Impact Evaluation of the TIST Program in Kenya

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Executive Summary

The International Small Group and Tree Planting Program (TIST) works with subsistence farmers in Kenya to generate carbon credits through tree-planting activities. The program components include training on tree-planting, conservation farming, health and nutrition education, bee-keeping, fisheries, and fuel-efficient cook stoves. Trainings are delivered within group settings that allow members to take monthly leadership roles and that foster the development of social support networks.

To determine whether TIST meets the Climate, Community and Biodiversity Alliance (CCBA) criterion for the Gold Level Exceptional Community Benefits certification, interviews were conducted with 124 TIST participants in the project area between June and August of 2011. The interview tool followed the Sustainable Livelihoods Framework (SLF) by measuring participant livelihoods through five main types of capital, including Social, Human, Financial, Physical and Natural. In addition, participants were asked about positive and negative impacts they have experienced as a result of TIST programs.

Results show that participants experience a range of economic benefits and positive social impacts, regardless of socioeconomic status or gender. The most important benefits and impacts were sales and savings from tree products such as fruits, nuts, and firewood sales and use of tree seedlings, increases in crop yield due to conservation farming methods, increased social support and leadership skills, and increased knowledge and use of preventative health measures. In addition, several negative impacts were identified and addressed. Based on these results, TIST programs appear to meet the criterion for the CCBA Gold Level Exceptional Community Benefits certification.

TIST engages in innovative strategies to reach the poorest and more vulnerable groups in the project area, such as community-driven Small Groups with rotational leadership and land share agreements. In addition, the use of hand-held Palm technology allows timely and up-to-date monitoring of TIST activities. In order to continue monitoring positive and negative social impacts on the community, it is recommended that TIST adapt a version of this social impact survey for the hand-held palm. In this way, TIST Quantifiers can continue to gather livelihood information on TIST participants and ensure that programs maximize benefits and minimize negative social impacts on TIST members and the surrounding community.

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1. Introduction

Program Description
The International Small Group and Tree Planting Program (TIST) works with subsistence farmers in Kenya to generate carbon credits through tree-planting activities. The program components include training on tree planting, conservation farming, health and nutrition education, bee keeping, fisheries, and fuel-efficient cook stoves. Farmers organize themselves into Small Groups, which are part of larger Clusters within the Meru and Nanyuki areas. Trainings are delivered at monthly Cluster meetings and leadership is rotational, with each member having a chance to fulfill a monthly leadership position. In this way, TIST provides training and education through community-driven efforts. The intervention theory is that TIST trainings, when delivered within group settings, foster social support and empower farmers to plant trees, improve agricultural practices, participate in additional income-generating activities, and improve knowledge about health and nutrition. If farmers participate in program activities, they will experience increased level of income, diversification of sources of income, increased crop yield and food production, strengthened social support networks, and improved knowledge of nutrition and health. These outcomes will translate to increased livelihoods and social impacts, such as increased food security, improved health and nutrition, and increased education for children.

Purpose of Evaluation
This evaluation is intended to assess whether TIST meets the Climate, Community and Biodiversity Alliance (CCBA) criterion for the Gold Level Exceptional Community Benefits certification. Specifically, the purposes of this evaluation are to:

- ➢ Quantify outcomes and related impacts of TIST programs on TIST participants
- ➢ Identify to what extent these impacts (both positive and negative) are experienced across all groups, particularly poorer households and individuals and other disadvantaged groups, including women
- ➢ Establish a baseline for future community impact monitoring and evaluation of TIST activities

2. Evaluation Methodology

Evaluation Type and Rationale
The type of evaluation to be conducted is both a process and an impact evaluation because it will identify successes and failures in program delivery, as well as measure benefits and impacts of program activities. Previous evaluations have gathered data on positive and negative impacts on program participants through surveys, focus groups, key informant interviews, and literature review (Nareda, 2010). However, they are unable to distinguish whether these impacts differ between poorer and wealthier households, due to a lack of economic and livelihood data at the household level. The CCBA certification standards require that program monitoring is able to identify positive and negative impacts on program participants and to differentiate between poorer and more vulnerable households. In order to accomplish this, information on relevant personal indicators will be gathered, in conjunction with economic and social value of program benefits, using semi-structured interviews.

Evaluation Approach

There are roughly 159 Clusters with an average of 357 people per Cluster (range between 7 and 2124). Meru and Nanyuki areas each cover two distinct agro-climatic zones, with Meru covering the larger Meru District and parts of the Kirinyaga District; and Nanyuki covering the larger Laikipia District and parts of the Nyeri North District. These districts differ in topography, climate, geology and soils, and drainage system and hydrogeology (Nareda, 2010), which could influence certain program benefits, such as type and number of trees planted, crop yield and access to firewood. In order to compare program benefits between socioeconomic groups within and between cluster groups, a subset of nine Clusters was randomly selected from the complete list. Clusters were then checked to make sure a range of important factors were represented, such as where they are located with respect to relevant agro-climatic regions.

To answer the main evaluation questions, trained interviewers conducted semi-structured interviews with TIST members at Cluster meetings. Nine TIST members were chosen as interviewers, half from Meru and half from Nanyuki. These members were chosen based on previous experience conducting interviews for TIST evaluations; specifically, they were chosen based on their motivation for conducting surveys in the last evaluation, accuracy of data and ease of understanding survey questions/survey design. Dorothy Naitore, a TIST leader who has had experience training interviewers for previous evaluations, trained the interviewers.

Before data collection began, Cluster Leaders were informed about the evaluation and its purpose. Leaders were urged to spread the word to Small Group members in an effort to boost attendance level and improve the chances of having a representative sample at the Cluster meeting. Because poorer and more vulnerable households may have additional barriers to meeting attendance, every effort was taken to increase attendance at meetings. One concern is that increasing attendance for these sampled clusters may give an incorrect view of level of participation; therefore, specific questions were asked about frequency of attendance and barriers to attendance (as described in the Instrument Development section below).

Two interviewers attended each cluster group meeting, conducting between five to ten surveys each (totaling 11 to 16 surveys per cluster group). Interviewers randomly selected survey respondents throughout the meeting, after an initial introduction explaining the purpose of the evaluation, that participation was voluntary and that answers were confidential. The total sample size was 124 TIST Small Group members.

A trained TIST contractor, Purity Naitore, entered data into an electronic database and the data was sent to Sophie Oppenheimer for analysis using Stata v.11.

Instrument Development

The interview tool consisted of 37 questions within four main topic areas, including demographic/basic information, TIST membership information, benefits from TIST activities, and specific questions on conservation farming and food security.

A multitude of factors contribute to whether or not a household is considered "vulnerable." To gain a fuller picture of the livelihood status of individuals, a variety of personal indicators were gathered. According to the Sustainable Livelihoods Approach (SLA), there are five main categories of assets that contribute to a person's livelihood, including Human Capital (formal education level, literacy, health and nutrition education, conservation farming training, and leadership roles), Social Capital (perceived level of social support and marital status), Natural Capital (land ownership, land use, trees planted, and crop production) Physical Capital (access to

markets, paved roads, hospital and school), and Financial Capital (income level, livestock ownership, and crop yield). Additional relevant information included gender of the head of the household and number of people living in the household. These indicators were measured in order to differentiate between poorer and more vulnerable households; and to identify and assess whether positive and negative impacts of the program are affecting households equally.

The TIST program is designed to improve livelihoods of individuals and communities through a combination of income-generating activities and education while building social capacity through group collaboration. To quantify outcomes of TIST programs on TIST participants, detailed information on the value of program benefits was gathered. These included the total production, local market value, total amount sold, and total amount used for personal needs for relevant program components, such as tree planting, use of conservation farming techniques, and fuel-efficient stoves. To assess how participants are benefiting from each TIST activity, short, medium and long-term outcome indicators were measured.

Short-term indicators included use of conservation farming techniques, number of trees planted, use of TIST fuel-efficient stoves, and participation in other income-generating activities, (bee-keeping, fish ponds, production of compost manure, and seedling nurseries). Medium term outcomes included harvesting tree products (including fruits, nuts, firewood, fodder, and medicine), increased crop yield through conservation farming techniques, reduced use of firewood, harvesting of seedlings, harvesting honey, and harvesting fish. Long-term outcomes included additional income from carbon stipends, sale of tree products, sale of crops, sale of livestock and livestock products, amount of money spent on education, food and non-food items, ability to start a business, increased consumption of self-produced food and decreased spending on externally produced food, increased level of perceived social support, decreased spending on firewood.

While the above-listed outcomes are important to improve livelihoods, they must be distinguished from social impacts. According to Schreckenberg, social impacts involve the altering of human behavior or welfare for better or for worse (Schreckenberg 2010). An example of a social impact is improved family health as a result of being able to afford a healthier diet through increased income from TIST activities. Therefore, a series of Likert Scale questions was asked to gauge perception of perceived impacts, both positive and negative. In addition, open-ended questions were placed throughout the survey tool in an effort to capture positive and negative impacts resulting from TIST activities.

A main assumption in assessing whether programs are effective is that members are actually participating in program activities. To ensure that program successes and failures, as well as barriers to participation are correctly captured, several questions on program adherence and exposure were asked. These include length of membership, meeting attendance, barriers to attending meetings, distance from meeting locations, opportunity for leadership roles, number of trees planted, exposure to health education, and exposure to conservation farming training.

3. Survey Results

3.1: Overview

Semi-structured interviews were conducted at nine randomly selected Cluster meetings between June and August of 2011 from the Meru and Nanyuki, Kenya TIST project areas. Two trained

interviewers attended each meeting, conducting between 5 and 9 interviews each to randomly selected TIST Small Group (SG) members. The total sample size was 124 interviews, with a range of 11 to 16 interviews per Cluster.

3.2: Demographics and Household Characteristics

Demographic and household information is reported within the Sustainable Livelihoods Framework (SLF) livelihood asset categories to present participant wellbeing within a broader context.

3.2.1 Human Capital

According to the Sustainable Livelihoods Framework, Human Capital refers to, "the skills, knowledge, ability to labour and good health that together enable people to pursue different livelihood strategies and achieve their livelihood objectives," (Department for International Development, 1999). This section summarizes the indicators used in this study to assess human capital among participants.

The total number of people per household ranged from 1 to 9, with an average of 4.13 people per household. 78 respondents (63%) reported having children (people under the age of 18 years) living in their household with a total average of 1.8 children per household (range 1 to 4). The average age of respondents was 50.36 years, with a range of 25 to 81. The gender ratio of respondents was consistent the overall gender ratio of TIST membership, with 61 respondents (49%) being female and 63 (51%) being male. The gender ratio among households was similar with 47% of household members being female. The table below presents basic demographic information among interview respondents and households.

Table 1: Respondent and Household Demographics

Total # Respondents	n =124
Female	61 (49%)
Married	108 (88%)
Average age (Years)	50.36
HH with children	78 (63%)
Mean # People per HH	4.13
Mean # Children per HH	1.8
HH Gender Ratio (% Female)	47%
Female Head of HH #(%)	25 (20%)
Married	15 (12%)
Male Head of HH #(%)	99 (80%)
Married	93 (75%)

Marital status and gender head of the household have been found to be possible indicators of household livelihood status (Jindal 2004). The majority of respondents were married, with only 12% indicating single status. 25 (20%) indicated a female head of household and 99 (80%) indicated a male head of household. The combination of single status and female-headed household is of particular interest. There was a significant difference ($p<.05$) in marital status between female- and male-headed households, where 40% of female-headed households were single and 60% were married, compared to male-headed households, where only 5% were single and 95% were married. There was a significant difference in number of people per household between single female- and single male-headed households, with the average number of people

in a single female-headed household the same as the overall average (4.2) and the average number of people in male-headed households being far below the average (1). There was no difference in number of children between these households.

Literacy is another important indicator for household wellbeing, as it increases access to information and employment opportunities. Literacy rates among respondents and across households are presented in the table below.

Table 2: Literacy Rates Among Individual Respondents and Households

Respondent Literacy (n=124)	110 (89%)
Females Illiterate #(%)	7 (5.5%)
Males Illiterate #(%)	7 (5.5%)
Mean HH Literacy Rate (n=510)	429 (84%)
Females Illiterate #(%)	37 (14.9%)
Males Illiterate #(%)	33 (12.6%)
HH with 100% Literacy	52%
HH with 75-99% Literacy	25%
HH with 50-74% Literacy	18.5%
HH with 25-49% Literacy	3%
HH with < 25% Literacy	1.5%

The majority of individuals interviewed were literate (89%), with equal numbers of male and females being illiterate. At the household level, average literacy was 84%, where slightly more females (14.9%) were illiterate compared to males (12.6%). More than half of households had a 100% literacy rate. A small percentage (4.5%) of households had less than half its members literate. These households are therefore deemed more vulnerable in terms of access to information and were examined more closely in subsequent analyses.

Another important indicator for livelihoods is level of education, as it allows for diversified job opportunities, potentially higher wages and knowledge that can impact health and other aspects of wellbeing. The table below presents education levels of interview respondents and across households.

Table 3: Respondent and Household Education Levels (n=124)

Respondent Education	#(%)
Primary	63 (51%)
Secondary	46 (37%)
Tertiary	3 (2.4%)
University	0
Household Education	#(%)
Only Primary	43 (35%)
Secondary	66 (53%)
Tertiary	10 (8%)
University	5 (4%)

A little over half of respondents had only a primary education and more than one-third had a secondary education. To gain a fuller picture of household wellbeing with respect to education, respondents were asked about education levels of household members. Over half of households

have at least one member who has a secondary level education and a small percentage (4%) have at least one member who has a university level education. Because having at least one household member with higher education can contribute to overall wellbeing of the household, those households with members who have only had a primary level education were deemed more vulnerable. A Fisher's Exact test showed a significant difference ($p<0.01$) between household education and household occupation, where households with all members having only a primary education were more likely to rely solely on farming for their income than households with people having a secondary education or higher.

3.2.2 Social Capital

Social Capital is more abstract than other types of capital listed in the SLF, and can include indicators such as, "networks and connectedness, membership of more formalized groups, and relationships of trust, reciprocity and exchanges," (Department for International Development, 1999). Some of these indicators are included in the Human Capital section (marital status and number of people per household) and the TIST Participation section below (membership length and meeting attendance). Additional information is reported in the benefits and social impact section below, including leadership roles, relationship building, and impacts from relationships built through TIST.

3.2.3 Natural Capital

Natural Capital includes, "the natural resource stocks from which resource flows and services useful for livelihoods are derived," (Department for International Development , 1999). When asked about land tenure and ownership status, 47% of participants reported freehold under customary tenure, 46% reported freehold with registered deed, and the remaining 7% reported either caretaker, leased out, or other. The average land size is 4 acres, ranging from .25 to 15 acres, with a standard deviation of 3.2. Participants were asked what proportion of their land went toward various activities. The table below shows the percent of respondents who use their land for various land-use activities, as well as the average acreage and percentage of land used for those activities.

Table 4: Land-Use Activities (n=124)

Land-use Activities	#(%) Households	% Land Used	Average Acres
Crop Production	119 (96%)	60	2.3
TIST Tree Planting	119 (96%)	20	0.66
Livestock Production	82 (66%)	14	0.63
Housing	100 (81%)	11	0.34
Other	18 (15%)	64	2.33

The most commonly reported uses for land were crop production and TIST tree planting, followed by housing and livestock production. The majority of land was used for crop production and other uses, including "customary" and "hire." On average, only 20% of total land (.66 acres) was used for TIST tree-planting activities.

An important indicator for household wealth is the number of livestock and poultry owned. In many cases, assets such as livestock or durable goods are better indicators for household wealth than annual income. Most rural inhabitants lack access to financial services and thus view these assets as investments. Additionally, subsistence farmers in the project area generally spend cash immediately for inputs or other necessary items.

To gain a better understanding of household wealth beyond reported income levels, participants were asked how many of each type of animal they owned. The average agricultural profile for respondents is presented in the table below.

Table 5: Animal Ownership Among Respondents (n=124)

Households owning animals	116 (94%)
#(%) HH owning livestock	111 (90%)
#(%) HH owning poultry birds	104 (84%)
Total # animals owned	104
Mean # animals per HH	21.7
#(%) HH do not own livestock/poultry	8 (6.5%)

116 participants (94%) owned some type of animal, including chickens (84%), cows (83%), goats (66%), sheep (25%), rabbits (16%) and/or donkeys (2.4%). On average, participants owned 12.8 chickens (0 to 101), 3.6 goats (0 to 30), 2.4 cows (0 to 30), 1.5 sheep (0 to 35), 1.4 rabbits (0 to 52), and/or .04 donkeys (0 to 3), for a total mean average of 21.7 animals per household. Only 8 (6.5%) households did not own any animals. These households were considered to be poorer and subsequent analyses focused on differences between these households.

Respondents were asked to list the five most important crops that they grow. The table below shows main crop categories participants listed with the number and percentage of total respondents who grew at least one crop in that category.

Table 6: Most Important Crops Grown in 2010 (n=124)

Crop	#(%) Households
Maize	81 (65%)
Beans/Legumes	64 (52%)
Roots/Tubers	17 (14%)
Other Grains	11 (9%)
Other Vegetables	8 (6.5%)
Fruits	3 (2.4%)
Specialty Crops	2 (1.6%)

The most commonly grown crops in 2010 were maize, beans/legumes (including beans, black beans, mung beans, peas, pigeon peas, cow peas, chick peas), roots/tubers (including potatoes, irish potatoes, sweet potatoes, yams, cassava), other grains (including millet, finger millet, sorghum), other vegetables (including kale, cabbage, pili pili hoho, tomatoes, squash), fruits (including bananas and passion fruit), and specialty crops (including coffee and cotton). 42 respondents (34%) did not give information on the crops they grew last year.

Table 7: Household Expenditure on Food

HH that bought food last year	75 (60%)
Mean # months food was bought	5.98
Mean KSh (USD) Spent on Food per Month	2330 ($25.82)

More than half of respondents reported buying food from the market last year (2010). Of those who bought food from the market, the average number of months they bought food was 6 months out of the year (1 to 12) and spent an average of 2330 Ksh (25.82 USD) per month at the

market (150 to 10,000 KSh). A Fisher's Exact test showed a significant difference (at $p<0.05$) between respondent occupation and whether or not they bought food at the market last year, with 43% of people with permanent jobs, 67% of farmers, and 77% of people with temporary/day laborer jobs buying food at the market. However, when occupation at the household level was considered, there was no significant correlation, most likely because households with at least one person having a permanent job also have members of the family who farm.

Firewood is the main source of energy in the region and therefore requires a large percentage of household expenditure in terms of time and money. The table below shows the percentage of households that engage in the various methods of collection and the average number of hours it takes per week.

Table 8: Average methods and time spent attaining firewood

Method of Collection	#(%)	Mean Time Spent (Hrs)
Harvest from Land	108 (87%)	1.60
Gather from Forest	5 (4%)	2.25
Buy from Market	19 (15%)	3.70

The most common method of collection among participants was harvesting from land, followed by buying from the market and gathering from the forest. Harvesting from land took the least amount of time, almost half the time it took to buy from the market. This is an important point as TIST participants are trained to maintain sustainable woodlots on their land and because 71% of participants reported growing TIST trees for fuel wood. In addition to methods of collection and time spent attaining wood, participants were also asked who provides the labor for these activities.

Table 9: Division of Labor in Firewood Collection

Method of Collection	Women	Men	Children	Combination	Hired Labor
Harvest from Land	54 (50%)	24 (22%)	4 (3.7%)	18 (17%)	8 (7.4%)
Gather from Forest	4 (100%)	0	0	0	0
Buy from Market	2 (10.5%)	2 (10.5%)	0	1 (5%)	14 (74%)

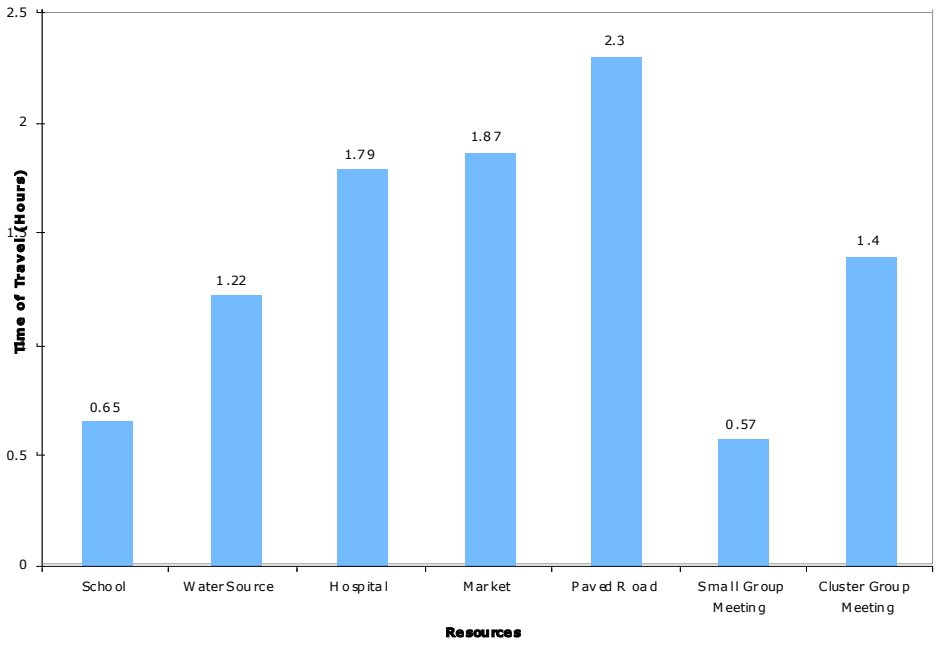
Women performed most of the labor of collecting wood when the method was harvesting from land or gathering from the forest. However, men were more likely to share in the task of collecting firewood when the household harvested from land than when the household gathered firewood from the forest or bought it at the market. There was a relatively high rate of households who hire labor to harvest firewood or buy it from the market. Households who buy firewood from the market were more likely to hire labor than households that harvest it from the land. For both methods of collection, the majority of households had at least one member with a temporary/day laborer job (11), followed by farming households (6) and households with a permanent job (5).

3.2.4 Physical Capital

Physical Capital includes, "the basic infrastructure and producer goods needed to support livelihoods," such as, secure shelter and buildings, water supply and sanitation, and access to information (Department for International Development , 1999). To determine access to physical assets, participants were asked how many hours it takes them to travel to various resources. The

table below shows average travel times to a school, a water source, a hospital, a market, a paved road, SG meetings and Cluster meetings.

Figure 10: Distance to Resources in Hours (n=124)



On average, participants had to travel the farthest to get to a paved road, the market or the hospital. The average participant was about an hour away from a water source and just over half an hour away from a school. TIST Small Group meetings took the least time to travel to (.57 hours) and Cluster meetings were a little farther than a water source (1.4 hours). Travel times to resources is an important factor in determining livelihoods, with those farthest from resources at a disadvantage for accessing necessary services when needed. In addition, travel times to TIST group activities could be a barrier to attendance and therefore interfere with program benefits.

3.2.5 Financial Capital

Financial Capital includes, "resources that people use to achieve their livelihood objectives," including available stocks and regular inflows of money, such as earned income, pensions or other transfers from the state and remittances, (Department for International Development, 1999). Type of occupation is an important indicator for financial capital as it indicates frequency, reliability and level of income. In addition, type of occupation may influence level and type of participation in TIST activities.

Table 11: Occupation Among Respondents and Households

Respondent Employment (n=124)	# (%)
Farming	94 (76%)
Temporary/Day Laborer	9 (7%)
Permanent Job	8 (6.5%)
Unemployed	2 (1.5%)
Other	9 (7%)
Household Employment (n=124)	# (%)
Farming	67 (54%)
Temporary/Day Laborer or Other	34 (27.4%
Permanent Job	23 (18.6%)

The main occupation for individual respondents was farming, followed by temporary/day labor, permanent job other than farming, unemployed, and "other," which includes business, retired officer and self-employed. At the household level, 54% of households rely solely on farming for their income, 27.4% have at least one member with a temporary/day laborer job other than farming and 18.6% have at least one member with a permanent job other than farming. A distinction must be made between occupations at the household level because households who have at least one person with a permanent job can rely on a steady salary and may experience TIST benefits differently in terms of time commitment or crop yield, than households who rely solely on farming or temporary/day labor for income. In addition, households with different types of occupations have diversified sources of income, which helps to prevent against shocks in the market or climate conditions that make farming households more vulnerable. Subsequent analysis will focus on the difference between respondents who reported being unemployed or relying solely on farming for their income versus households with at least one member having permanent employment.

In addition to occupation, respondents were asked their personal monthly income. The table below shows reported annual income brackets for respondents in Kenyan shillings (KSh) and U.S. Dollars (USD/$).

Table 12: Self-reported Annual Income Among Respondents (n=124)

Annual Income (KSh)	$ (USD)	% Respondents
< 12,000 KSh	< $133	44 (35.5%)
12,000 - 60,000 KSh	$133 - $665	58 (47%)
60,000 - 180,000 KSh	$665 - $1,996	15 (12%)
> 180,000 KSh	> $1,996	2 (1.5%)

The majority of respondents (82.5%) made 60,000 KSh ($665) or less, per year, with 35.5% making 12,000 KSh ($133), or less, per year. To put these figures into perspective, the table below compares this sample to data from the Kenya Ministry of Agriculture in Miriga Mieru East and West Divisions.

Table 13: Annual Income Brackets from the Kenya Ministry of Agriculture

Income Level (Ksh)		*Income Level US$*		*Pct of Groups*	***Our sample %***
Min	*Max*	*Min*	*Max*		
0	12,000	$0	$160	5%	35.5%
12,000	60,000	$160	$800	40%	47%
60,000	180,000	$800	$2,400	25%	12%
180,000	300,000	$2,400	$4,000	15%	1.5%
300,000	420,000	$4,000	$5,600	10%	0%
420,000	above	$5,600	above	5%	0%

This comparison shows that TIST reaches a high proportion of individuals in the lowest income brackets within the project area. Although annual income is important as an indicator for household wealth, it is usually not reliable in these settings because participants rarely have an accurate idea of how much they make due to a lack of regular sources of income (Jindal 2004). Therefore, while income levels were examined in subsequent analysis, they were taken to be less indicative of household wealth than occupation or ownership of physical assets, such as livestock or land.

Several statistical tests were performed to investigate the relationship between income, occupation and livestock ownership. At the individual level, a Fisher's exact test revealed a significant difference ($p < 0.001$) between occupation and annual income, with farmers more likely to be in the two lowest income brackets than other occupations and respondents with permanent jobs more likely to be in the upper income brackets. In addition, an Analysis of Variance (ANOVA) test revealed a significant difference (at $p < 0.01$) between occupation of households and livestock ownership. On average, households with at least one member having a permanent job had twice the total number of animals (36 animals) than a household that relies solely on farming for their income (17 animals) or having at least one member as a temporary/day laborer (22 animals). Further analysis, therefore, used livestock ownership as a measurement of wealth at the household level and individual level.

3.3 Participation in TIST activities

Details of TIST membership are also important when determining benefits and impacts on households. The TIST program was established in the project area in 2005. Aside from when Cluster Groups were established, individual enrollment dates and attendance at group meetings are important potential confounding variables for level of benefits and impact experienced by TIST members. The tables below present the reported dates of enrollment among participants and the average number of meetings attended.

Table 14: TIST Enrollment Dates

Year	#(%) Respondents
2005	20 (16%)
2006	25 (20%)
2007	23 (18.5%)
2008	34 (27.4%)
2009	5 (.4%)
2010	3 (.2%)
2011	11 (9%)

Table 15: Participation Levels in TIST

TIST Participation	n	Mean	SD	Min	Max
Length of membership (years)	121	4.7	1.72	1	7
SG Meetings/month	121	1.6	0.98	0	4
CG Meetings/year	123	8.8	4	1	24

The majority of interview respondents have been members of TIST since 2008 or earlier. The average length of membership was 4.7 years, with the average respondent attending 1.6 Small Group meetings per month and 8.8 Cluster Group meetings per year. As expected, there was a significant difference ($p<0.05$) in membership length between clusters. Age of cluster cannot account for all the difference, as rates of enrollment are different for all the clusters.

Pearson's and Spearman correlation tests showed a weak but significant positive correlation between Cluster Group attendance and membership length, with respondents who have been members for longer attending more meetings per year, on average. The opposite was true for Small Group meetings, with tests showing a significant but weak negative correlation between member length and Small Group attendance, where newer members reported attending more Small Group meetings per week than older members. Subsequent analyses look at the relationship between meeting attendance and the benefits/social impacts that participants experience through TIST activities.

Because meeting attendance is an important factor in benefiting from TIST services, such as payments, trainings and social networking, tests were run to see if meeting attendance varied between wealthier households, occupation, literacy, and gender. Analysis of Variance (ANOVA), Spearman and Pearson's Correlation tests found no significant difference in meeting attendance among respondents by livestock ownership, occupation, age, literacy or distance from meetings.

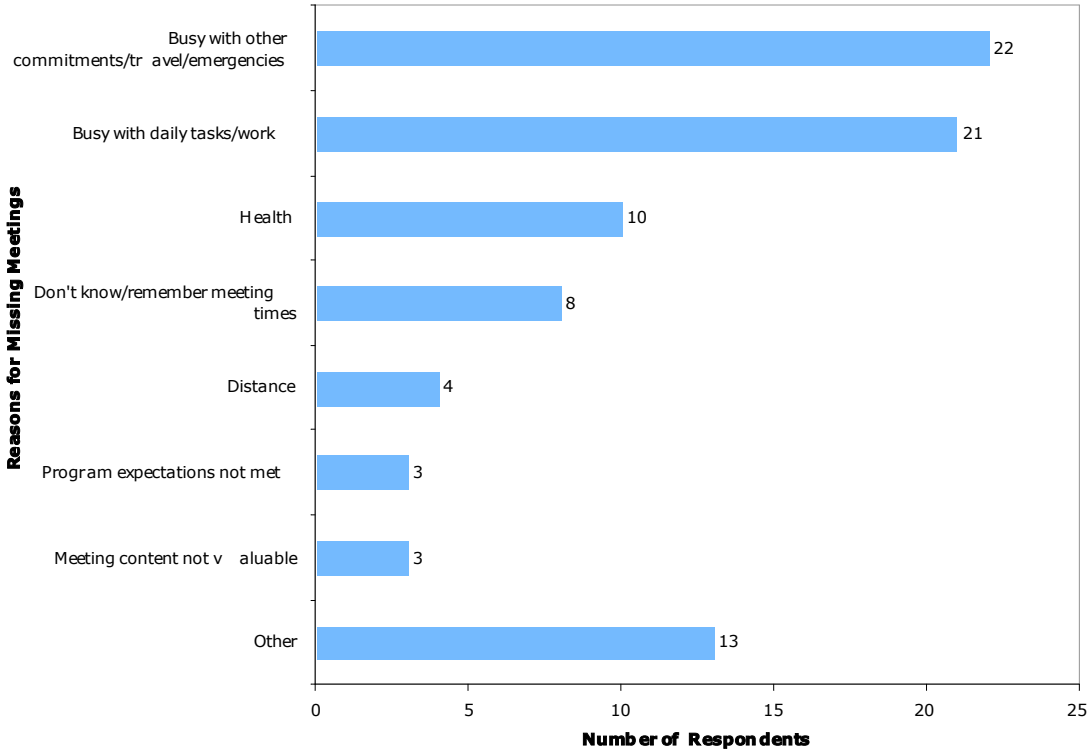
There was also no difference between education level and Cluster meeting attendance, but there was a significant difference ($p<0.05$) in Small Group attendance by education level, such that people with Primary education attended an average of 1.56 meetings per month, Secondary (1.7 meetings per month) and Tertiary (1 meeting per month). Similarly, there was no difference in Cluster meeting attendance by gender, but there was a significant difference in Small Group meeting attendance, where females attended at average of 0.44 more Small Group meetings per week than males.

Analysis of Variance (ANOVA) tests showed moderately significant difference (at $p<0.1$) in Cluster meeting attendance ($p=0.053$) and Small Group attendance ($p=0.064$) between income

brackets, with respondents who make 60,000 KSh ($665) or less attending 0.51 more Small Group meetings per week than respondents who make more than 60,000 KSh per year. The trend was reversed for Cluster Group meetings, with respondents in the higher income brackets attending one more meeting per year than those in the lower two income brackets.

Because meeting attendance indicates level of exposure to program activities, barriers to attendance are considered important. To identify possible barriers to meeting attendance, participants were asked, "What prevents you from attending TIST meetings?" Three TIST US Staff members independently coded qualitative answers into main categories. The categories include, Meeting content not valuable, Program expectations not met, Distance, Don't know/remember meeting times, Health, Busy with daily tasks/work, Busy with other commitments/meetings/travel/emergencies, and Other.

Figure 1: Reported Reasons for Missing Meetings (n=77)



77 respondents (62%) answered this question. The most common reasons for missing TIST meetings were due to being busy with other commitments, such as meetings, travel, or family emergencies (22); and being busy with daily tasks or work, such as grazing cattle, working on the farm or at home, or working at their job or office (21). The next most common answers were related to personal/family health (10) and because the person did not know about or remember meeting times (8). A small percentage did not attend meetings because program expectations were not met (3) or because they did not find the meeting content valuable (3). The category "other," included lack of security at meetings due to administration disapproval, discouraged by low attendance rates, and "nothing."

The findings suggest that the large majority of people might miss meetings because they have to complete daily tasks related to work or because occasional time conflicts arise. The most

important finding from this question were the responses regarding the lack of security at meetings. Specific answers were, "No security since administration is inciting the community against TIST," and "The chief has a low opinion of TIST hence no security in meetings." Further analysis revealed that these answers were both from female participants in the Karocho cluster, which began in 2008. This cluster had a high literacy rate among respondents (79%) and among households (85%), was 64% female, had 43% of households relying solely on farming for income, and had an average of 18.6 animals per household. In addition, this cluster had a higher ratio of female-head of households (50%) than the total sample. The TIST Staff has already been alerted to this finding and is currently taking steps to investigate the issue with Cluster leaders in the field.

3.4 Benefits and Positive Social Impacts

Respondents were asked a series of questions about the benefits and impacts they have experienced as a result of their participation in TIST. The various TIST activities are presented below within four main categories including income, food security, social & community development, and health & nutrition.

3.4.1: Income

There are several ways by which the TIST program aims to increase household income including employment opportunities, tree-planting activities, conservation farming practices, nurseries, fuel savings through fuel-efficient stoves, and promotion of diverse income generating activities such as bee-keeping and fish ponds. Detailed information was gathered on the extent to which each of these activities influenced their household income. The most lucrative activities to individual members were sale of additional cows kept through fodder production (22,950 KSh per year to average member benefiting from this), sale of firewood (6,908 KSh per year), sale of fruits and nuts (4,934 KSh per year), and sale of seedlings (2,319 KSh per year). This section outlines the total amount of sales and savings from TIST activities in Kenyan Shillings, for both a total estimate since time in TIST and a yearly estimate after controlling for length of membership for members that realized these benefits. Because benefits differed in both number of members who realized a benefit and value of benefit to the average individual, additional analysis was carried out to determine the importance of each of these benefits to the 'average' TIST member. For example, while the sale of livestock might be the highest value to an individual, it is relatively rare

<u>Employment</u>

Aside from paying salaries to permanent staff members, TIST also offers small incentives to TIST Small Group members for their work as Quantifiers, Trainers or other roles. Of the interview participants, 4% reported receiving incentives for a total average of 11,531 KSh since their time at TIST. Because length of membership influences the opportunities to experience benefits, total reported earnings were divided by length of membership. The average yearly earnings among these TIST participants ranged from 20 KSh to 10,000 Ksh with an average of 2270 KSh per year. For the most part, the number of people receiving incentives was too small to detect statistical differences; except in the case of gender, where males were more likely to have received incentives than females ($p<.05$).

In addition to direct employment and incentives for volunteers, 10 respondents (8%) reported that they were able to start a business because of their participation in TIST. Types of businesses included beekeeping, bread selling, buying and selling bananas in market, buying and selling macadamia nuts, livestock keeping, poultry keeping, sale of seedlings, self-employment, and

soap making. Of those who started a business, 33% employed 1 person, 44% employed 2 people, 11% employed 3 people, and 11% employed 5 people. Total number of jobs created in the community from these TIST members was 19 people. Although 70% of those who started a business were female, there was no significant difference between males and females. However, there were significant differences in length of membership and number of livestock owned. On average, respondents who started a business had been members for 1.6 more years and owned 18.4 more livestock than those who had not. Results should be interpreted with caution due to low sample size.

Tree-planting Activities

The main focus of TIST is carbon sequestration through tree-planting activities. The direct benefits to TIST members include additional income through carbon stipends, sale of tree products (fruit, nuts, fodder, timber, medicine, and firewood), and ability to keep additional livestock and poultry as a result of increased fodder production. 121 of interview respondents (97.6%) have planted TIST trees since their time at TIST, with a total average of 336 TIST trees, (range 0 to 7782). When accounting for membership length, participants planted an average of 78 trees per year, with a range of 0 to 1556. Most participants planted trees for timber (51.7%), firewood (25%), and fruits and nuts (10.7%); as well as fodder (3.6%) and medicine (.8%).

Participants were asked whether they have received carbon stipends, whether they have harvested tree products, and how much money they have received for these activities since their time at TIST.

Table 16: Members Reporting Economic Benefits From Tree-planting Activities (n=124)

Activity	# (%) Respondents
Carbon Stipend	42 (34%)
Harvested Tree Products	85 (68.5%)
Sold Tree Products	24 (19%)
Used Tree Products	65 (52%)

One-third of respondents (34%) have received carbon stipends since their time at TIST. In TIST Kenya, to receive payment, a Small Group must be registered, have at least 500 Quantified trees, and attend Cluster meetings where payments are made. The table below shows that the average income generated through carbon stipends was 1,564 KSh since time at TIST or 296 KSh annually. These numbers are consistent with TIST records. The large ranges are due to a variety of factors, including membership length and varying tree counts by group.

Selling and using products from TIST trees is another way in which household income is affected by TIST activities. Roughly two-thirds of respondents (68.5%) reported harvesting fruits, nuts, fodder and/or firewood from TIST trees. Most participants who harvested products from TIST trees used products at home for food (65 respondents) and fewer (25) reported selling products. The table below shows the average economic benefits from TIST tree-planting activities.

Table 17: Average Income and Savings from Tree-planting Activities: KSh (USD)

Activity	n	Mean	SD	Min	Max
Carbon Stipends					
Total time at TIST	38	1,564 ($17)	2,209 ($24)	100 ($1)	12,000 ($133)
Annually	35	296 ($3)	428 ($5)	21 ($.23)	2,400 ($27)
Tree Products Harvested					
Total time at TIST	75	33,256 ($369)	70,058 ($777)	97 ($1)	513,080 ($5,688)
Annually	73	8,753 ($97)	12,223 ($136)	22 ($.24)	64,640 ($717)
Tree Products Sold (Income)					
Total time at TIST	24	26,770 ($297)	66,745 ($740)	322 ($4)	324,480 ($3,597)
Annually	23	4,814 ($53)	9,783 ($108)	64 ($.71)	46,354 ($514)
Tree Products Used (Savings)					
Total time at TIST	65	25,881 ($287)	40,834 ($453)	97 ($1)	188,600 ($2,091)
Annually	64	6,528 ($72)	8,252 ($91)	22 ($.24)	33,800 ($375)

The total average value of products harvested since time at TIST was 33,256 KSh ($369), with an annual average of 8,753 KSh ($97), after controlling for length of membership. These numbers represent the maximum potential income based on reported harvests. To quantify actual observed additional income earned and actual savings as result of household use, respondents were asked the amount of products sold in the market, the amount they use at home for food and the normal market price for each product. Of the 85 participants who harvested products from TIST trees, 24 (28%) reported selling their products for a total average observed income of 26,770 KSh ($297) and an average annual observed income of 4,814 KSh ($53) per year. Many more participants 65 (76%) used what they harvested at home for food. The total average savings was 25,881 KSh ($287) during their time at TIST and 6528 KSh ($72) annually after controlling for length of membership.

Sale of Animal Products

In addition to market sales and home uses, fodder production has the additional benefit of allowing participants to keep more livestock. Of the 25 participants who reported harvesting fodder from TIST trees, 12 (48%) were able to keep more animals because of the extra fodder produced. Of these respondents, 8 members could keep an average of 7.5 extra goats (range from 3 to 18), 5 members kept an additional 16.2 poultry (10 to 30), and 7 members kept an additional 2.3 cows (range 1 to 5) since their time at TIST. This translates to .4 extra cows (range .14 to .83), 1.3 extra goats (range .43 to 3), and 2.7 extra chickens (range 1.7 to 5) per year, when controlling for length of TIST membership. The additional income generated from the sale of these animals and their products is presented in the table below.

Table18: Economic Benefit of Keeping Livestock Due to Extra Fodder Production (KSh)

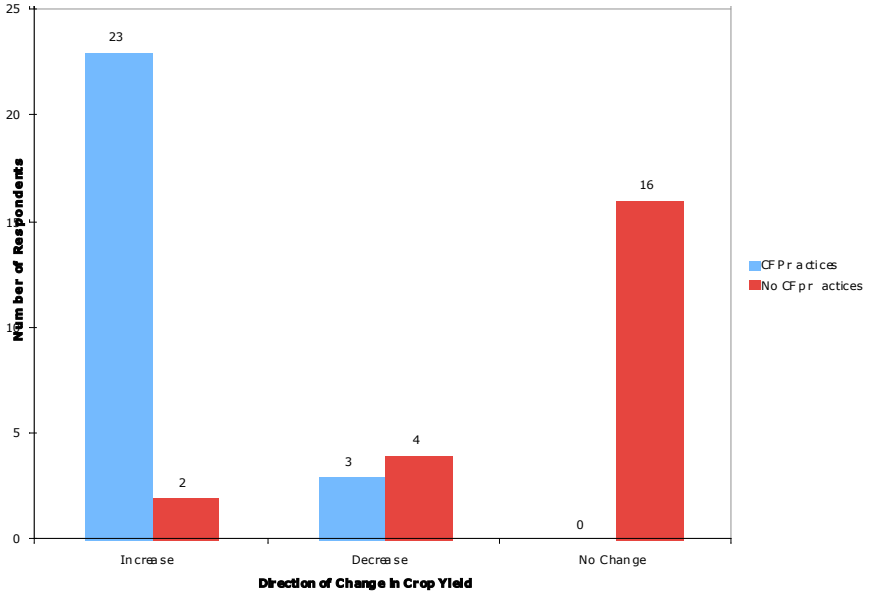
Activity	n	Mean	SD	Min	Max
Animal Products Harvested					
Total time at TIST	11	67,732	60,961	3,833	1,296,167
Annually	11	11,796	10,638	639	32,694
Animal Products Sold (Income)					
Total time at TIST	5	94,975	110,045	182	239,288
Annually	5	16,055	18,191	26	39,881
Animal Products Used (Savings)					
Total time at TIST	4	10,296	13,583	122	28,946
Annually	4	1,718	2,262	17	4,824

The total potential value of additional livestock and poultry production due to increased fodder production through TIST tree-planting activities was 67,732 KSh since total time in TIST, which translates to an average of 11,796 KSh additional income annually. Again, these numbers reflect potential benefits based on reported numbers of additional livestock and poultry kept. It does not include milk and eggs. To get a more accurate estimate of observed benefits, respondents were asked detailed questions about what they sold in the market, what they used at home and normal market prices. Of the 12 participants who were able to keep additional livestock and poultry because of fodder production through TIST tree-planting activities, 5 reported selling cows, goats, chickens, cow milk, goat milk and/or chicken eggs and 4 reported using one or more of those products at home.

Conservation Farming Practices

85 respondents (69%) have been trained on conservation farming techniques. Of those who were trained, 42 (49%) used conservation farming techniques last year (2010). Conservation farming methods were only used for maize, beans and sweet potato crops. The figure below shows reported change in yields in 2010 when using conservation farming (CF) methods versus using conventional methods.

Figure 2: Change in Maize Yield for CF Practices Vs. Conventional Methods (n=71)



For maize growers, 28 (39.4%) reported using conservation farming techniques. Among those who used conservation farming techniques, 82% reported an increase in crop yield last year and 10.7% reported a decrease (7% did not respond). For the 38 (53.5%) maize growers who did not use conservation farming techniques, only 5% reported an increase in crop yield, 10.5% reported a decrease in crop yield and 42% reported no change in crop yield for the same year (42% did not respond). These numbers suggest that increases in maize yield were due to conservation farming methods, rather than weather conditions.

On average, crop yields increased by 486 Kgs (n=20) and decreased by 270 Kgs (n=2) for those who used CF practices last year; for those who did not use CF practices last year, crop yields decreased by 780 Kgs (n=3), on average. The average reported decreases in crop yield are unreliable due to low sample size. However, the average increase in crop yield due to CF practices is more reliable due to a higher sample size. Based on the reported average market price of 25 KSh per kilogram of maize, the average added value of using conservation farming techniques is 12,150 KSh per year.

Only two farmers (4%) who grow beans reported using conservation farming techniques. Both farmers indicated increased yield last year for an average increase of 115 kgs (range 50 to 180 kgs). For bean farmers who did not use conservation farming methods, 32% saw an average decrease of 136 kgs (range 2 to 360 kgs) in yields, 13% saw an average increase of 82 kgs (range 20 to 135), and 55% saw no change. Two farmers reported growing sweet potatoes or yams. Only one farmer reported using conservation farming techniques last year and experienced an increased crop yield of 500 kgs of sweet potatoes. Because of a lack of data, it is impossible to tell if conservation farming was responsible for the increase in crop yields. However, this limited data suggests that using conservation farming practices for sweet potatoes might be beneficial.

In addition to increased crop yield, conservation farming practices includes making compost manure to sell in markets and to use for planting.

Table 19: Economic Benefit from Producing Compost for Manure

Compost Harvested (sacks)	n	Mean	SD	Min	Max
Total time at TIST	33	92	218	1	1000
Annually	30	45	182	0.43	1000
Compost Harvested (KSh)					
Total time at TIST	33	14,113	33,281	153	152,800
Annually	30	6,913	27,838	65	152,800
Compost Sold (KSh)					
Total time at TIST	2	840	972	153	1,528
Annually	1	306	-	306	306
Compost Used (KSh)					
Total time at TIST	25	15,683	37,924	153	152,800
Annually	22	8,921	32,460	127	152,800

35 participants (29%) produced compost manure for a total average of 92 sacks since their time at TIST and an annual average of 45 sacks, after controlling for membership length. Average reported market price for one sack of compost in the market was 152 KSh. The majority of respondents who produced compost used it on their own fields (71%) and a small percentage

sold their compost in the market (6%). The observed annual income generated through sales was 306 Ksh (no range, only one observation) per year and the observed annual savings of 8,921 KSh from using compost on fields, assuming farmers would buy compost in the market if they did not produce their own. This also does not take into account possible savings associated with using compost instead of buying expensive synthetic fertilizer.

Other Activities

TIST is also involved in other income-generating activities, including beekeeping, fishponds, nurseries and fuel-efficient stoves.

Table 20: Economic Benefit from Bee-Keeping Activities

Honey Harvested (kg)	n	Mean	SD	Min	Max
Total time at TIST	20	27	52	2	240
Annually	20	6	8	0.4	34
Honey Harvested (KSh)					
Total time at TIST	20	4,837	9146	352	42,288
Annually	20	1,040	1447	70	6,041
Honey Sold (KSh)					
Total time at TIST	15	4981	10,488	352	42,288
Annually	15	955	1,496	70	6041
Honey Used (KSh)					
Total time at TIST	10	1,621	2,276	352	7,753
Annually	10	493	725	70	1,938

23 respondents (18.6%) reported keeping bees as a result of their participation in TIST. On average, these members reported harvesting 27.5 kgs of honey since their time at TIST, which translates to an average annual harvest of 5.9 kgs. The average price of one kilogram of honey in the market was reported to be 176 KSh. Of those who harvested honey, 15 (65%) sold their honey for an observed total average added income of 4,981 KSh since their time at TIST and an annual observed average income of 955 KSh after controlling for membership length. Fewer people used honey at home for food (10 respondents (43%)) for an average total savings of 1621 KSh since TIST membership and an annual average savings of 493 KSh, after controlling for length of membership. It is important to note that while the use of honey may be seen as savings, it is a specialty item that is not necessarily a staple for most households. In fact, when asked what foods respondents normally buy at the market, honey was not mentioned.

TIST programs include training on nurseries and seedling production as a means to generate income, diversify income sources and reduce barriers to entry so participants do not have to buy seeds. Participants were asked about total seedlings harvested, as well as indigenous seedlings harvested.

Table 21: Seedling Production Among Respondents

#(%) Respondents Producing Seedlings	18 (14.5%)
#(%) Respondents Producing Indigenous Seedlings	10 (8%)
# Respondents Sold Seedlings	6
# Respondents Used Seedlings	11
# Respondents Used Indigenous Seedlings	7
Mean % of Total Seedlings Indigenous	24%
Market Price Seedling (KSh)	12.5
Market Price Indigenous (KSh)	17.5

18 respondents (14.5%) were able to produce extra tree seedlings for neighbors or the market as a result of their participation in TIST. Indigenous seedlings made up 24% of total seedlings produced. On average, market prices for indigenous seedlings were 5 KSh more per seed. Of those who produced seedlings, 6 (33%) sold the seedlings at the market or to neighbors, 11 (61%) used seedlings on their own land and 7 (39%) used indigenous seedlings on their own land. The table below shows number and value of seedlings harvested, sold and used through TIST nurseries.

Table 22: Economic Value of TIST Seedling Production

	Total	Annual
Total Seedlings Produced (Seedlings)	1,579	808
Indigenous Produced (Seedlings)	1,139	422
Value Seedlings Sold (KSh)	15,906	2,319
Value Seedlings Used (KSh)	12,044	3197
Value Indigenous Seedlings Used (KSh)	18,140	5,082

Average observed additional income from seedling sales (including indigenous) was 15906 KSh (range 188 to 37,500 KSh) for total time in TIST and 2319 KSh (range 38 to 6,250 KSh) per year, after adjusting for membership length. In addition to seedling sales, participants also benefited from nurseries by using seedlings for planting on their own land. The total average number of seedlings used since their time at TIST was 964 seedlings (range 5 to 9000) and 1037 indigenous seedlings (range 6 to 7000). When controlling for length of membership, these respondents used an average of 256 (range 1 to 1800) seedlings and 290 (range 2.9 to 1400) indigenous seedlings per year. In producing and using seedlings instead of purchasing at a market, participants are able to reduce the cost of agricultural inputs. The average annual savings associated with seedling production was 3197 KSh for total seedlings (n=9) and 5082 KSh for indigenous seedlings (n=5).

Two respondents (1.6%) reported starting fishponds as a result of their work with TIST. Average numbers of fish produced ranged from 32 to 1000 KSh. The average market price was 125 KSh per fish. Between these two participants, the average number of fish sold was 4500, for an average total income of 562,500 KSh since time at TIST and an annual amount of 112,500 KSh per year. The average number used at home for food was 21 fish, for an average total savings of 2,625 Ksh since time at TIST and an annual savings of 411 KSh per year after adjusting for length of membership. (Due to low sample size, these numbers are unpredictable and cannot be applied to the broader population).

9 participants (7.3%) reported using less firewood because of a TIST fuel-efficient stove. Of these, 4 respondents (44%) reported using an average of 1 (range .5 to 2) fewer small bundles per week, which translates to an average of 52 fewer small bundles per year. 4 respondents (44%) reported using an average of 1.75 (range .5 to 3) fewer large bundles per week, or 91 fewer large bundles per year. Average market price for small bundles was 130 KSh and average market price for large bundles was 184 KSh. The total average savings for these participants was 11,752 KSh (range 3,380 to 28,704 KSh) annually.

Total Economic Benefits

It is useful to note that TIST participation is diverse, and that not every member surveyed experienced all of the benefits above. To determine which benefits were most important overall, the total value of tree products harvested (including fruits, nuts, fire wood, and fodder), value of additional animals possible because of extra fodder produced by TIST activities (including cows, goats, chickens, eggs, and cow milk), value of compost, value of seedlings produced, value of improved yield from CF (maize only), value of fuel savings from efficient stoves, value of carbon stipends and value of incentives were calculated. The table below shows these results:

Table 23: Total value of benefit reported for the 124 members surveyed (Ksh)

Tree Products Harvested	2,494,234
Animal Products Harvested	749,991
Compost Produced	465,734
Seedlings Produced	321,950
CF Improved Yields	243,025
Honey Harvested	96,734
Fuel Savings from Improved Stoves	94,016
Carbon Stipend	59,420
Incentives	57,655
Total	**4,582,759**

For the average TIST member surveyed, tree products harvested provided the greatest benefit, with animal products and compost proving the next greatest benefit value. When the total benefit value of 4,582,759 Ksh is distributed across the 124 members surveyed, the average total benefit is 36,958 Ksh per member. To determine whether benefit value differed between males and females, a separate total was taken for females. The average total monetary benefit for women (n=61) was 36,749 KSh.

Social Impacts from income-generating TIST activities

Although many households experienced increased income as a result of the participation with TIST, it is important to understand that increased income does not necessarily translate to positive social impacts. To assess how increased income impacted the livelihoods of TIST participants, the survey included questions about where people spent their additional income and the perceived social impacts they experienced as a direct result of TIST. When asked a general question about whether they have received additional income from TIST activities, 22% replied "yes." The table below shows where and how much they spend the additional income generated through TIST participation.

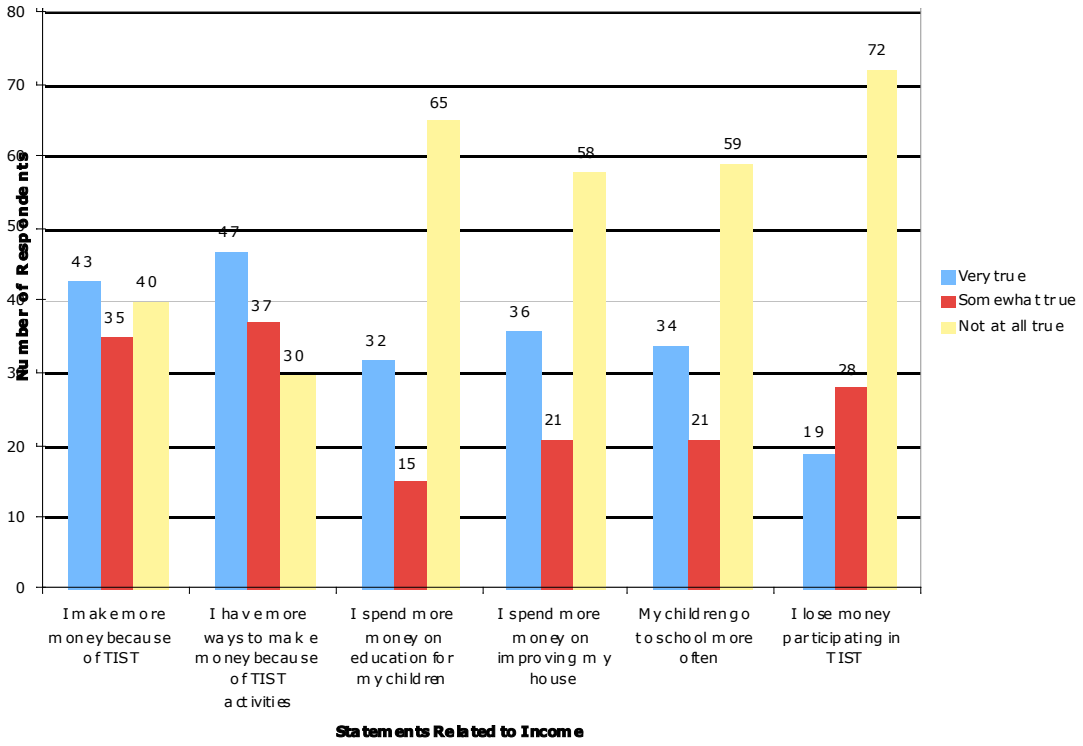
Table 24: Annual Expenditures from Additional TIST Income (n=27)

Service/Good	Additional Income (%)	Mean (KSh)
Food	44	4,068
Education	44	3,151
Agricultural Inputs	41	2,150
Medicine	15	2,000
Non-Food Items	0.7	700

Most participants spent the additional income generated from TIST activities on food (from market or neighbors), education (school fees and materials, etc.), or on agricultural inputs (fertilizer, irrigation, seeds, etc.). Fewer spent their additional income on medicine or on non-food items (television, bicycle, radio, DVDs, clothes, etc.). These numbers are most likely an underestimate, as more than 22% of respondents indicated increased income through TIST activities throughout the survey. However, it is interesting to note that almost half of participants who answered this question spent additional TIST income on education.

Participants were asked a series of Likert Scale questions related to perceived social impacts from TIST programs. There were six that were specifically related to how increased income from TIST activities has affected their lives. Participants were asked to select, "Not at all true," "Somewhat true," or "Very true" for each statement. The table below shows the results for these questions.

Figure 3: Perceived Social Impacts from TIST Activities: Income (n=124)



The majority of participants indicated that they make more money because of TIST and that they have more ways to make money because of TIST. To determine whether perceived impacts

differ between poorer and more vulnerable households, a series of statistical tests were performed.

3.4.2: Food Security

In addition to direct sales of products from TIST activities, respondents also gave detailed information on the proportion of products used at home. Aside from monetary savings associated with producing instead of buying food at the market, food production also contributes directly to food security and indirectly to improved health and nutrition as a result of increased household consumption. Because increased food production does not necessarily mean increased household consumption, participants were asked how much of each product they used at home for food. The TIST activities directly related to food security are products from TIST trees, beekeeping, fishponds, additional livestock kept due to increased fodder production, and increased crop yield due to conservation farming practices.

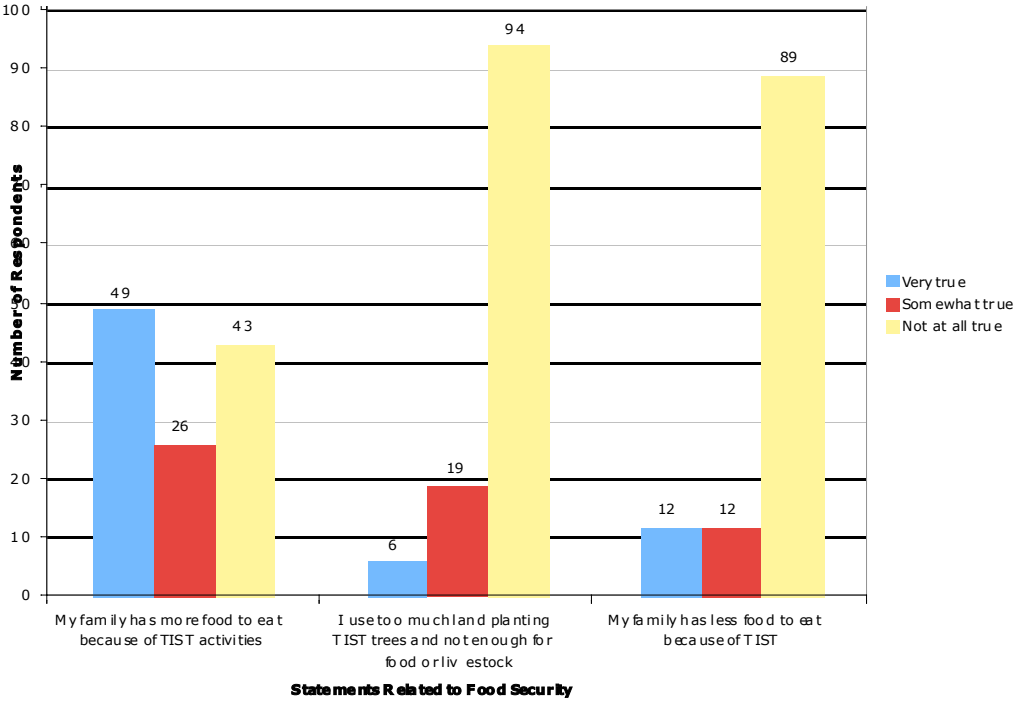
The table below shows how much of each product respondents used at home for food. 36 respondents (29%) reported using either fruit, nuts, honey, goats, chickens, eggs, cow milk or fish that they produced through TIST activities at home for food. Although some participants produced cows, they did not use the meat for food, only cow milk. Contrastingly, participants who produced goats only used the meat for food and did not drink the milk.

Table 25: Annual Amount of Food from TIST Activities Used at Home

Food Product	(n)	Mean	SD	Min	Max
Fruit (kg)	24	22.61	29.61	0.40	116.67
Nuts (kg)	5	22.05	15.72	1.67	40
Honey (kg)	10	2.80	4.12	0.40	11
Goats	5	2.70	1.46	1.67	5
Cows	0	-	-	-	-
Chickens	2	2.92	2.95	0.83	5
Eggs	1	5.83	-	-	-
Goat Milk (ltr)	0	-	-	-	-
Cow Milk (ltr)	4	1.71	1.71	0.25	4
Fish	2	3.29	1.82	2.00	4.57

The most common product used at home for food was fruit, followed by nuts and honey. In addition to food produced by TIST trees, conservation farming methods increased maize yields by an average of 486 kgs last year (as stated in the income section above). It is unclear as to how much of this increase was used versus sold at the household level.

Figure 4: Perceived Social Impacts from TIST Activities: Food Security (n=124)



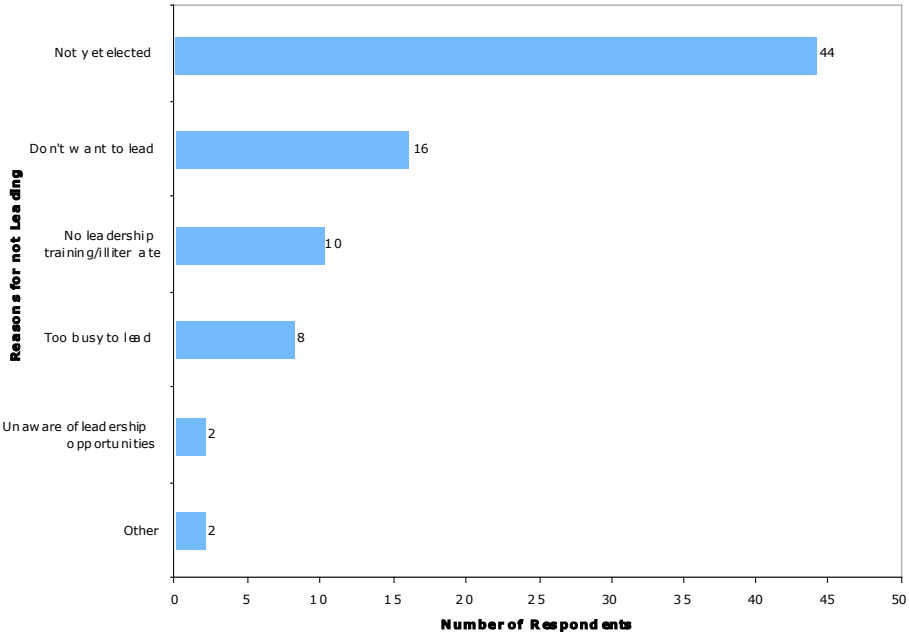
3.4.3: Social and Community Development

TIST engages in rotational leadership at Small Group and Cluster Group meetings in order to foster leadership skill development in individuals and to maintain a sense of ownership among members. TIST members are trained in rotational leadership, and are asked to practice rotational leadership in their Small Groups and clusters. Each member is encouraged to take a turn to lead to build their skills and to share their unique strengths with the group. TIST encourages these volunteer leaders by training on Kujengana, or Building Up of members. Every member is asked to give one piece of specific, positive feedback to the leader to encourage them and others in the groups to build on this foundation. TIST emphasizes the importance of women's participation in leadership. During training seminars, for example, each cluster is required to send at least as many women as men. 44 participants (35%) have taken a leadership role in their time with TIST. A main focus is female empowerment and TIST works to maintain equal gender roles throughout program operations. A Chi-square test showed no significant difference (at $p < .05$) between male (48%) and female (52%) participants who have held leadership positions since their time at TIST. This is an important finding, given traditional gender roles within the culture of the project area.

In addition, a series of Chi-square tests, Fisher's Exact tests, and t-tests, were used to investigate relationships between having a leadership position and other livelihood indicators, including income, marital status, occupation, respondent education, livestock ownership, attendance, membership length, cluster and literacy. Several indicators were significant (at $p<0.05$) in determining who is more likely to take leadership positions, including respondent literacy ($p=0.018$) and Cluster Group attendance ($p=0.0006$). Other indicators were moderately significant ($p<0.10$), including household education (0.080), membership length (0.072), and household literacy rate (0.095). These correlations are not conclusive, but do provide initial insight into possible differences among respondents who take leadership roles and those who

don't. To get a fuller picture, participants were asked specifically what barriers they face in taking a leadership position in TIST. Three TIST Staff members independently coded responses into six main categories, including, Not yet elected, Don't want to lead, No leadership training/illiterate, Too busy to lead, Unaware of leadership opportunities, and Other.

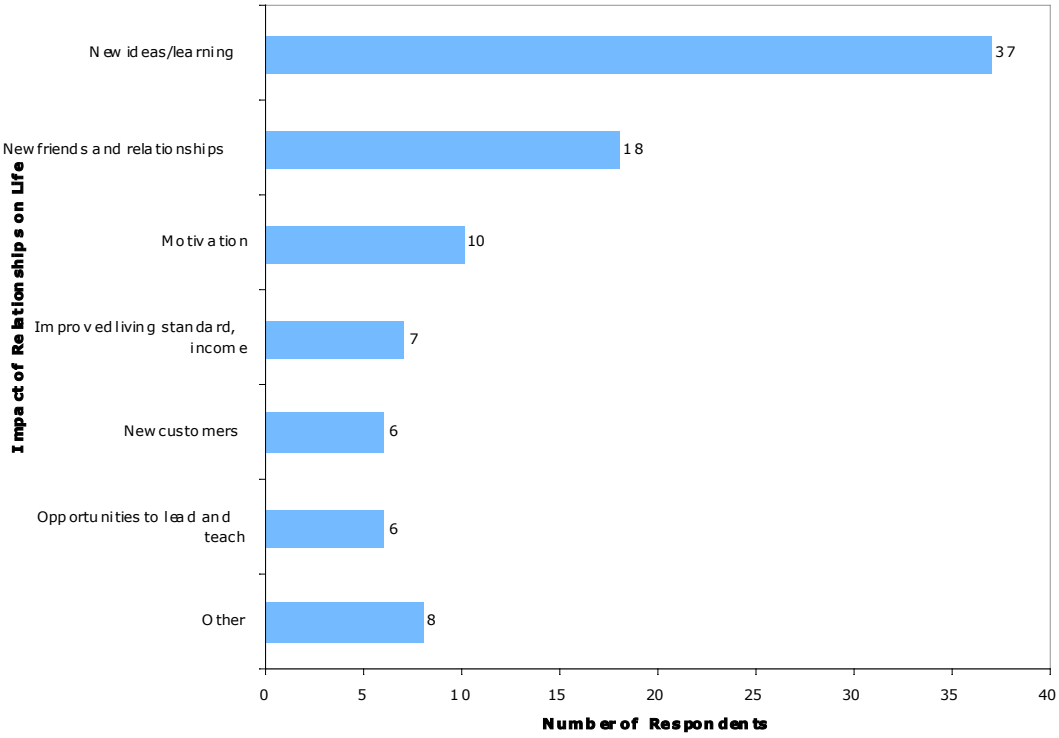
Figure 5: Barriers to Having a Leadership Role in TIST (n=75)



The main reason that participants gave for not yet having a leadership position was because they had not yet been elected (59%) or because they did not want to lead (21%). Others reported that they had no leadership training or that they were too busy to lead. A few were unaware of leadership positions.

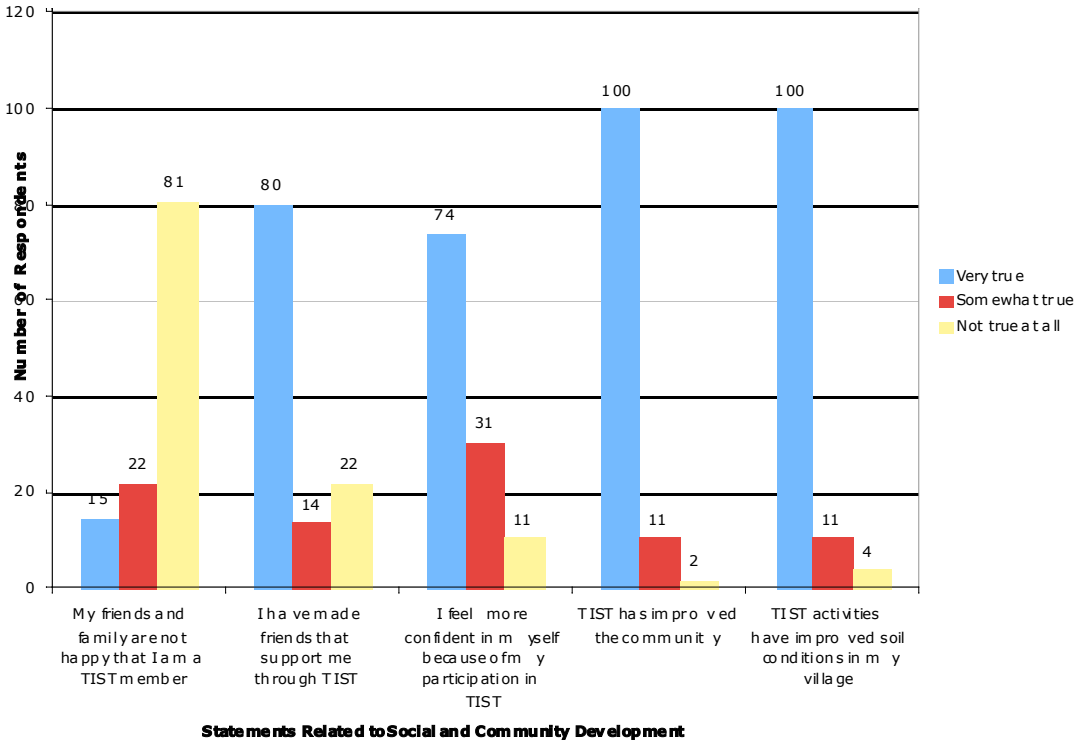
The method of program delivery through group platforms and rotational leadership are meant to build relationships among members, improve social networks and foster information exchange. 82 respondents (66%) indicated that they have built relationships with other TIST members as a result of their participation in TIST. Respondents were then asked how the relationships they have built through TIST have impacted their lives. Answers were independently coded by three TIST Staff members into seven main categories, including New ideas/learning, New friends and relationships, Motivation, Improved Livelihood/Income, New Customers, Opportunities to lead and teach, and Other.

Figure 6: Ways That Relationships Built Through TIST Impact Participants' Lives (n=78)



The majority of respondents reported that they have been exposed to new ideas and learning through relationships built at TIST. A large percent also reported that they have made new friends, have become motivated to engage in tree-planting and other activities, and have improved their livelihoods. Fewer have reported that they were able to get more customers for their business or gain knowledge to lead and teach other community members. In addition to this question, respondents were asked to rate a series of Likert Scale statements related to social and community development, with answers including, Not at all true, Somewhat true, and Very true.

Figure 7: Perceived Social Impacts of TIST: Social and Community Development (n=124)

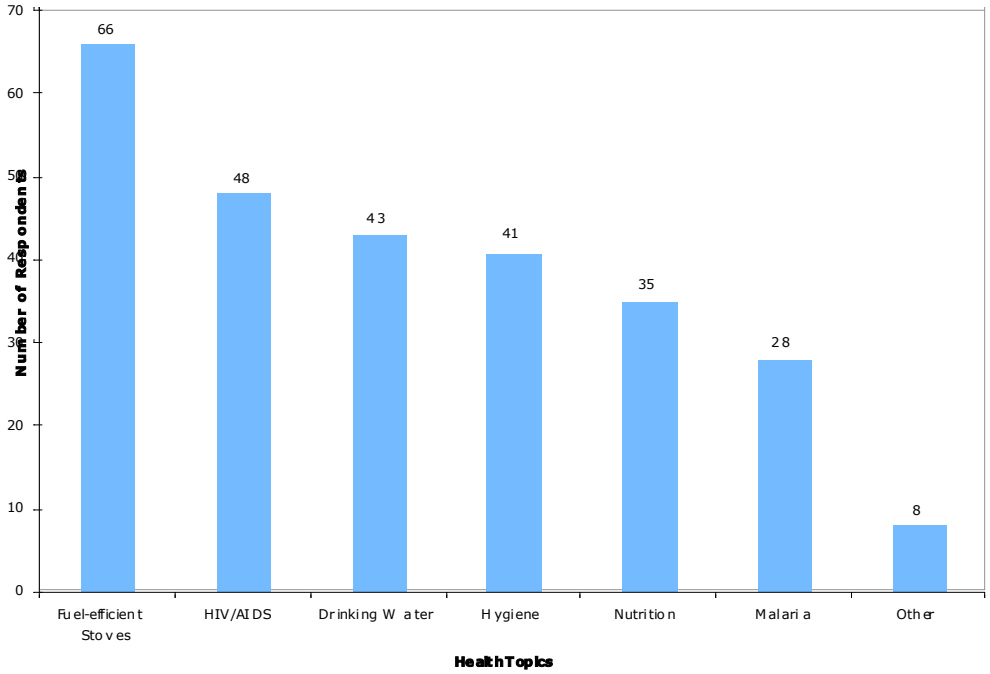


The overwhelming majority of respondents have seen general improvement in the community and improved soil conditions in their village as a result of TIST programs. In addition, most respondents reported making friends and feeling more confident in themselves as a result of participation in TIST. Very few reported that friends and family are not happy about their participation in TIST. To determine which members were experiencing family difficulties as a result of TIST participation, further analysis was conducted. There was no difference between poorer and more vulnerable groups. However, there was a significant difference ($p<0.05$) between people reporting that their family is not happy that they are a TIST member and others was between cluster groups, including Gachua, Kilia, and Karocho clusters.

3.4.4: Health and Nutrition

In addition to income-generation and food production, TIST works to improve the health and nutrition of TIST participants and the surrounding community through educational training sessions and fuel-efficient stoves. 89 participants (72%) reported attending training sessions on either, HIV/AIDS, malaria, hygiene, clean drinking water, fuel-efficient cooking stoves, nutrition and/or "other," which included adult literacy and rabbit keeping (and was excluded from further analysis because they are not directly related to health or nutrition).

Figure 8: Health and Nutrition Training Among Respondents (n=124)



The most common training topic was on fuel-efficient cooking stoves (53% of respondents attended at least one training session), followed HIV/AIDS (39%), clean drinking water (35%), hygiene (33%), nutrition (28%), malaria (23%) and "other" (6%). Participants were also asked the number of times they had been to each type of training session, as increased knowledge is more likely to occur with increased exposure to information. The table below shows the average number of times participants attended each topic.

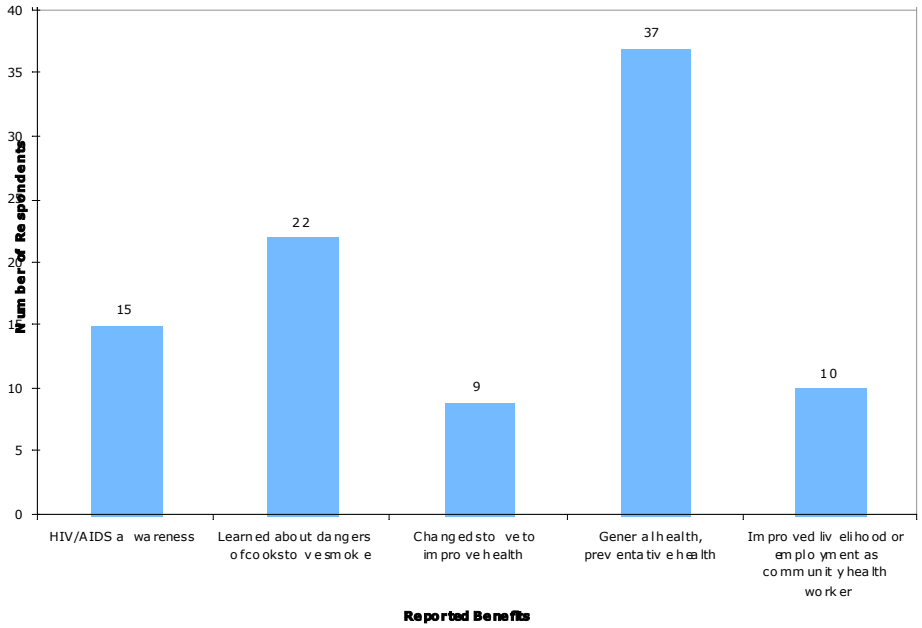
Table 26: Average Number of Health Sessions Attended (n=124)

Health Topic	Mean	SD	Min	Max
Fuel-efficient Stoves	1.06	2.16	0	20
HIV/AIDS	1.15	2.64	0	20
Drinking Water	0.88	1.69	0	10
Hygiene	1.00	2.82	0	20
Nutrition	0.71	1.85	0	12
Malaria	0.55	1.23	0	6

The average respondent has attended between 0.55 and 1.15, health training sessions since their time at TIST. The large range for most health topics is a result of TIST membership length. When membership length was accounted for, ranges dropped to a maximum of 4 sessions attended per year. Respondents who attended the most health trainings were more likely to have been TIST members for a longer period of time and were more likely to attend Cluster Group meetings. In addition, there was a large difference between cluster groups with respect to training topics.

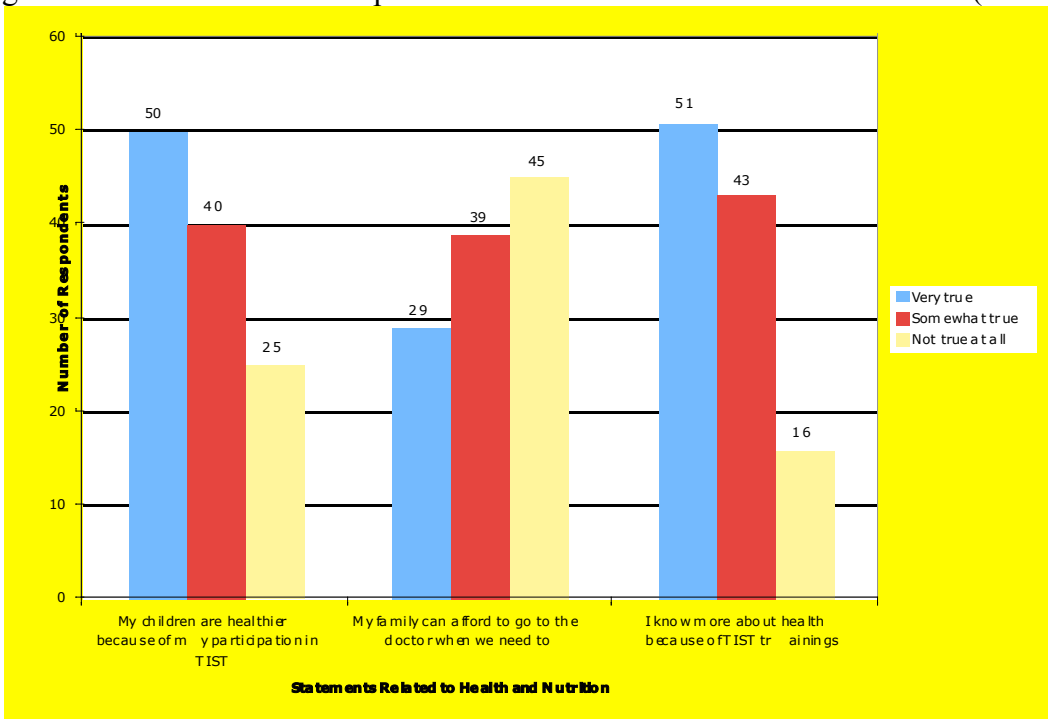
To assess how these training sessions had impacted their lives, respondents were asked, "How has this training on health topics affected your life?" Three TIST US Staff members coded the answers independently into 5 main categories, as see in the figure below.

Figure 9: Reported Benefits of Health Training Sessions (n=82)



The most common category was general health/preventative health, which included comments about purifying water through boiling, the reduction of disease in their communities, or protecting families from diseases. The next most common category was learning the dangers of cooking stove smoke, with several actually changing to fuel-efficient stoves to protect their health. HIV/AIDS awareness was another common category, as improved livelihood or employment as a community health worker. In addition to this question, respondents were asked to rate a series of Likert Scale statements related to health and nutrition, with answers including, Not at all true, Somewhat true, and Very true.

Figure 10: Perceived Social Impacts of TIST Activities: Health and Nutrition (n=124)

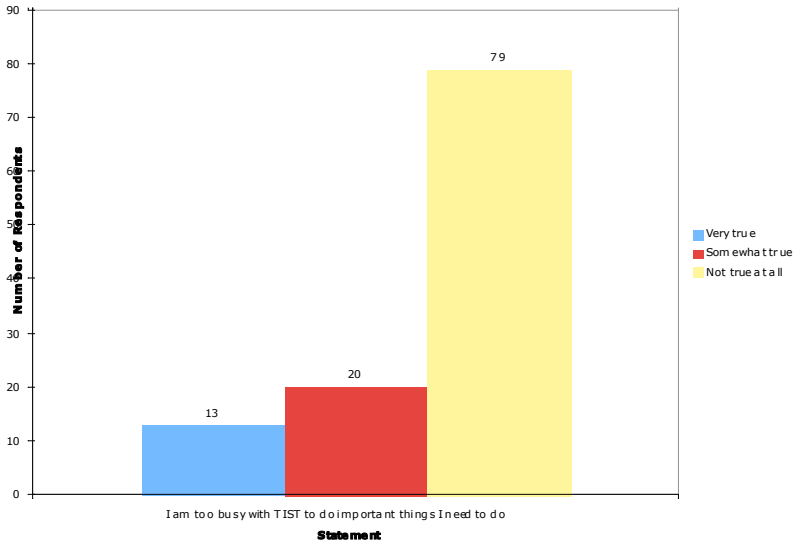


Most respondents reported that their children are healthier and that they know more about health as a result of their participation in TIST. Fewer reported that their family can afford to go to the doctor when they need to. There was a significant difference ($p<0.05$) between clusters whether a respondent ‘s family could afford to go to a doctor when they needed to, with Kamaroo, Kambiti and Mithuri clusters more likely to report “Not at all true.”

3.4.5: Negative Impacts

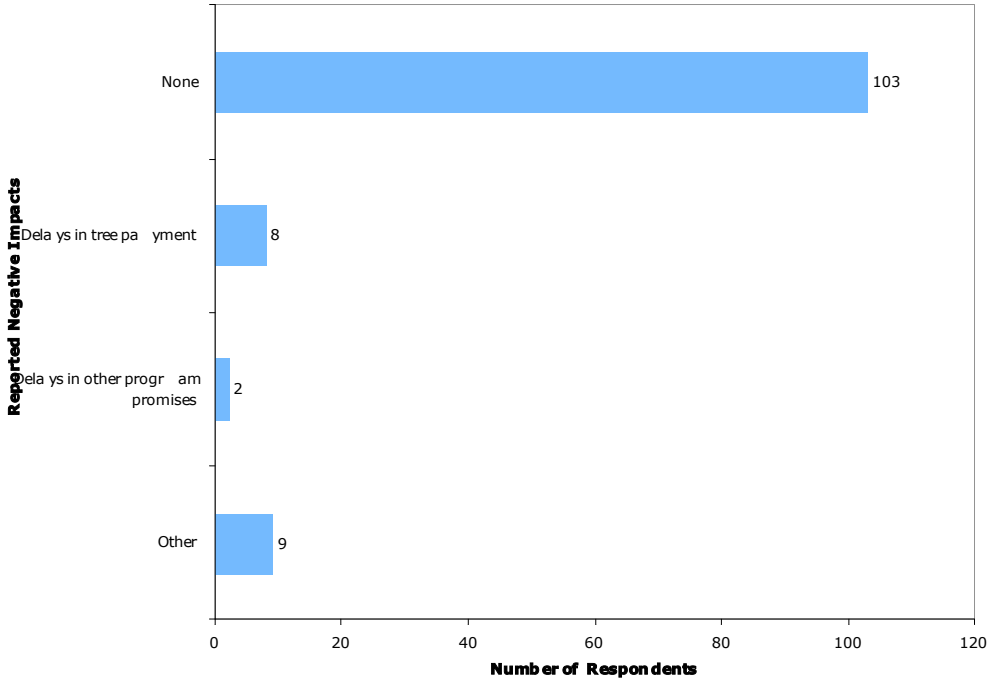
In addition to the perceived social impact statements mentioned above, several open-ended questions were asked to better understand some of the negative impacts that TIST participants may be experiencing. One concern is that people are too busy with TIST activities to engage in necessary daily activities. The table below shows how participants rated a statement related to time constraints.

Figure 11: Perceived Impact of TIST Activities on Important Daily Tasks (n=124)



Most participants did not experience disruptions in daily tasks due to participation in TIST. An open-ended question was asked to gain deeper insight into specific negative impacts experienced by participants. Three TIST Staff members coded answers independently and grouped responses into four main categories, including None, Delays in tree payments, Delays in other program promises, and Other.

Figure 12: Negative Impacts Reported by Respondents (n=121)



The majority of respondents reported experiencing no negative impacts as a result of their participation in TIST. The most common responses were related to delays in tree payments. "Delays in other program promises," was least common and included one response about delayed delivery of maize seeds and one response about delayed delivery of a fuel-efficient stove. The "other" category included responses without a detailed description, responses related to lack of payment for volunteer activities, and lack of understanding of how incentives work.

An analysis was run to determine the percentage of female participants that experienced negative impacts as a result of their participation in TIST. The table below shows the results of the negative impact questions for females.

Table 27: Responses to Negative Impact Questions Among Females (n=61)

Question	Very True	Somewhat True	Not at all True
Lose money participating in TIST	9 (15%)	13 (21%)	36 (59%)
Use too much land for TIST trees and not enough for food and livestock	2 (3%)	10 (16%)	48 (79%)
Family has less food to eat because of TIST	6 (10%)	10 (16%)	40 (66%)
Friends and family are not happy that you are a TIST member	8 (14%)	14 (24%)	36 (62%)
Too busy with TIST activities to do important things you need to do	7 (11.5%)	7 (11.5%)	42 (69%)
Open-ended Response	# (%)		
Experienced delays in tree payments	5 (8%)		
Experienced delays in other program promises	1 (1.5%)		
Other	3 (5%)		

The percentages of female participants experiencing negative impacts from TIST programs was comparable to the percentage of total participants who reported experiencing negative impacts from TIST programs. The majority reported "Not at all True," for all negative impact questions, and a smaller percentage reported "Very True" or "Somewhat True."

4. Focus on Poorer and More Vulnerable Groups

Given the range of benefits and impacts on TIST participants, it is important to identify the poorer and more vulnerable groups and assess to what degree they are experiencing positive and negative impacts. Poorer and more vulnerable groups were identified by their Sustainable Livelihood Framework asset profile, as previously outlined in the Demographics and Household Characteristics section. More vulnerable households were those with less Natural Capital (land and animal ownership), Financial Capital (household occupations and income), Human and Social Capital (marital status, gender, education, number of adults per household and literacy) and Physical Capital (distance from resources). Because TIST reaches a large percentage of poor households that fall into the lowest income brackets, rely solely on farming for income, and have low levels of education, vulnerability was determined by additional factors. Specifically, vulnerable households were considered to be those with animal ownership in the lowest quartile (6 animals or less), land ownership in the lowest quartile (2 acres or less), only one adult living in the household, or single marital status. In some cases, single households had excessive animal or land ownership, and were thus not considered to be in the poorest bracket. Similarly, households with fewer animals or land had more than one adult living in the household.

In the end, there were 19 people who fit the description, with 11 being female and 8 being male. 67% of these households were single, had an average of 3 adults per household, had an average of 2.8 animals and owned an average of 1.2 acres of land. There was a significant difference ($p<0.05$) in income, with 68% in the lowest bracket, 26% in the second lowest bracket, and 5% in the third income bracket. There was no significant difference in household education levels, household occupation, number of children per household, gender head of household or household literacy rate. This is most likely due to the large number of people in the sample who have only a primary or secondary level education and because of the large number of households that rely solely on farming for their income. The reported sales and savings experienced by these households are presented in the table below:

Table 28: Annual Sales and Savings Reported by More Vulnerable Households (n=19)

Activity	Sold (KSh)	Used (KSh)
Carbon Stipend	154	-
Incentives	5,014	-
Sale of Tree Products	11	4,406
Animal Products	0	0
Honey	476	0
Seedling	6,250	600
Maize from CF practices	1,350	-
Compost	0	306

Results show that these households experienced a range of benefits from sales and savings. The average number of trees planted was 27 trees per year. Notably, harvesting tree products such as fruit, nuts, fodder and firewood was important for this sub-group, with resources being used at

home more often than sold at the market. Similarly, compost was used rather than sold. Conversely, honey and seedlings generated large amounts of additional income from sale at the market, rather than savings from home use. Additional maize yields from conservation farming methods were also an important benefit to these households. When taking total harvests of all tree products, animal products, carbon stipends, incentives, honey, seedlings, maize yields from conservation farming, and compost into account, the average total economic benefit to these households was 30,395 KSh.

There also did not appear to be significant barriers to meeting attendance for these households. The average length of membership was 5 years and average meeting attendance was 8.7 Cluster Group meetings per year and 1.4 Small Group meetings per week. There was no significant different in number of health trainings for these households versus others, with an average of 5.3 health training sessions since their time at TIST. In addition, these households did not differ significantly from richer households in their perceptions of positive and negative social impacts.

An additional analysis was run to determine the percentage of vulnerable households that experienced negative impacts as a result of their participation in TIST. The table below shows the results of the negative impact questions for the poorer and more vulnerable households.

Table 29: Responses to Negative Impact Questions Among Poorer Households (n=19)

Question	Very True	Somewhat True	Not at all True
Lose money participating in TIST	4 (21%)	5 (26%)	9 (47%)
Use too much land for TIST trees and not enough for food and livestock	2 (10.5%)	1 (5%)	16 (84%)
Family has less food to eat because of TIST	2 (10.5%)	4 (21%)	13 (68%)
Friends and family are not happy that you are a TIST member	2 (11%)	2 (11%)	14 (78%)
Too busy with TIST activities to do important things you need to do	4 (21%)	4 (21%)	10 (53%)
Open-ended Response	# (%)		
Experienced delays in tree payments	2 (11%)		
Experienced delays in other program promises	1 (5.5%)		
Other	0 (0%)		

The percentages of poorer participants experiencing negative impacts from TIST programs was comparable to the percentage of total participants who reported experiencing negative impacts from TIST programs. The majority of respondents in the poorest quartile responded "Not at all True," to all negative impact questions and fewer responded, "Very True" or "Somewhat True."

5. Discussion

The TIST program provides economic and social benefits to program participants and the surrounding communities. The most beneficial activities for participants were sale of tree products, specifically fruits, nuts, and firewood, increased crop yield from use of conservation farming methods, sale of animal products as a result of increased fodder production, and

production of seedlings. These benefits were experienced for members of all socioeconomic statuses, with the exception of sale and use of animal products. In addition, social impact information was gathered to determine the social benefits and negative impacts of the TIST program on participants and the surrounding community. The most important findings were that the majority of people saw an improvement in their child's health, have improved social support networks, and have seen an improvement in soil conditions in their village. Equally important is identification of negative impacts, which included frustration with lack of tree payments, low levels of leadership among illiterate members, and lack of security in the Karocho Cluster due to disapproval by local administration. Most importantly this evaluation has established that benefits and negative impacts can be identified and differentiated between poorer and more vulnerable households.

This study has several limitations. The data is subject to response bias due to social acceptability of answers or participant memory. In addition, interviewer bias could have influenced answers, either through biased interviewer techniques or misinterpretation of answers. Lastly, although the total sample size was enough to attain normal distribution for general variables such as age, other variables had too few entries to establish reliable figures, such as benefits from fishponds, which only had two observations. Despite these drawbacks, this evaluation has shown that gathering data using indicators based on the Sustainable Livelihoods Framework in conjunction with TIST program benefits and participation levels will be able to differentiate poorer and more vulnerable households from wealthier households.

TIST has implemented several innovative strategies to reduce barriers to participation. Namely, Small Group and Cluster Group platforms allow members to share land so that those with less land can participate. These meetings are formed in close proximity to villages, with travel times being less than other important resources such as hospitals, schools or water sources. These group platforms also foster social support and leadership skills, which were evident among the poorest and more vulnerable groups, with no difference in leadership positions between males and females. Additionally, use of technology allows TIST Quantifiers to keep updated information on TIST tree planting activities, which provides a unique chance to continue monitoring and evaluation of livelihood impacts.

According to the findings, it appears that TIST meets the requirements for the CCBA Gold Level Exceptional Community Benefits certification. The recommendations for moving forward are to continue monitoring the benefits and impacts on TIST participants to ensure that TIST is constantly reaching the poorest households in the community, that they experience positive social impacts, and that negative impacts can be quickly identified and mitigated. It is recommended that TIST adapt a portion of this evaluation tool, including indicators from the Sustainable Livelihoods Framework, and create an electronic form for Palms to be used readily in the field for continued monitoring.

6. Acknowledgements

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