

Evaluating the Asset Transfer Model in Facilitating Sustainable Livelihoods

Ellen Fitzpatrick^a, and Sedef Akgungor^b

^aUniversity of Arkansas, Clinton School of Public Service, Little Rock, USA

^bDokuz Eylul University, Izmir, Turkey

Summary: This study examines whether a dairy development intervention designed as an asset transfer and training project catalyzes social capital, and sustainably improves the livelihoods of the participants. Social network analysis is used to quantify the social capital in the intervention and comparison group. The intervention group demonstrates statistically different levels of social capital confirming that the intervention resulted in an increase in social capital. We also examine whether the infusion of three sources of capital, physical (asset transfer), human (training) and social capital, generated sufficient increases in net income to bring participants above the benchmark of a living income. The levels of net income three years after the project were sixty-five percent higher than at the close of the project, providing strong evidence of improved livelihoods and sustainability.

1. Introduction

The aim of the paper is to explore whether a development model centered on asset transfer and training catalyze significant and sustainable effects on livelihoods for vulnerable populations. We used data from a Heifer International, Malawi Smallholder Dairy Development Project (MSDD1) to test two elements, which are foundational to the Heifer model. The research questions focus on whether the asset transfer and training activities improve livelihoods and if these changes are sustainable and sufficient to provide a pathway out of poverty. A key assumption of the Heifer model is that the interventions augment indigenous social capital and that this social capital is an important factor in increasing income and hence improving livelihoods. This study examines the extent to which social capital is catalyzed and whether it contributes significantly to livelihoods.

This study was conducted three years after the close of the project. The project, (MSDD1) began in 2009 with training and the initial transfer of dairy cows. We collected the data for this analysis in 2015, three years after Heifer's active involvement. Since the study was not planned at the beginning of the project, we used a nonequivalent comparison design where the comparison group displayed similar characteristics to the intervention group at the inception of the project in 2009. To understand the contribution that asset based interventions play in stimulating sustainable increases in livelihoods and the role that social capital plays in creating economic opportunity, this study tests two new metrics. Using real net income as a proxy for 'improved livelihoods' and juxtaposing real net income with the benchmark of 'living income' (Anker, 2014). This will tell us if participants improve their income so that they can sustain a "modest but decent living." We use social network analysis to develop quantitative measures of networks and households' position within those networks as indicators of social capital.

1.1 The Intervention: Malawi Smallholder Dairy Development Project

This study examines the impact of the Heifer Malawi Smallholder Dairy Development (MSDD) project on social capital formation and improved livelihoods. Heifer Malawi implemented the Malawi Smallholder Dairy Development Project in Mchinji district, Mlonjeni traditional authority with joint financial and technical support from the United States Agency for International Development (USAID) and Heifer International. The goal of the project was to enhance the livelihoods among smallholder farmers whose income and access to resources put

them at or below the poverty line. The project included an asset transfer (dairy calf) and was designed to enhance participants' knowledge and capabilities in dairy production and marketing and to catalyze existing social capital to facilitate collective action to support dairy-based livelihoods. The project transferred a cow with calf to 130 participants. The household that received the initial asset (Original Group, OG), was obliged to pass on the off spring from the transfer to another project participant who was ready to receive a calf¹ (Passing on the Gift, POG). Over a three-year period: October 2009 - September 2012 a total of 611 households participated in the project.

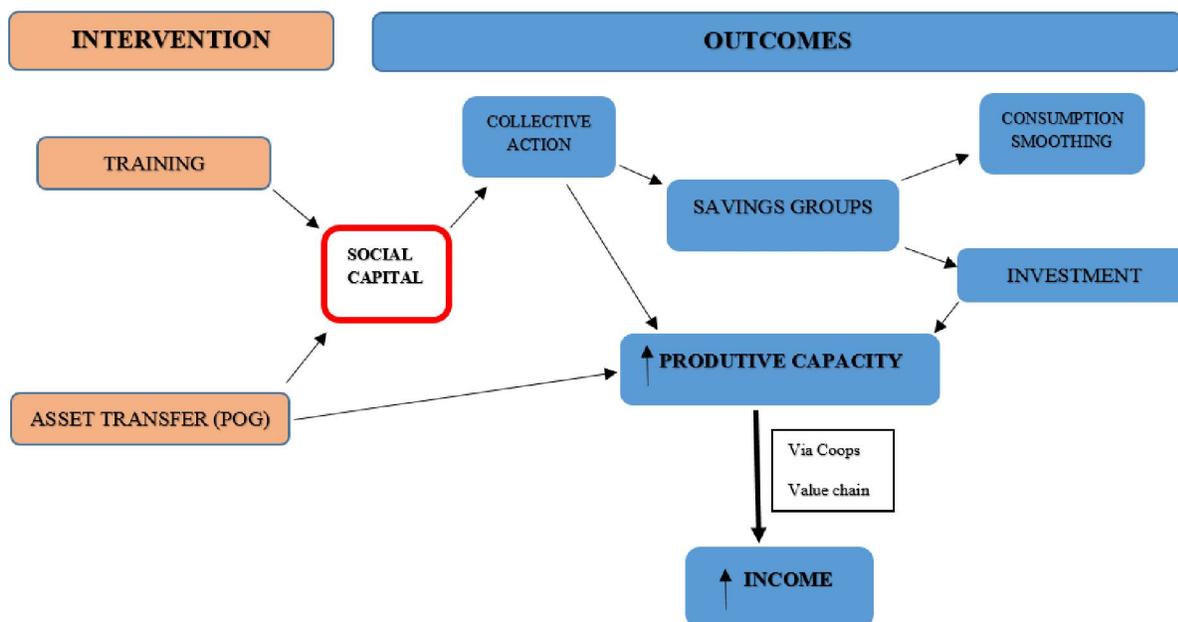
A total of 19 community volunteers were trained as Community Animal Health Workers (CAHWs) and equipped to support other dairy farmers within their communities to manage basic animal health issues. The project supported farmers of Bua Milk Bulking Group, which established a milk collection and chilling center in their community. The project assisted in the acquisition of milk chilling equipment while the farmers contributed locally available resources and labor to construct the collection and chilling house. The Center started operations in April 2011 and established a business relationship with Lilongwe Dairy Processors, one of the large-scale dairy processors in Malawi (Heifer International Malawi, Final Report for Malawi Smallholder Dairy Development Project, December 2012).

1.2 The Heifer Theory of Change

The Heifer model of community development asserts that the transfer of the asset of livestock (physical capital) combined with a set of trainings (human capital) enhances social capital and productive capacity among beneficiary households. This new productive capacity then stimulates an increase in income. It is further assumed that participants, through collective action, will link to markets and sustain advances made in income. The ultimate goal is that the intervention catalyzes a movement out of poverty for the communities in which Heifer works.

¹ Households that receive a calf from an original group (OG) are selected by the participants and must have gone through sufficient training to be prepared to care for the animal.

Fig. 1: Theory of Change



The Heifer model hypothesizes that social capital facilitates the collective action that contributes to economic opportunity especially in an environment of missing markets. Although this link between social capital and increased economic opportunity is frequently cited as important to facilitate endogenous development, there has been limited evidence that interventions have led to a deepening of social capital and that the deepening social capital, has contributed to economic opportunity. This study tests these two links: the intervention to social capital (activity to output) and intervention to sustainable real net income (activity to outcomes).

2. The Conceptual Framework

Capital theory suggests that growth comes about through the increase in the stock of different types of capital; human, physical, natural and social. The asset transfer in the form of livestock enhances physical capital and the training² contributes to human capital. What is missing from many models of sustainable livelihoods is a measure of social capital and the understanding of how this form of capital contributes to improved livelihoods especially in an economy with informal and missing markets.

Social capital theory suggests that social relations have an economic value especially in a Global South setting, where households may rely on social networks to exchange knowledge, provide safety net and create economic opportunities (Hartmann, 2014). Where a household is positioned in a network will influence their access to resources and hence their success in adopting new techniques, technologies and marketing opportunities (DeHerdt, 2007). This study

² Training includes animal management, food production and nutrition, agroecological farming practices and collective action

assesses whether the ‘typical asset transfer and training’ intervention contributes to the stock of social capital, endogenous growth and hence, sustainable livelihoods. The idea is that social networks and associated collective action relax the binding constraints by filling missing markets such as credit, information, labor. This triggers change in the structure of the local economy, by leading to adoption of new productive activities or techniques, more formal rules or standard operating procedures and as such contribute to nascent market institutions. The dynamics of economic opportunity embed new capabilities that in conjunction with new institutions, allow for endogenous growth in the local economy. Endogenous growth is important because the change is regenerative signaling a capacity for sustainability.

Endogenous growth theory is based on the premise that the spillovers from investments in physical, human and social capital stimulate growth. This study situates the Heifer model in an endogenous growth framework, where households accumulate new physical capital--livestock, human capital-- training, and increased capabilities and social capital—filling essential missing markets. This accumulation of capital catalyzed by the NGO intervention, inadvertently contributes to the productivity of capital held by others. The roots of endogenous growth are deepened by including the synergistic effects of spillovers via social capital. Social capital in the form of networks provide information channels, trust and reciprocity--essential for broadening the proximity of transactions, and creating foundational market institutions. In this study we examine whether the intervention has augmented social capital and whether the spillovers from physical, human and social capital (induced by the intervention) have contributed to growth measured by net income.

Heifer’s intervention via the infusion of physical and human capital is expected to have an impact on net incomes but understanding how this change perks through the local economy is largely a function of social networks, an outcome of social capital. An aspect of this process, endogenous capability, illustrates the link between human capital and social capital. This is described by Hartmann as the change in productive activity and marketing that is sparked by changes in technology and techniques (Hartmann, 2014). This new knowledge is internalized and reproduced by households in networks and hence reinforces the link between social capital, networks and endogenous development.

In this study we ask two related sets of questions. Did this program increase net income, our proxy for improved livelihood and, are there indications that this potential change will be sustainable and lead to more resilient livelihoods. The second, and related set of questions was whether the intervention increased social capital and if so, if this social capital contributed to net income.

The paper aims to answer the following research questions:

1. Has the MSDD project made significant impact on social capital formation?
2. Has the MSDD project made a significant impact on the economic livelihoods of the target population?
3. Does social capital have an impact on improved livelihoods in the target population?
4. Were changes in economic livelihoods sustainable after the end of the project?

The first research question explores whether training and collective action through the milk bulking group augmented social capital in the MSDD project. Program theory suggests that the intervention increased awareness of the benefits of working together resulting in the creation of savings groups, collective labor and a cooperatively governed milk-bulking group.

The second research question focuses on whether project activities have created economic opportunity. Project activities are expected to contribute to incomes through increased social capital via the sharing of knowledge (improved animal management, prices for inputs/outputs), the accumulation of productive assets, increased production of milk and market access via the milk bulking group.

The third research question examines whether social capital formation contributes to improved livelihoods (net income).

The fourth research question asks whether the sustainability of gains made in securing increased net income continued when the project ended. Frequently, INGOs go into a community to either distribute assets or provide services or training. They note an increase in an outcome as the project ends but do not go back and determine whether the outcomes achieved have sustained. This study examines changes in net income three years after the project had ended

All four of these research questions are posited to test the efficacy of elements of the Heifer theory of change, did the intervention increase social capital, did social capital contribute significantly to improved livelihoods, did an increase in improved livelihoods occur due to the intervention and was that change sustainable?

2.1 The Hypotheses to be tested

Following the conceptual model, the paper aims to test the following hypotheses:

Hypothesis 1: The MSDD project made a positive impact on the social capital formation in the target population.

Hypothesis 2: The MSDD project made a positive impact on the economic livelihoods of the target population.

Hypothesis 3: Social capital formation has a positive impact on net income.

Hypothesis 4: The positive impact of the MSDD project on the economic livelihoods has continued after the completion of the project

3. Data and Methods

3.1. Data

The study draws on a baseline (2009), final (2012), and a post project (2015) household survey. These surveys include questions that allow us to calculate net income of the farmers. It is possible to compare the average net income across the years³.

The 2015 survey was the first attempt to use social network analysis to capture social capital. In order to understand the impact of the MSDD project on social capital we identified a comparison group. To minimize spillovers, but close enough to assure similar environments, we chose the comparison group 30 miles away from the intervention group. In order to assure comparability between the post project (2015) group and the comparison group, we compared statistical differences between the mean values of key demographic and economic characteristics of the 2009 MSDD group and the 2015 comparison group so that the comparison group would resemble the MSDD farmers before the beginning of the project.

The first part of the household surveys for 2012, 2015 treatment and 2015 comparison group contain identical questions. These questions allow us to gather data to calculate the net real income of the households before and after the project and between treatment and comparison populations. We make the following comparisons:

- To see the impact of MSDD on net income: End of project net income (2012) with comparison group net income under the assumption that the comparison group represents the treatment group before the beginning of the project
- To see the impact of MSDD on sustainability of net income: Baseline (2009) and end of project net income (2012) with MSDD group net income in (2015).

The second part of the 2015 datasets for treatment and comparison includes questions about the farmers' social relations. The analysis aims to compare the social capital of the Heifer farmers with the comparison group. Had we been able to design this study at the beginning of the intervention, it would have been insightful to include a baseline Social Network Analysis for both the treatment and comparison groups. Although we did not have the data to examine over time, conducting SNA with the comparison group allows us to attribute differences in outcomes to the intervention. Table 1 Presents the sample size in 2012, 2015 (MSDD and comparison).

Table 1: The survey sample size in 2012 and 2015

Sample size in 2012 (MSDD farmers)	Sample size in 2015 (MSDD farmers)	Sample size in 2015 (Control group)
81	130	147

³ The data from the baseline survey was not as complete as the final and post final. Some assumptions had to be made about costs of production and local prices for goods.

3.2. Analysis Methods

3.2.1. Operationalizing Living Income

The purpose of measuring changes in the net real income of households is twofold; to determine if positive change occurred and if it was sustained after the end of the intervention. To measure changes in improved livelihoods, this study examines the difference between a ‘living income’ benchmark and household real net income. If participants are able to achieve a level of net income that is equal to or greater than the ‘living income’ benchmark, and at least sustain this level of income after the close of the project, we can conclude that livelihoods have improved, is on the path to sustainability and that households have some resilience to unexpected events.

Living income is a concept adopted from the work of Anker and Anker, 2014 which outlines the need and methodology for calculating a ‘living wage.’ Drawing from their foundational work, ISEAL (2015) and others have adapted the ‘living wage’ methodology to estimate a living income. Living income is largely applied to agriculturally based households or those who own small to medium enterprises. Living income is different from a poverty line in that it encompasses the idea of a ‘decent living,’ one that measures the ability of households to meet all their basic needs including food, water, education, housing, healthcare, clothing and a provision for unexpected events.. The living income benchmark can also be estimated by region allowing more accurate assessments of specific economic characteristics.

Living Income = cost of nutritious low cost diet + basic acceptable housing + other essential expenses + savings for unexpected events.

The calculation for living Income benchmark for MSDD1 was based on the Anker and Anker study of the living wage in the tea growing area of Malawi in 2014 (Anker and Anker, 2015). The project site is in the central region of Malawi so adjustments were made based on differential costs of food and housing. All prices were adjusted to a 2015 base.

The limitations of living income as a benchmark of improved livelihoods is that it does not account for how income is distributed over the year nor does it allow us to estimate the reliability of the income. Both of these issues are important for food security and the ability to meet needs at specific times.

We then calculate an estimation of net real income for beneficiary household for 2012 and 2015. All living income calculations are at 2015 prices. The relative position of net real income to the benchmark reveals the progress households are making over time. Net real income is calculated as follows:

Real Net Income = income non-farm+ (income farm+ value of home consumption) -cost of production.

Non-farm income includes remittances, salaries, small business returns and wages. Farm income is from the sales of agricultural products (livestock and crop). The value of home consumption is included into real net income to account for the value of food produced and consumed by the household. It is especially important to account for these changes in subsistence and semi-subsistence households. In this study, we included the value of milk plus the value of

food crops produced and consumed at home. After consulting with multiple key informants, we established the following protocol:

Milk: Sales of milk represent 50% of total production. Therefore, we can infer that the remaining 50% is consumed in the home⁴.

Food Crops: Sales of food crops represented 20% of total production. Therefore, we can infer the remaining 80% consumed at home.

The percentages of production that were assigned to consumption were valued at market prices and included in the ‘value of home consumption.’

Costs of production include the cost associated with dairy production and food crops. Included in the costs of dairy production for the Heifer participants was the cost of an improved cow shed depreciated over 7 years, maintenance of the shed, feed, veterinary services and the opportunity cost of time spent in dairy and food production. The opportunity cost was valued at the rate for unskilled labor in the agricultural sector in the Central region.

3.2.2. Operationalizing Social Capital

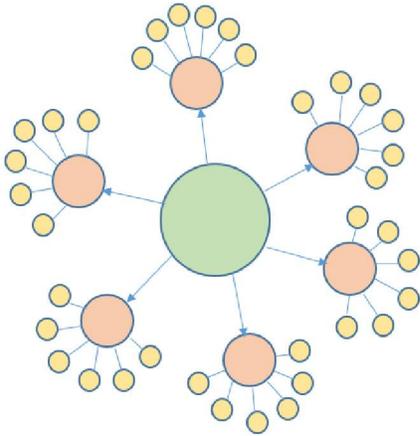
The outcomes of social capital are networks, norms, and trust that enables participants to act together more collectively to pursue shared objectives (Putnam, 1995). Similar definition is presented by the World Bank (1999) as, the institutions, relationships, and norms that shape the quality and quantity of a society’s social interactions. Social capital manifests in a set of relationships among multiple actors. World Bank proposes the following indicators of social capital (Woolcock, 2000)

The first indicator of social capital is whether individuals in the society are members in local associations and networks or engage in collective action such as self-help groups, cooperatives or farmers groups. The second indicator is related to existence of trust and adherence to shared norms in a society including reciprocity and involvement in community events. In an environment of few formal market institutions, social networks create a conduit for knowledge, safety net and economic opportunity. The position of the actors in a network reveals the household’s set of opportunities and limitations.

The 2015 MSDD group and 2015 comparison group surveys included a series of questions in which the farmer gives names of other farmers with whom he/she exchange information about agricultural related matters, borrowing or lending of money, land use, family matters and other issues such as buying inputs, selling cows, dairy products and other agricultural products. The following illustration demonstrates the use of the ‘snowball’ technique for the data collection.

⁴ On average, beneficiary households sell the milk produced in the morning, consume, and distribute milk produced in the evening.

Fig. 2: Snowball



The Social Network Analysis (SNA Survey) has three rounds. In the first round, the enumerators surveyed the 130 MSDD participants. The 130 farmers were asked to give names of up to 6 farmers with whom they exchange information, rely on for safety net concerns or have an economic relationship with. The second round includes surveying the group identified by the first round of farmers. The second round farmers were also asked to give names of up to 6 farmers as well. We sorted the new names for the third round.

Table 2 presents the MSDD sample and affiliation of the farmers according whether the farmer is a participant in the MSDD project (Heifer) or not (Non Heifer).

Table 2: 2015 Treatment Sample

	FIRST ROUND	SECOND ROUND	THIRD ROUND	TOTAL
	Number of interviews			
HEIFER	127	3	0	130
NON HEIFER	0	343	176	519
TOTAL	127	346	176	649
	Number of contact names			
HEIFER	120	61	10	191
NON HEIFER	595	2151	1028	3774
TOTAL	715	2212	1038	3695
CONTACT PER FARMER	5.6	6.4	5.9	5.7

Sampling in the comparison group followed a similar pattern (Table 3). The survey was started with a sample of 130 farmers in the comparison community. Heifer Malawi identified the community of Mevwere as a candidate community for comparison. Demographic, economic and agronomic data were used to compare the intervention community (2009) with comparison (2015). The results demonstrated statistical similarity suggesting an appropriate comparison group.

Table 3: Control Sample

	FIRST ROUND	SECOND ROUND	THIRD ROUND	TOTAL
	Number of interviews			
TOTAL	130	177	191	498
	Number of contact names			
TOTAL	840	1067	854	2761
CONTACT PER FARMER	6.5	6.0	4.5	5.5

Social network analysis (SNA) allows us to look at the network as a whole by size and density variables. The size of the network is determined by the total number of individuals (nodes) within a boundary. The density of the network measures the intensity of relationships between all households. Density also captures a household's connections to each other. Failing to reach out-- a redundancy of relationships, may suggest a lack of trust, reaching out only to those you know before larger network develops (Borgatto, 2014).

Centrality measures show the position of the individual in the network. Degree centrality measures the number of ties of a household and the extent to which the household has connections with other households. As the centrality measure of the household increases, the households have increased opportunity to interact and share what they know.

Betweenness centrality is the number of times the household acts as a bridge along the shortest path between two other households and quantifies the control of a household on the communication between others. Betweenness centrality measures whether a household serves as a bridge between people. Serving as a link to households who might otherwise not be connected is important because it "creates opportunities for exploitation of information and control of benefits" (Borgatto, 2014).

Closeness centrality measures how close each household is to other households in the network. This variable shows the ability of the household to contact other households in fewest steps and indicates a central position in the network.

Eigenvector centrality measures one's connections to popular households, those with a higher number of ties by combining the number of connections a household has and the degree centrality of the connection. Eigenvector centrality measures the extent to which households are connected to other households who have a high degree centrality. The variable measures whether the household is connected to well-connected households.

For hypothesis 1, we compare the MSDD and non-Heifer participants with respect to density and average centrality measures.

For hypothesis 2, we compare the average real net income with the living income benchmark for the three time periods, 2009, 2012 and 2015. To establish attribution, that the

change in net income observed is due to the Heifer intervention, we ran a t-test to determine statistical difference between net income for the comparison group and the Heifer participants in 2009.

Hypothesis 3 we used multivariate regression to explain the variation in net income for Heifer participants and comparison group as a function of participation in MSDD and centrality measures. Since degree, betweenness, closeness, eigenvector and clustering coefficient variables all together pose a multicollinearity problem we need to reduce the number centrality dimensions and obtain an uncorrelated and independent variable for centrality. We use factor analysis with principle axis factoring for extraction and direct oblimin for rotation and restricted results for one factor solution. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy is 0.665, means the use of factor analysis is appropriate. Table 4 shows the mean and standard deviation of each centrality variables.

Table 4: Factor analysis results

Centrality Measures	Components	Mean	Std· Deviation	N
Degree Centrality	0.815	8.28	3.16	238
Closeness Centrality	-0.288	0.0057	0.0274	238
Betweenness centrality	0.861	55938.49	70225.97	238
Eigenvector centrality	0.804	0.0013	0.0024	238
Clustering coefficient	0.282	0.0497	0.0773	238
Extraction sums of squared loadings	2.214			
% of variance after rotation	44.28			
Keiser-Meyer-Olkin Measure of samplinc adequecy	0.665			

Extraction method: Principle axis factoring

Rotation method: Direct oblimin with Kaizer normalization

Number of factors limited to 1 extraction

Factor scores were calculated and saved with Bartlett's method for further analysis. The dependent variable of the regression is net real income and the independent variables are centrality factor scores and a dummy variable that indicates MSDD participation. If hypothesis 3 is true, we expect that the coefficient estimates of MSDD participation and centrality factor scores are positive and significant. Table 5 presents the variables of the regression equation.

Table 5: Variables in the regression model (dependent variable: Net Income)

Variable name	Definition	Average, Minimum, Maximum Values)
Net Income	Net income of the respondent in Malawian Kwachas (2015 prices)	Mean: 1251,30 SD: 2444.85 Min: -1085.64 Max: 21495.06
Centrality factor scores	Normalized factor score values for degree, betweenness, closeness and eigenvector centrality variables	Mean: 0.00 SD: 1.00 Min: -2.24 Max: 4.54
Dummy	Dummy variable that takes the value of 1 if the farmer is a participant of the MSDD project and 0 otherwise	Mean: 0.43 SD: 0.50 Min: 0.00 Max: 1.00

For hypothesis 4, we compare the position of average net real income to the living income benchmark from baseline 2009, end of project, 2012 to post project, 2015.

4. Findings

4.1. MSDD and Social Capital

Social network analysis results confirm that hypothesis 1 is true and that MSDD project made a positive impact on the social capital formation of the target population.

Figure 3 presents the network map of the first round interviews of the Treatment 2015 where green dots denote MSDD households and blue dots denote the first round of non-Heifer households identified by the MSDD1 Original Group (OG) members. The figure is a visual representation of the interaction of the MSDD households with non-Heifer households in their network.

Figure 3. Social Network Map of the MSDD farmers

TREATMENT FIRST ROUND INTERVIEWS (HEIFER FARMERS)

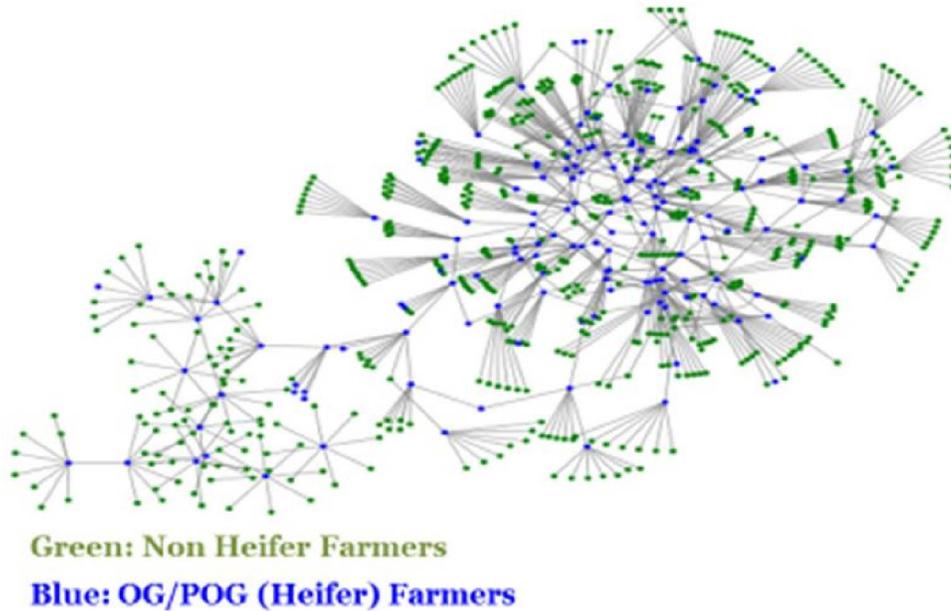


Table 6 presents summary measures of the 2015 Heifer participants with their network and the 2015 comparison group sample. The number of households in the treatment sample (Heifer and non-Heifer in the Heifer network) is 3858 and comparison sample is 2906 (all non Heifer not in network). As described above, the network corresponds to the households that are named as contacts by the interviewed households. The average value of the centrality measures is statistically different at the 1% level. The average value of the degree centrality, betweenness centrality and eigenvector centrality measures are higher for the treatment group and the average value of the closeness centrality variable is lower for the treatment group. The results confirm Hypothesis 1 that the Heifer intervention augments social capital.

Table 6: Comparisons of centrality measures for MSDD Group Network and Control Group Network

	Degree Centrality	Betweenness Centrality	Closeness Centrality	Eigenvector Centrality	Clustering Coefficient	N
MSDD and its network	2.493	10569.025	0.0058	0.00025	0.0118	3858
Control group and its network	2.371	8003.504	0.0108	0.00034	0.0236	2906
t-Statistics	1.679**	2.953*	5.367*	2.447*	4.336*	

*Significant at the $\alpha \leq 0.01$ level

** Significant at the $\alpha \leq 0.05$ level

Moreover, when only the Heifer participants are examined with the comparison group, the difference between the centrality measures become larger and becomes more significant (Table 7). The average value of the degree centrality of the Heifer participants in the treatment group is 9.36 and is statistically different from the average value of the degree centrality the comparison sample (7.46). Similarly, we observe smaller closeness centrality for the Heifer sample indicating that the Heifer farmers are able to reach other farmers in fewer steps when compared with the comparison group. These results also confirm hypothesis 1.

Table 7: Comparisons of centrality measures for MSDD Group and Control Group

	Degree	Betweenness	Closeness	Eigenvector	Clustering	Net Income	N
HEIFER	9.36	89720.78	0.00005	0.00221	0.05965	2144.6	103
COMPARISON	7.46	30163.84	0.00995	0.00054	0.04217	569.7	135
t-statistics	4.810**	7.132**	-2.798**	5.723**	1.736*	5.186**	

** Significant at the $\alpha \leq 0.05$ level

*Significant at the $\alpha \leq 0.01$ level

4.2. MSDD and Economic Livelihoods

The average net real income per day for a beneficiary household of five⁵ at the close of the project (2012) was above the adjusted living income benchmark suggesting that MSDD1 households had sufficient income to consume the basics for a ‘decent life.’ Comparing the net real income in 2015, three years after the close of the project, to the benchmark, demonstrates an even larger and positive gap. Net income above the ‘living income’ indicates a capacity for resilience as well as a strong indicator of sustainability (Table 8).

Table 8. Comparison of living income benchmark and net real income

YEAR	2012	2015
Living Income Benchmark	2.52	2.52
Real Net Income	2.78	4.60
Gap	+26	+2.08

One of the important elements in evaluating outcomes such as improved livelihoods is attributing the change observed to the project intervention. Since there was no base line data for the comparison group, we examined the net real income data between the treatment group (Heifer participants) and the comparison from the 2015 survey to determine attribution. We then ran t-test to determine if the differences were statistically significant (Table 9).

Table 9. Net Real Income: MSDD and Control Group

	Heifer Participants	Comparison	t-statistic
Net real income (USD₂₀₁₅/day)	4.6	1.06	7.32

Net real income between the two populations is statistically different suggesting that the improved livelihoods can be attributable to the project intervention. The findings support Hypothesis 2, which states that the MSDD project made a positive impact on the economic livelihoods of the population.

⁵ Anker and Anker (2014) calculated a family size of 5 for their living income baseline calculation.

4.3. Social Capital and the Impact on Improved livelihoods

Social network analysis and comparison of centrality measures allowed us to demonstrate that social capital had been augmented by the Heifer intervention with the MSDD project. Now, drawing on social capital theory, we expect that this new source of capital should have a positive impact on net income through enhanced capabilities and access to information, credit and other resources. Table 10 presents the regression results.

Table 10. Regression Analysis Results (dependent variable: Net income)

Variables	Coefficient estimate
Constant	714.31***
Centrality factor score	378.70***
Beta	0.16
Dummy	1240.82*
Beta	0.25
Adj R2	0.11
F-Statistics	16.28***
N	237

***Significant at the $\alpha \leq 0.001$ level; * Significant at the $\alpha \leq 0.05$ level

The results confirm that MSDD participation has a positive impact on net income. The coefficient estimate of the centrality measure is significant and demonstrates that social capital has an impact on increasing the net income of the participants. Coefficient estimates refer to change in dependent variable per one unit change in the independent variable. The Beta under each of the coefficient estimate shows the standardized coefficients for each of the independent variables. Standardized coefficients refer to how many standard deviations a dependent variable will change, per standard deviation increase in the predictor variable. Standardization of the coefficient shows the degree of impact of the independent variables on the dependent variable, when the variables are in different units of measurement. For example, the standardized coefficient estimates show that the impact of social capital is higher than the impact of MSDD participation on net income meaning that the farmers with higher social capital gained the most benefit from the MSDD project. The regression results confirm Hypothesis 3.

4.4. Sustainability of net income

Average net real income for a beneficiary household moved from below living income in 2009 to just above living income in 2012 at the close of the project. That net real income has continued to increase 3 years after the close of the project suggests that the economic structure

has shifted and that these changes will likely be sustainable. While it is necessary to continue to monitor incomes over the next decade, this positive trajectory is a strong indicator of sustainability.

5. Conclusions

This study draws on capital and social capital theory to understand the effects of an outside intervention on expanding economic opportunities in a local economy. The binding constraints to growth in the local economy are the stock of physical, human, social capital and missing markets. The results of this study suggest that this intervention, which enhanced the stocks of capital, sufficiently relaxed these constraints and catalyzed an increase in economic opportunity with evidence of sustainable effects.

The assumption of many economic development interventions is that the stimulus of increased physical capital (livestock) and human capital (training) will contribute to change in the incomes of program recipients. What is unique about the design of Heifer projects and MSDD1 in particular is the catalytic role of social capital as it expands the opportunity set created by the infusion of the physical and human capital. In this study, we asked two related sets of questions. Did this program increase net income, our proxy for improved livelihood and, are there indications that this potential change will be sustainable and lead to livelihoods that are more resilient. The second and related set of questions was whether the intervention increased social capital and if so, if this social capital contributed to net income.

Mapping the social networks of both the intervention (MSDD1) and a statistically matched comparison group enabled us to establish that social capital increased and that the increase was due to the intervention. We also tested whether social capital formation had a significant impact on participants' net income. We found that social capital did have a significant effect on net income. We suggest that this benefit occurred because social capital performed some of the functions of foundational market institutions. Constraints that producers faced in their local economy with missing or incomplete markets were in part filled through social networks and collective action. As the constraints were relaxed, economic opportunities expanded.

We found that the change in net income for the project households was sufficient to afford participants a 'modest but decent living' at the close of the project in 2012. When we measured net income in 2015, three years after the end of the project, net incomes had increased 65%, demonstrating evidence of sustainability. The increases that we see in net income are likely to level off at least in the short to medium run as supply and demand condition adjust. What is important is that this infusion of capital has allowed participants to increase incomes above the 'living income' and as such has increased the economic resiliency of this group. The net incomes of the MSDD1 households were statistically different from the comparison group allowing us to infer that this increase in income can be attributed to the program intervention.

While the results of this study pertain to a specific project, they also provide preliminary evidence of the importance of catalyzing and engaging physical, human and social capital in an intervention to influence the structure of a local economy in a way that leads to a sustainable set of new opportunities for the most vulnerable.

Bibliography

- Anker, R. a. (2014). *Living Wage for Rural Malawi*. Fair Trade International, Sustainable Agriculture Network .
- Borgatto, S. a. (2014). *Network Measures of Social Capital*. Analytictech.
- DeHerdt, T. a. (2007). Special Issue on Individual Freedoms as Relational Experiences.
- Hartmann, D. a. (2014). *Measuring Social Capital and Innovation in Poor Agricultural Communities. The Case of the Chaparra- Peru*. Universitat Hohenheim.
- Heifer International - Philippines. (2014). *"Raising Income of CCT Families Through Sustainable Agri-Business 9RICSA) project*. Manila: Heifer International .
- ISEAL. (2015). *"Living Income Practitioners' Workshop" hosted by ISEAL & GIZ*. Eschborns: ISEAL.
- Takavarasha, G. R. (2013). *Running Randomized Evaluations*. Princeton: Princeton University Press.
- Woolcock, M. N. (2000). Social Capital: Implications for Development Theory, Research and Policy. *The World Bank Research Observer*.

