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Contribution of Tree Farming on Improvement of Livelihood Assets to Smallholder Farmers in Njombe District, Tanzania

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Abstract: As a coping mechanism to job creation and income poverty reduction, people in the rural areas are engaging in commercial farm activities commonly known as agribusinesses including tree farming. The study assessed the contribution of tree farming by smallholder farmers on livelihood assets in the study area before and after their engagement. Household survey and key informant interviews were used to collect data from 270 respondents randomly selected from 4 Wards of Njombe Distrct to include Ihanga, Iwungilo Kifanya and Lugenge which mostly practice tree farming; and 4 key informants' interviews were done to the district officers in the Department of Agriculture, Irrigation and Cooperative. Seven out of nine livelihood asset ownerships were found to have significantly improved after farmers' being engaged in tree farming. A paired sample t-test was conducted to evaluate the possession of assets by respondents and it was found that household assets before tree farming was (M= 1.80, SD= 0.752) and after engaging in tree farming was (M=2.00, SD= 0.199), t (269) = 8.706, p<0.0005(two-tailed). The mean increase score in houses ownership for instance was 0.2 at 95% confidence interval ranging from -0.433 to 0.033. The *eta* squared statistic of (0.219) indicated a strong effect on tree farmers' livelihood in the study area and a significant improvement in livelihood assets after engagement in tree farming. It is concluded that, this activity has contributed to income poverty reduction by giving smallholder farmers a good purchasing power for the livelihood assets. It is recommended that; the government should control the market of forest related products and ensure price stability.

Keywords: tree farming; smallholder farmers; livelihood assets; poverty reduction; Tanzania

1. Introduction

Around the globe, there are around 2.9 billion poor people living in poverty and about 873 million still live in life-threatening poverty (World Bank, 2022). It is estimates that around 9.7% of the world's population lived in extreme poverty. Extreme poverty is defined as living on less than $1.90 a day. Out of these, nearly 75 percent live in rural areas and depend on agriculture for their subsistence. Ninety five percent of the rural poor live in South Asia, sub-Saharan Africa, East Asia where most of these poor people are smallholders and household farmers. 325 million people among the poorest in the world are said to be in the Sub-Saharan region which is ranked as the second region with the greatest number such people globally. According to the World Bank (2020), income has stood to be lower in the sub-Saharan region going below the poverty line of $1.25 per day for most countries. Actually, two thirds of the population leave in the rural areas and small-holder farmers account for 80% of the poor where 45% lives on less than $1 per day. It is established that Burundi, Somalia, the Central African Republic, Democratic Republic of Congo, Niger, Mozambique, Liberia, Malawi, Madagascar and Chad in descending order are the countries worst hit by absolute poverty in the sub region (World Bank, 2020). As a coping mechanism to income poverty reduction, people are engaging in commercial agricultural (agribusinesses) Thus, through available natural resources, such as forests, uses of modern agricultural technology are urgent needed to improve the welfare of the population of the sub region.

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As a coping mechanism to income poverty reduction, people in the rural areas are engaging in commercial farm activities commonly known as agribusinesses including tree farming. Tree farming is the practice of creating, conserving and scientific management of forests and the utilization of their resources for various uses, including commercial, social, agricultural, and environmental. It includes all thinking and all actions pertaining to creation and management of forests, including harvesting and utilization of all forest products and services (FAO, 2019). On the other hand, smallholder farmers are categorized by farm size average of landholding size estimated variously at 2 hectares (5 acres) and 1 to 3 hectares (2.5 – 7.5 acres) (FAO, 2019). According to FAO (2016c), to be poor is to be deprived of the means for a decent life. Deprivations in poverty include income which is the lack of means to acquisition of basic goods and services; consumption which means inadequate access to basic goods such as food and water; capability which means insufficient knowledge, health or skills to fulfill normal livelihood functions and living conditions which means poor housing, unhealthy or dangerous environment, and bad social relations. According to URT (2015) poverty is categorised into two aspects; income poverty and the non-income poverty. The income poverty is when a person or a portion of population experiences a shortage of income to meet basic needs. The non-income poverty is when a person or a proportion of the population experience deprivation of social needs and services such as health services, education, water, sanitation, environmental care and decision making.

Studies show that, in Tanzania almost three-quarter (72%) of the poor are dependent on agriculture (Kimambo *et al.,* 2020; Arvola, 2020; Hingi, 2018). This is an indication that, household income poverty reduction means confronting the problems that farmers face in generating income within their households. Hingi (2018) for example indicated that, agricultural growth must be accelerated with a quick speed if poverty is to be reduced especially in the rural settings. This can be achieved through assistance to smallholder to engage in profitable agricultural enterprises including tree farming in order to improve their livelihood capabilities so that they can be able to afford balance diet, better health services, education costs, transportations costs and general livelihood assets.

Tanzania's forest and woodland products such as firewood, honey production, wild fruit and construction material, account for some 40% of total household consumption in some areas. To enhance the usage of and support of these requirements, the World Bank helped to bring 4.1 million hectares (13% of Tanzania's forests) under sustainable participatory management including village forest reserves (Arvola *et al*., 2019). In spite of all these efforts, there is an annual increase of poverty in many rural areas where majority fails to afford education costs, better health services, transportations and poor food diet (Kimambo *et al.,* 2020). This is attributed by most farmers' dependence on short-lived crops such as rice and maize, and lack of stable marketing price (Arvola, 2020). The poverty level among households in rural areas continues to be very high at 31.3% than in urban areas which is 15.8% (Snyder et al., 2020).

Therefore, in light of this scenario, this study aims to investigate on how tree smallholder farmers in Njombe district had reduced their household income poverty through tree farming by only assessing livelihood assets improvement. The novelty of this study is that, many researchers in the forestry sector had concentrated their studies on forests management, quality of timber industries and tree plantation (Mbwambo *et al*., 2013; Kiptot, 2015; Bankole *et al*., 2012), challenges and opportunities (Ernest, 2013; Khanal, 2011 and Sonwa *et al*., 2011). Less of the studies have been done on contribution of tree farming on household asset improvement as an indicator of poverty reduction something which this study focuses upon. As a result, this study findings will help policy makers at District Regional and country levels on developing strategies for smallholder farmers especially those involved in tree farming.

2. Literature Review

2.1. Theoretical Underpinnings

The study was informed by the Theory of Participative Behaviour (TPB) (theory of margin) and the Sustainable Livelihood Approach (SLA) The theories were used together as they complement

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each other in the study towards addressing the key aspects of tree growing and livelihood outcomes. The TPB was advocated by McClusky (1963) to conceptualize an understanding of adults' behavior to participating into various socio-economic endeavors particularly when various households' demands or dynamics increase in income. The assumption of the TPB is that being an adult means facing continuous growth and change in which constant effort must be made to partake into various socio-economic activities for meeting normal living errands (McClusky, 1963). Thus, participatory behaviour is a function of the power a person can command over and above what is required for preserving a minimum level of living. A necessary condition for participation then is access to and/or the activation of a margin of energy that may be available for the process of participation (McClusky, 1970). In this study the theory provided the theoretical reflections towards understanding the underlying participatory behaviour among the small holder farmers in tree farming business aimed at improving livelihoods outcomes.

The SLA was developed by DFID (2001); the theory advocates that, there are three insights into poverty underpinning this approach. The first is the realization that while economic growth may be essential for poverty reduction, there is no an automatic relationship between the two since it all depends on the capabilities of the poor to take advantage of expanding economic opportunities as supported by Kunze et al, (2019). Secondly, there is the realization that poverty as conceived by the poor themselves is not just a question of low income, but also includes other dimensions such as bad health, illiteracy, lack of social services as well as a state of vulnerability and feelings of powerlessness in general. Finally, it is recognised that the poor often know their situation and needs best and must therefore be involved in the design of policies and project intended to better their livelihood. Therefore, in understanding tree farming, smallholder farmers' livelihood outcomes it is important to understand how to utilize the livelihood capabilities and assets to achieve the desired livelihood outcomes in terms of sustainable use of resources, increased household income, reduced vulnerability, empowerment and ownership of household assets as qualified by DFID (2001). Thus, the study is focused on understanding how smallholder farmers in tree farming businesses improve their income and hence their assets livelihood outcomes.

2.2. Empirical Literature Review

Tree farming, particularly on smallholder farmers' have shown significant impacts on livelihoods, the environment, and local economies. Hawkes and Sumari (2018) in their study on the contribution of smallholder farmers to forest raw materials base in Tanzania who linked their findings with household poverty, they found that, child labour is a reflection of poverty by a large number of children working in tree farms in Njombe District. According to Hawkes and Sumari (2018), the main cash crops in in Njombe district include timber from plantations and other wood products, pyrethrum and tea. Other crops produced include vegetables, tomatoes and green maize, which is produced in the valley bottoms locally known as *Vinyungu*. Forestry activities are of great importance in the district where wattle, eucalyptus and pines are grown heavily (Private Forestry Programme, 2017). It is estimated that, the whole Southern Highlands have a total of 207,000 Ha of forest plantations. More than 70% of the plantation areas are located outside the large government and company-owned plantations, which is a fact suggesting the significant potential of smallholder woodlots. Mufindi, Makete, and Njombe are the districts with the greatest forest plantation coverage in Tanzania (Private Forestry Programme, 2017).

Likewise, Martin (2022) in his study on integrative and exclusionary roles of trust in timber value chain in the Southern Highlands of Tanzania using a multiple linear regression found that, in order to shrink poverty among the poor rural households, agribusiness and its prominence and level of adoption have not been well understood in most parts of the rural areas in Tanzania. Furthermore, the study by Martin (2022) suggested that, agroforestry as a multipurpose land use and as a flexible system has been suggested as a resolution to achieve sustainability in land use and as a supplement to the prevailing land use management systems. The study concluded that, agroforestry has numerous benefits including; protection of soil fertility, control of soil erosion and improvement of biodiversity; improving crop yields, enhancing level of income to farmers, provision of fuel like

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woods and charcoal, fruits for balanced diet, silage and building materials to households and commercial.

Furthermore, Cunningham *et al.,* (2016) studied on impacts of timber on poverty reduction among small scale traders in Mufindi District Tanzania using descriptive statistics. Findings of the study indicated that, trade in timber and non-timber forest products are important contributors to agricultural and economic development through the revenue farmers generate for the government and the income they provide to rural households. The study concluded that, in selecting eco-regions, forestry is the highest income earning sector especially for rural households residing around forest land or plantations in the Southern Highlands of Tanzania. Likewise, FAO (2020) reports that, trees resources contribute to food security as they include provision of commercial opportunities and employment to the poor. Thus, tree farming plays a significant role in the livelihoods of millions of the rural populace, principally as a sustenance safety net, but also as a source of cash income, capital asset, and a source of employment. Tree farming is often central to the development of good local governance (MNRT, 2018). Thus, the removal of obstacles that prevent forests and trees from contributing to livelihoods of the poor as well as support for emerging opportunities is important to realize fully advantage of the tree farming sector.

2. Materials and Methods

2.1. The Study Area, Data Collection and Analysis

Njombe district in Njombe Region was selected for the study since it is one of the districts which have significant number of smallholder tree farmers in Southern highlands (Private Forestry Programme, 2017). As for administrative capacity, Njombe district has two councils, Njombe town council and Njombe district council. According to 2012 National census, the total population of Njombe region was 702 097, while Njombe district had the total population of 309 797 people (URT, 2013). The main economic activities in this district included selling of trees for timber, building poles, electric poles and other wood products. Pyrethrum and tea have also been a cash crops for a while although the district also is a largest producer of different types of vegetables like tomatoes. Other crops include Irish potatoes and green maize produced in the valley bottoms locally known as Vinyungu. In recent year, a large population has embarked into trees farming for timber and related products. Common tree species grown in Njombe district are Pines to a very large percentage and a little of Eucalyptus and Wattles (Martin, 2022).

The study used a cross-sectional research design with a mixed approach. The design was preferred because of the vigor nature of objectivity for the purpose of obtaining relationships among variables and the design allowed interventions to be made on the effects of explanatory variables on an outcome variable as explained by Olsen *et al.*, (2004). The study used a sample size of 270 (70% response rate) respondents out of 384 obtained expected using a formula for unknown population provided by Bartlett *et al.,* (2001) and 4 key informants from the Agriculture, Irrigation and Cooperative of Njombe District. The response rate was not complete due to remoteness of some areas and low collaboration from some respondents where others required to be paid so that they answer questions instantly from the questionnaire. Simple random sampling technique was applied which gave smallholder tree farmer's equal chance of being selected and studied. The study also used cluster sampling technique where the district was divided into two clusters according to the two Councils of Njombe Urban Council and Njombe District Council. The key informants who were two forest officers two agricultural officers one from each council were selected as they were assumed to be knowledgeable about key issues in the study topic. Thereafter, a household survey using a self-administered questionnaire to smallholder tree farmers was conducted followed by key informant interview as the former was the main data collection tool. Kurtosis and Skewness Tests were conducted to detect whether the sample drawn from the population was normally distributed. Since it is quite unlikely to achieve perfectly symmetrical, the values of Skewness and Kurtosis approximately ranges between -1 and +1. A descriptive analysis revealed approximately normal distribution of the data related to all six variables under this study as shown in Table 1.

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Table 1. Skewness and Kurtosis test statistics.

Factors	Std. Deviation	Skewness		Kurtosis	
		Statistic	Std. Error	Statistic	Std.Error
Age of respondent	0.502	0.872	0.315	0.837	0.767
Level of income	0.430	0.756	0.487	0.949	0.557
Household size	0.303	0.934	0.358	-0.954	0.728
Land ownership	0.316	-0.935	0.518	-0.983	0.686
Gender of respondent	0.438	-0.876	0.405	0.901	0.669
Education level	0.532	0.930	0.476	0.857	0.745

Content Analysis was used to analyse qualitative data where themes about the subject matter was developed followed by a discussion which was enhanced by the literature and the theory used to inform the study. On the livelihood status of assets for smallholder tree farmers before and after involving in tree farming, analysis was done using a sample paired t-test analysis technique. This technique was preferred since the questionnaire was designed to measure same smallholder tree farmers' status before and after involving in tree farming.

3. Findings and Discussion

3.1. Demographic Characteristics of Respondents

With regard to the demographic characteristics of respondents, it was found that two third of the respondents were male hence the study was dominated by male respondents than women. This may be due to the fact that, land ownership in Africa and so in Tanzania male family members dominates. As a result, more men are expected to engage in tree farming than women. About age of respondents, it was found that, tree farming is dominated by farmers aged 30 years and above indicating that this is a farm activity dominated by matured population in the study area. Likewise, two third of the tree smallholder farmers were married showing that tree farming is there to support households; and the household size was 6 members and above indicating that, tree farming is an endeavor to support livelihood of many people in respective households in the study area. As for the level of education, majority of respondent had acquired primary education and few achieved at least secondary school education level and with more than 16 years of farming experience as indicated in Table 2.

Table 2. Farming experience (n=270).

Number of years	Frequency	Percent (%)
Less than 10 years	27	**10.0**
11-15years	53	**19.6**
16-20 years	109	**40.4**
21-25 years	54	**20.0**
26 years and +	27	**10.0**
Total	**270**	**100.0**

Source: Field data (2020).

3.2. Smallholder Farmers Livelihood Asset Improvement

Nine pairs of assets owned by stallholder farmers were used for the study which included ownership of radios, bicycles, sofa sets, televisions, houses, motorcycles; motorcars, source of energy and mobile phones. Findings in Table 2 indicate that, the overall mean was increasing before the smallholder farmers engaged in tree farming and after engaging. The increase in mean of diversification of economic activities could mean that, there was significance improvement in smallholder tree farmers in Njombe district in incomes obtained from this farm activity. However,

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this mean increase cannot give assurance whether such improvement in farmers' livelihood was due to engagement in tree farming or not. Further analysis was required on the effect of land size (eta squared) in each variable to confirm the indication of improvement of farmers' livelihood as a result of tree farming activities. The eta squared (η^2) was calculated by the formula shown below and the results have been merged with Paired sample test table (Table 3).

$$eta\ squared = \frac{t^2}{t^2 + (N-1)}$$

Table 3. Paired Samples Statistics (n=270).

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	House	2.00	270	0.199	.584
	House	1.80	270	0.752	.365
Pair 2	Radio	.90	270	.301	.018
	Radio	.61	270	.489	.030
Pair 3	Bicycle	.70	270	.459	.028
	Bicycle	.50	270	.501	.030
Pair 4	smart phone	.90	270	.301	.018
	smart phone	.30	270	.459	.028
Pair 5	sofa set	.70	270	.459	.028
	sofa set	.20	270	.401	.024
Pair 6	motor cycle	.61	270	.489	.030
	motor cycle	.30	270	.459	.028
Pair 7	motor vehicle	.30	270	.461	.028
	motor vehicle	.20	270	.401	.024
Pair 8	Education	.30	270	.459	.028
	Education	.30	270	.459	.030
Pair 9	Energy	3.19	270	1.080	.066
	source of energy	2.00	270	1.343	.082

Source: Field Data (2020).

A paired sample t-test was conducted for nine pairs of livelihood assets that were included for smallholder tree farmers in the study area. First asset ownership was evaluated the possession of houses before and after smallholder farmers being involved in tree farming activities. Findings in Table 3 shows that, there was a statistically significance increase in house ownership before engagement in tree farming (M= 1.80, SD= 0.752) and after engaging in tree farming (M=2.00, SD= 0.199), t(269)= 8.706, p<0.0005(two-tailed). The mean increase score of houses ownership was 0.2 with 95% confidence interval ranging from -0.433 to 0.033. The *eta* squared statistic (0.219) indicated a strong effect on tree farmers' livelihood in study area. This is indications that, tree farming by smallholder farmers lead to improvement in their livelihood status by improving housing status. This may be attributed by lamp sum of money they receive from tree product sales like timber and transmission poles. Through this, most of them managed to improve their houses to modern houses from traditional ones such as mud pole roofing to iron sheet roofing. Some of them have managed to construct new modern houses for their families and for business through renting. The findings are supported by that of Snyder *et al*, (2018) who acknowledged that, although poverty is a multi-dimensional issue, it is directly associated with household's income, asset holding, and other economic activities that mutually generate a household's livelihood strategy and outcomes. As a result, it is important to underpin the underlying mechanisms related to rural poor's livelihood strategies in order to achieve the poverty reduction goals for the country.

Likewise, the second asset ownership was about radio possession. Findings indicated statistically significant increase in radio ownership before involving (M=0.61, SD=0.489) in tree farming and after (M=0.90, SD=0.301, t(269) = 7.522, p<0.05 (two-tailed). The mean increase score of radio ownership was 0.293 with 95% confidence interval ranging from 0.216 to 0.369. The *eta* squared

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effect is 0.174 indicating strong effect on radio possession which in turn improved their livelihood asset ownership. Smallholder tree farmers had no radios and some had small radios before engaging with tree farming. After engaging in tree farming, they managed to buy large and new modern radios which also gave them access to information which they were not able to get before. This may imply that, tree farming has improved the smallholder tree farmers to the extent of owning large and modernized radios which may be used to access more information about tree farming opportunities hence improve their tree farming activities. These findings are similar with the findings by Arvola (2020) who found that, about 60% owned radio worth more than Tanzania Shillings 60,000 whereas about 80% had cell-phones worth above Tanzania Shillings 60,000. Arvola (2020) further indicated that, 85% of respondents had bought their radio and cell-phones respectively using incomes earned from timber businesses. This is evidence that timber trading contributes significantly to the ownership of such assets in the tree farmers households. One of the key informants also informed that;

> *'Through tree farming, most if the farmers are able to purchase good radios and music systems in their homes. Also, most of the tree farmers own smart phones which are said to be expensive than the button phone'.*

The explanation by the key informant is evidence that the purchasing power of smallholder tree farmers for radios a livelihood asset has improved from the level before participating in tree farming to the current status.

Table 4. Paired Samples Test (n=270).

		Paired Differences					t	η^2	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper				
Pair 1	House	.200	.673	.053	-0.433	0.033	8.706	0.219	269	.000
Pair 1	Radio	.293	.639	.039	.216	.369	7.522	0.174	269	.000
Pair 2	Bicycle	.204	.751	.046	.114	.294	4.456	0.069	269	.000
Pair 3	Smartphone	.600	.665	.040	.520	.680	14.835	0.449	269	.000
Pair 4	Sofa Set	.500	.501	.030	.440	.560	16.401	0.499	269	.000
Pair 5	Motor cycle	.307	.644	.039	.230	.385	7.846	0.186	269	.000
Pair 6	Motor vehicle	.104	.703	.043	.019	.188	2.423	0.02	269	.016
Pair 7	Education	-.000	.401	.024	-.248	-.152	0.201		269	.000
Pair 8	Energy source	1.189	1.717	.105	.983	1.395	11.375	0.325	269	.000

As far as bicycle possession is concerned, findings indicates statistically significant increase in mean before tree farming (M=0.50, SD=0.501) and after (M=0.70, SD=0.459, t(269)=4.456, p<0.05). The mean increase score was 0.204 at 95% confidence interval ranging from 0.114 to 0.294. The *eta* squared effect was 0.069 indicating a moderate effect on bicycle possession before and after engaging in tree farming. Basically, most of the smallholder farmers owned bicycle even before engaging in tree farming as a normal household possession used as a major means of transport in short and medium distance travelling. Therefore, this may imply that, tree faming has slightly influenced smallholder tree farmers to own more bicycles thus their livelihood assets ownership has slightly improved in terms bicycle ownership.

Concerning smart phone possession, there was statistically significant increase in mean score before tree farming was (M=0.30, SD=0.270) and after involving (M=0.90, SD=0.270, t(269)= 14.835, p<0.05). The mean increase was 0.60 at 95% confidence interval ranging from 0.520 to 0.68. The *eta*

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squared effect was 0.449 indicating a strong effect on smartphone possession. It is a fact that, smartphone has become popular in recent years due to overwhelming innovation in developed countries. Before engaging in tree farming which is about 10 years past, smart phones were yet popular and expensive while currently prices are cheap and affordable in African countries as found out by Kimambo *et al,* (2020). Therefore, this effect also can also be a result of technological advancement making smartphone possession affordable to more smallholder farmers. Taking all other things constant, this implies that, tree farming has enabled smallholder farmers to own smartphone which improved their communication and instant receipt of news and knowledge about their business through social Medias accessible through their smartphones.

Likewise, findings of the study revealed that, there was statistically significant mean increase of sofa set ownerships before engaging with tree farming (M=0.20, SD=0.40) and after engaging (M=0.70, SD=0.459, t (269) =16.401, p<0.05). The mean increase was 0.500 at 95% confidence interval ranging from 0.440 to 0.560. The *eta* squared effect was 0.499 indicating a strong effect on sofa set possession after the engaging in tree farming. This could mean that, smallholder tree farmers have improved their livelihood in terms of sitting assets as sofas. As the matter of fact, smallholder tree farmers are producing timbers which are used as raw materials. Thus, it facilitates sofa making at low costs lowering the final price of the final product. This imply that, smallholder tree farmers have improved their livelihood by being equipped with home facilities like modern siting sets.

About motorcycle possession, the results indicated a statistically significant increase in mean before involving with tree farming (M=0.30, SD=0.459) and after involving with tree farming (M=0.61, SD=0.489, t(269)= 7.846, p<0.05). The mean increase was 0.307 with 95% confidence interval ranging from 0.230 to 0.385. The *eta* effect was 0.186 indicating moderate effect on motorcycle possession as a result of tree farming. This might be due to effect of other factors like easily availability of motorcycles at low price which enable smallholder tree farmers to own them even if they we are not involved in tree farming. These motorcycles have simplified tree farmers movements in their tree farming businesses. The findings imply that, tree farmers' livelihood improvements in terms of transport which is an important service for them to use a short time to travel from one point to another.

Furthermore, in this study a comparison of the motor vehicle mean increase before and after involving in tree farming was done. The results in Table 3 indicate that, there was statistically significance increase in mean before (M=0.20, SD=0.401) and mean after was (M=0.30, SD=0.461, t(269)= 2.423, p<0.05). The mean increase was 0.104 with 95% confidence interval ranging from 0.019 to 0.188. The *eta* effect was 0.02 indicating very small effect on motorcar possession. This means that, tree farming by smallholder farmers has not yet enabled many farmers to own motorcars. This may be attributed by high cost of purchasing cars and running cost being high compared to farmer's income of which they may not afford. This is indications that, a large number of stallholder tree farmers are not yet in a position to own motorcars. Only few farmers with proportionately large income can afford.

Concerning the level of education, findings shows that there was no statistical significant increase in the mean as it remained the same before (M=0.30, SD=0.459) and after involving in tree farming (M=0.30, SD=0.459, t(269)=0.00, p<0.05). This may be true due to the fact that, majority of tree farming are aged 30 years and above of which if one was not educated before engaging in tree farming activities, may not be possible to go back to school. This may further imply that; tree farming activity do not influence smallholder farmers to increase their education levels. If this study could have aimed at looking in the family education status, this could be statistically increase in mean due to the fact that, smallholder farmers now are able to manage education costs for their children even in private schools where it is expensive compared to public schools' education. One of the key informants reported that,

> *'Smallholder tree farmers may not be much educated, but the incomes they get from tree farming have transformed their lives and spending by sending their children to even more better and expensive schools.'*

It was also found that, there was statistically significance increase in mean of source of energy before was (M=2.00, SD=1.343) and after (M=3.19, SD=1.080, t(269)= 11.375, p<0.05). The mean increase

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was 1.189 at confidence interval of 95% ranging from 0.983 to 1.395. The *eta* squared effect was 0.325 indicating a strong effect on improvement of source of energy for cooking and lighting. This may be true due to the fact that, smallholder tree farmers are able to connect electricity lines from Rural Electricity Accessibility (REA) and ability to buy solar energy as well as gas equipment. Therefore, this may imply that, tree farming has influenced smallholder farmers to access better sources of energy which have improved their livelihood in term of lightening energy and use of electronic equipment.

Findings in this study are in line with the findings by Hingi. (2018) put forward that, contribution of the tree farming sector in Tanzanian cannot be underestimated. However, there seems to have been little exploration on how Tanzania's' tree farming business improve smallholder tree farmers' incomes to enhance livelihood assets ownerships specifically in the rural areas. Forestry and forest industry in Tanzania are to certain extent acknowledged in keeping ample employment opportunities to the rural population as well as urban residents. The largest part of the employment opportunities is generated by the natural forests though the plantation forests also have a great potential for livelihood assets improvement (Mlowe, 2017). Further, forests act as a saving account for people living in and around them and provide a range of products for subsistence. Forests should not be considered in terms of economic value of timber alone as they draw on local knowledge to learn a full range of their benefits and functions and how different groups use them. For instance, it helps in assessing the impact of interventions on livelihoods by studying and analyzing the complex interactions between local people and forests (FAO, 2020).

4.0. Conclusion and Recommendations

The study has confirmed that, by looking on livelihood assets of smallholder tree farmers before and after involving in tree farming, a significant improvement was observed. Therefore, since improvement in livelihood assets have significant role in a certain livelihood strategy like assets improvement or capabilities; and winning in a certain livelihood strategy has positive impact on livelihood outcome (Shanta *et al.*, 2018), the findings of this study conclude that, smallholder tree farming contributes much on household assets improvement which is an indication of income poverty reduction. It is recommended that; the government should control the market of forest products and ensure price stability so that smallholder farmers can maximize their profit and enhance more their livelihood assets. Also, the government should make initiatives to promote other tree products since they have huge potential to increase smallholder farmers' productivity.

APPENDICES

Appendix I: Sample Size Determination

Bartlett *et al*., (2001) describe sample size formula
Sample size **n** of a population P given by:

$$\frac{Z^2pg}{d^2}$$

$$\frac{1.96^2 \times 0.5 \times 0.5}{0.05^2}$$

$$\frac{0.9604}{0.0025}$$

Therefore, the sample size of this study will be 384 respondents

Where:

Z = a value on the abscissa of a standard normal distribution (from an assumption that the sample elements are normally distributed), which is 1.96 or approximately 2.0 and corresponds to 95% confidence level.

p =Percentage of target population estimated to have particular characteristics if it is unknown we assume maximum heterogeneity and use 50% which is P=0.5, **q** =1 - p

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d =acceptable margin of error (or precision), whereby the general rule is that in social research desired set at least 5% for categorical data and 3% for continuous data (Krejcie and Morgan, 1970). In this research, 5% will be used since substantial categorical data will be collected in order to obtain sample size which is managable to study.

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