**

In order to expand knowledge on the impact of cooperative memberships and the specific conditions necessary to attain improved outcomes, more research needs to take place addressing specific questions regarding context, impact and effectiveness. This research must be longer term in order to capture the full breadth of production and economic impacts and assess sustainability. Ideally, an expansion in research initiatives would include experimental evaluation designs which could unequivocally attribute impacts to membership and minimize bias to allow for broader conclusions.

Related to supporting continued research, standardization of outcome indicators would be highly beneficial. One of the main challenges faced by the research team was in finding appropriate measurements that correspond to the outcomes of interest. This is because there is no consensus on measuring certain production, economic, and market indicators. An effort to partner with research institutions and other thought leaders to arrive at a standard approach for measuring and evaluating agriculture, market related interventions would streamline the analysis and comparison of future research and increase the likelihood of extracting practical lessons to inform implementation.



# APPENDIX 1: SEARCH WEBSITES

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## WEBSITES:

### Search Engine Websites:

- Google, Google Scholar, Scirus.com
- USAID, USDA, MCC, FEWSNET
- The World Bank (IEG, Agricultural and Rural Development), IADB, ADB, AfDB
- CIDA, DANIDA, AusAID, USAID DEC, FFPr, FFP, FAS, UNDP, Dfid, FAO, GTZ, IFAD, OECD, CGIAR
- University Websites
- AGRIS, CARIS, WTO, IFPRI, 3ie, JPAL, IPA, Centre for Environmental Economics (CEE) and Policy in Africa, Transport Research Information Services (TRID), R4D

### Peer-Reviewed Journals:

- World Development
- Journal of International Development
- Journal of Development Effectiveness
- Agricultural Economics
- The Journal of Development Studies
- Journal of Development Economics
- National Bureau of Economic Research
- Economic Development and Cultural Change
- Journal of Transport Economics and Policy Impact Factor and Information
- Research in Transportation Economics

# APPENDIX 2: SEARCH TERMS

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Keywords used for the searches followed PICOS format (Population, Intervention, Comparison, Outcomes, Study design). Combinations (or permutations) of the keywords were used to identify relevant studies. Further, searches were conducted through the reference lists and bibliographies of relevant studies.

## POPULATION SEARCH TERMS:

South and South East Asia, Eastern Europe, Middle East, Latin America, Africa, NIS countries (developed countries in these regions will not be included);  
Rural populations;  
Farm households;  
Farmers;  
Agriculture;  
Agribusinesses;  
Cooperative members

## STUDY DESIGN SEARCH TERMS:

Impact evaluation,  
Experimental designs,  
Randomized control trial,  
Quasi-experiments,  
Propensity score matching,  
Instrumental variable,  
Difference in difference,  
Panel data / longitudinal data based evaluations

## INTERVENTION SEARCH TERMS:

Agricultural cooperatives,  
Agricultural service cooperatives,  
Agricultural supply coops,  
Agricultural marketing coops,  
Agricultural input coops

## INTERVENTION SEARCH TERMS

### (CONTINUED):

Agricultural output coops,  
Agricultural associations,  
Farmer cooperatives,  
Farmer associations

## COMPARISON SEARCH TERMS:

Control group,  
Comparison group,  
Treatment group,  
Comparator,  
Counterfactual,  
Matching

## OUTCOMES SEARCH TERMS:

Income,  
Profits,  
Revenues,  
Output, crop & input prices,  
Market access,  
Market participation,  
Production, productivity,  
Yield,  
Poverty,  
Expenditure, consumption,  
Costs of production,  
Modern technology adoption,  
Jobs / employment,  
Transport

## APPENDIX 3: SEARCH DETAILS BY SITE/SOURCE

Website / Database	# of combinations searched	Notes
<b>Search platform</b>		
Google Scholar/Google	273	No filter was used. The first 2-4 pages were coded, based on how relevant the search results were.
Bibliographies from proposal studies	N/A	Bibliographies of the studies included in the proposal were mined. Bibliographies of those relevant studies were then mined.
<b>Donor Websites</b>		
USAID DEC	5	Filters used: Agriculture and food security, 2000-2009, 2010 or later. The first 5 pages were coded.
USDA, FFP, FFP, FAS	3	Filter used: Data and Analysis.
MCC	2	Filter used: Independent Evaluations. No results for database 2 were found.
FEWSNET	3	No filter used.
The World Bank (IEG, Agricultural and Rural Development)	N/A	Filters used: IEG, Impact Evaluation reports
IADB		Filter used: Working papers
ADB	2	No filters applied.
AfDB	3	Filters used: Documents, Evaluation Reports, Project Evaluation, Agriculture & Ago-industries
CIDA	2	No filters were used. 0 studies fit inclusion criteria
DANIDA	3	Filter used: Evaluation reports
AusAID	1	No filters were used. 0 studies fit inclusion criteria

Website / Database	# of combinations searched	Notes
UNDP	3	Filters used: Evaluation Resource Center, Searched Impact Evaluation
DfID	2	Filters used: R4D, Evaluation reports, Research and Analysis Reports Evaluation reports. No results for database 2 were found.
FAO	2	Filter used: Impact Evaluation
GTZ	2	No filters were used. 0 studies fit inclusion criteria
IFAD	2	Filter used: Impact Evaluation
<b>University Websites</b>		
University of Nebraska-Lincoln	4	No filter was used. The first 2 pages were searched. 0 studies fit inclusion criteria
Florida State University	4	No filter was used. The first 2 pages were searched. 0 studies fit inclusion criteria
University of Northern Colorado	4	No filter was used. The first 2 pages were searched. 0 studies fit inclusion criteria
Arkansas Tech University	4	No filter was used. The first 2 pages were searched. 0 studies fit inclusion criteria
Cornell University	4	No filter was used. The first 2 pages were searched. 0 studies fit inclusion criteria
University of California-Davis	4	No filter was used. The first 2 pages were searched. 0 studies fit inclusion criteria
Tufts University	4	No filter was used. The first 2 pages were searched. 0 studies fit inclusion criteria
University of Florida	4	No filter was used. The first 2 pages were searched. 0 studies fit inclusion criteria
Texas A&M	4	No filter was used. The first 2 pages were searched. 0 studies fit inclusion criteria
Oxford University	4	No filter was used. The first 2 pages were searched. 0 studies fit inclusion criteria

Website / Database	# of combinations searched	Notes
<b>Project and Implementing Partner Websites</b>		
AGRIS	3	No filters were used.
CARIS	3	No filters were used. 0 studies fit inclusion criteria
WTO	3	No filters were used. 0 studies fit inclusion criteria
IFPRI	3	Filter used: Impact
3ie	3	Filter used: Impact Evaluation. 0 studies fit inclusion criteria.
JPAL	2	Filter used: Evaluations. 0 studies fit inclusion criteria
IPA	3	Multiple filters used but no coded results: Filters used: Research Explore Studies Cooperatives, Research Explore Studies, Research Explore Key Findings, Research Explore Publications
Centre for Environmental Economics (CEE) and Policy in Africa		No filters used. Searched under Publications for “Cooperatives”
Transport Research Information Services (TRID)	2	No filters applied and no coded results.
R4D	3	No filters applied, 0 studies fit inclusion criteria
IFRTD (International Forum for Rural Transport Development)	1	No filters used: 0 studies fit inclusion criteria.

Website / Database	# of combinations searched	Notes
<b>Peer-Reviewed Journals</b>		
World Development	7	No filters were used. Coded first 25 results per query.
Journal of International Development	7	No filters were used. Coded first 25 results per query.
Journal of Development Effectiveness	7	No filters were used. Coded first 25 results per query.
Agricultural Economics	7	No filters were used. Coded first 25 results per query.
The Journal of Development Studies	7	No filters were used. Coded first 25 results per query.
Journal of Development Economics	7	No filters were used. Coded first 25 results per query.
National Bureau of Economic Research	7	No filters were used. Coded first 25 results per query.
Economic Development and Cultural Change	7	No filters were used. Coded first 25 results per query.
Research in Transportation Economics	7	No filters were used. Coded first 25 results per query.
<b>Foreign Language Sites</b>		
EMBRAPA Base de Dados de Pesquisa Agropecuaria (Portuguese)	4	No filters were used. The first 2 pages were coded. 0 studies fit inclusion criteria
EMBRAPA Sabiia (Portuguese)	4	No filters were used. The first 2 pages were coded. 0 studies fit inclusion criteria
Google Scholar (in Portuguese)	4	No filters were used. The first 2 pages were coded. 0 studies fit inclusion criteria
Google Scholar (in Spanish)	4	No filters were used. 0 studies fit inclusion criteria
Google Scholar (in French)	3	No filters were used. 0 studies fit inclusion criteria.
CIRAD	3	No filters were used. 0 studies fit inclusion criteria

# APPENDIX 5: CALCULATING COHEN'S D

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In statistics, Cohen's d is calculated as follows:

$$d = \frac{\bar{X}_T - \bar{X}_C}{S_{pooled}}$$

Where:

d represents Cohen's d

$\bar{X}$  represents the mean for the indexed group

T represents the treatment (beneficiary) group

C represents the comparison group

The numerator in the above equation represents the average difference between the beneficiary and comparison groups attributed to treatment.

Since almost all of the studies included in the meta-analysis used regressions with various controls to analyze data and display results, the research team used the regression coefficients for the numerator. In cases where there were multiple regression models, the team selected the author's primary model (where specified). If the primary model was not specified, as a general practice, researchers used the model with the maximum number of controls in order to minimize bias. The denominator in the above equation is generally calculated using the following equation:

$$S_{pooled} = \sqrt{\frac{s_T^2(n_T - 1) + s_C^2(n_C - 1)}{n_T + n_C - 2}}$$

Where:

n represents the number of observations in the specified group

s represents the standard deviation of the outcome variable for the indexed group.

However, individual standard deviations were not available for the beneficiary and comparison groups in some papers. In such cases, researchers used the overall standard deviation as a close proxy.

# APPENDIX 6: BIBLIOGRAPHY

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