FARM-OFF-FARM LINKAGES: CONTRIBUTION OF OFF-FARM EMPLOYMENT TO FARM INPUTS EXPENDITURE, SHOCKS MANAGEMENT AND POVERTY REDUCTION IN KILOMBERO VALLEY, TANZANIA

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A THESIS SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOSHY OF SOKOINE UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA.

2016

EXTENDED ABSTRACT

Livelihoods diversification towards off-farm employment is becoming a norm in developing countries and has some welfare effects. Hence, this study was carried out to unveil the effect of off-farm employment on three dimensions of poverty. These dimensions were farm input expenditure, exposure to income shocks and income poverty. The study adopted a cross-sectional design and was carried out in the Kilombero Valley. Data were collected using a structured questionnaire from 309 randomly selected households and complemented with in-depth interiviews and focus group discussions. The sampling process involved mutlistage and purposive sampling techniques. Regression models and Foster-greer-Thorbecke (FGT) poverty index were employed as analytical tools. Content analysis was used to analyse qualitative data. The findings show that 82% of the surveyed households were engaged in off-farm employment. This engagement was positively influenced by a household's structural and cognivive social capital levels, education and age of household head, land owned under cultivation and access to loans. Results on the input effect show that non-farm-self employment was positive and significant ($p \leq 0.05$) in explaining input expenditure, implying farm-off-farm production linkage in which case off-farm income is spent on inputs purchase. On the contrary, engagement in farm wage employment was found to impose labour shortage for households own farm work, leading to a lost labour effect. Despite its undesirable household's labour withdrawal effect, this employment category had a consumption smoothing effect thus, playing an *ex post* risk management role. The findings further reveal that non-farm self-employment has comparably more positive effects on the Foster-Greer-Thorbecke poverty measures than activities related to farm wage and

non-farm wage employment. The main conclusion drawn from the thesis is that, off-farm employment is heterogeneous and its effects on offsetting farm inputs constraints, income shocks and income poverty differs. It is recommended that, the issue of rural development should not be viewed as an artificial choice between promoting either off-farm wage labour or off-farm self-employment or subsistence farming alone. The issue is what strategic combinations and interlinkages are required to develop a vibrant diversified rural economy in which off-farm is a critical component.

DECLARATION

I, John Victor Msinde, do hereby declare to the Senate of Sokoine University of Agriculture that this thesis is my own original work and that it has neither been submitted nor concurrently being submitted to any other institution.

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AKNOWLEDGEMENTS

DEDICATION

This work is dedicated to my father Victor John Msinde and my mother Aurelia Msinde for their love and tireless support in the course of my education.

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LIST OF ABBREVIATIONS AND ACRONYMS

AEUs	Adult Equivalent Units
BSU	Building Stronger Universities
DANIDA	Danish International Development Agency
DFID	Department for International Development
FAO	Food and Agriculture Organisation
FGDs	Focus Group Discussions
FGT	Foster-Greer-Thorbecke
FW	Farm Wage
FHM	Farm Household Model
IFAD	Interantional Fund for Agriculture Development
KPL	Kilombero Plantation Limited
MAFC	Ministry of Agriculture, Food Security and cooperative
NBS	National Bureau of Statistics
NFSE	Non Farm Self Employment
NFW	Non Farm Wage
NAIVS	National Agriculture Voucher Scheme
NSGRP	National Strategy for Growth and Reduction of Poverty
OECD	Organisation for Economic Cooperation and Development
OLS	Ordinary Least Square Regression
PWR	Participatory Wealth Ranking
REPOA	Research on Poverty Alleviation
SSA	Sub-Saharan Africa
SAPs	Structural Adjustment Programmes

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SLF   Sustainable Livelihood Framework

TDV   Tanzania Develpoment Vision

URT   United Republic of Tanzania

USA   United States of America

VEO   Village Executive Officer

VICOBA   Village Community Banks

WB   Word Bank

1SLS   One Stage Least Square

2SLS   Two Stage Least Square

CHAPTER ONE

1.0   Introduction

1.1   Background

Rural populations in the developing countries depend on and generate a large proportion of their income from agriculture. However, there is increased recognition of rural households' modification of their economic activities through a variety of mechanisms depending on their socio-economic and agro-ecological conditions (Ellis, 2000). One of such mechanisms is geared towards intensification and extensification of agricultural production in which households invest more on agricultural improvement technologies or simply increase area under cultivation. Other mechanisms involve engaging in a number of off-farm self and wage employments. Indeed rural households in developing countries have become less reliant on what they produce from their own farms and increasingly seek for wage labour on other farms, non-farm wage and non-farm self-employment.

In characterising Sub-Saharan Africa's (SSA) off-farm employment trend, Bryceson (1996) considered it as "deagrarianisation", meaning the declining role of agriculture in the household's income and livelihood strategies. In describing a similar situation of rising off-farm employment Bouahom *et al.* (2004) used the term 'de-peasantisation,' and defined it as a process by which traditional subsistence farming based livelihood no longer addresses emerging tensions brought by population growth and market integration.

Diversification towards off-farm activities may be perceived as a rational response that rural households adopt due to lack of opportunities in crop specialization or crop diversification both of which require significant farm investment. Studies, (IFAD, 1999; Barrett *et al*., 2001; Ellis and Freeman, 2004; Riggs, 2006) suggest that rather than promoting crop production and specialisation in existing farm based portfolios of livelihood activities, expanding to off-farm employment in order to augment income could be more realistic and relevant for poverty reduction. Off-farm employment[1] in this thesis is defined as income generating activities other than those related to own farm crop and/or livestock production. They therefore include: i) agricultural processing and trade, construction, transport as non-farm self employment activities, ii) non-farm wage employment and iii) farm wage employment activities.

The need and importance of off-farm employment has been extensively documented. For example, IFAD (1999) outlines four reasons why households may need to engage in off-farm employment in rural areas. These are: first, income from farm activities that poor rural households generate can barely sustain family needs due to landlessness and meagre land ownership among the rural poor. Second, agricultural activities and income are associated with seasonality, thus off-farm employment supplements farm income during the season of low agricultural income and activities. Third, most rural nonfarm activities require little capital and generate more employment per unit of capital than farm activities, thus, they are suited to low income households. Lastly, rural non-farm employment has inequality reducing

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[1] In some studies the concepts of off-farm and non-farm have been used synonymously. But strictly speaking non-farm employment does not include farm or agricultural wages. Thus all literature cited in this thesis on non-farm incorporate farm wage employment unless stated otherwise.

effects as it provides a source of income for vulnerable groups such as women and other poor and landless rural populations.

Availability of off-farm income generating opportunities, besides agriculture in rural areas has several other potential advantages in terms of farm investement, shocks and income poverty reduction. Phimister and Roberts (2006) and Chang and Wen (2011) have positively associated off-farm employment/income and capital availability for farm investment in rural Scotland and Taiwan respectively. Mishra and Goodwin (1997), Barrett *et al*. (2001) and Dimova *et al.* (2015) have linked off-farm income with households ability to cope with income shocks and smooth income in studies conducted in USA, rural Africa and Malawi respectively. Tanzania specific evidence shows that people who combine farm with off-farm activities are better off in terms of moving out of poverty than those focusing on farming alone (De Weerdt, 2010). With these benefits of off-farm employment, one may find potential complementary linkages between farm and off-farm employment through which poverty among farming rural households in developing countries including Tanzania can be explored and addressed.

Kilombero Valley, the study area, located in the South Western part of Morogoro region, Tanzania is generally regarded as having favourable agro-climatic conditions. However, the area suffers from poor infrastructure, inadequate availability of farm inputs and unreliable markets for crops produced (Kato, 2007). In addition, there have been recent land use changes including those related to demarcation of previous

paddy cultivated wetlands to Ramsar site[2] and migration of agro-pastoralists from North-Western parts of Tanzania. All these challenges impose severe strain on farmland availability and livelihoods which depend largely on crop (paddy) farming alone. There has, however, been evidence of increasing households' diversification towards off-farm employment activities in Kilombero Valley in response to these and other challenges including those related to climate change (Balama *et al.,* 2013). Generally, off-farm employment may have the potential to address adversities facing households. For example, off-farm income may provide capital for more farm intensification and insurance for various market and climatic risks that affect farming and livelihoods. Therefore, this study was undertaken to broadly examine the potential role of off-farm employment in influencing households' farm investment of reduction of exposure to crop shocks and income poverty.

1.2 The Rise of Off-farm Employment and Approaches to Rural Development

Policy changes resulting from Structural Adjustment Programmes (SAPs) and trade liberalization in the 1990s have been associated with rising importance of off-farm employment in rural areas in most developing countries (De Janvry and Sadoulet, 2001). These policies include the elimination of public subsidies and reduction of parastatal services to agriculture. Generally, SAPs policies led to the dismantling of marketing boards and parastatals that had serviced peasants' input requirements, enforced commodity standards, and provided single channel marketing facilities and controlled prices (Brycesson, 2002). These changes had a direct effect on rural households as far as farming is concerned in terms of both input supply and markets

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[2]This is a convention on the protection of wetlands that Tanzania ratified in 2000 (MNRT, 2004) of which Kilombero valley became part. Besides conservation purpose, the convention also aims to improve social and economic values of the area, which is conserved (Mombo *et al.,* 2011)

for farmers' produce. Declining access to rural services and lack of access to input credit markets propelled farm households to engage in off-farm activities including rural non-farm self-employment and non-farm wage related activities. According to FinScope (2013), credit services to the poor rural Tanzanians are very limited. The prevailing situation is that credit institutions mostly favour the urban based production sector. Therefore, diversification towards off-farm income is considered as an important substitute for formal credit (Ellis and Mdoe, 2003).

According to Ruben and Van den Berg (2001), rural development policies, prior to trade liberalisation paid too much attention on farm activities while neglecting the role of off-farm employment. Generally, there has been a tendency to view land and particularly agricultural land as the only asset and subsistence farming as the only activity that rural households are endowed with and engage in (De Janvry and Sadoulet, 2001). Consequently, governments in developing countries addressed rural poverty by redistributive land reforms and integrated rural development programmes in an attempt to raise productivity. De Janvry and Sadoulet (2001) term this trend the "traditional approach" to poverty reduction and distinguish it from the "new approach," which, instead, emphasises on off-farm income generation. Accordingly, the "traditional approach" has generally failed to reduce poverty at the time when there is increasing engagement in off-farm employment among the rural poor particularly in developing countries (Ellis, 2000; Reardon *et al.,* 2000; Davis and Bezemer, 2003; Haggblade *et al.,* 2007).

In a more pessimistic view towards agriculture, Riggs (2005) argues that the best strategy to bring pro-poor growth to rural areas is to focus less on supporting smallholders' agriculture and divert more resources on skills training that may get them out of farming. A "new approach" has emerged at least at the theoretical level, calling for agricultural policies and development programmes that generate incentives not only for farm activities, but also for non-farm employment and linkages between the two (Reardon *et al.*, 2000). For farming households in rural areas, this 'new approach' generally is more promising for reducing deprivation, as it addresses multiple dimensions of poverty. These poverty dimensions of relevance in the context of the Kilombero Valley include, lack of essential farm inputs, crop income shocks and income poverty.

Notably, several authors (Lanjouw and Lanjouw, 2001; Reardon *et al.*, 2007; Anríquez and Daidone, 2010) have argued that, rural economy depends on parallel growth and performance of both farm and off-farm activities. If this is the prevailing situation then the best empirical approach in examining off-farm employment effect is to consider the linkage it has with the farm sector. Likewise, this thesis employs the framework that capitalises on these linkages by mainly focusing on the role of off-farm employment in the three attributes of farming livelihoods which are farm investment, risk management and income poverty.

1.3   Farm and Off-farm Linkages

Literature identifies two major types of farm/off (non)-farm linkages: these are production and expenditure linkages (Hagglabade *et al.,* 2002; Hagglabade *et al.,*

2007; Anríquez and Daidone, 2010). Nonetheless, production linkages can further be divided into backward and forward linkages. Forward production linkage generally refers to linkages from farm to the part of the non-farm sector that provides inputs for agricultural production (Hagglabade *et al.,* 2007). For example, favourable agricultural productivity increases demand for agricultural inputs and marketing facilities, and this induces growth of Off-Farm Employment (OFE). On the other hand backward production linkages refer to the part of the off-farm sector that uses agricultural output as an input (Hagglabade *et al.,* 2007). The distribution and processing of agricultural outputs are fundamental components of forward production linkages. In this case, the stagnation of one sector can largely be explained by decline of the other (Kruster, 2010).

Generally, expenditure linkages refer to the fact that households deriving income from one type of activity, farm or non-farm, are likely to spend or invest that income on products of other activities. This investment may be in two dimensions: first, when surplus production from agriculture is to be sold to provide capital for off-farm activities. Another way is via the investment in on-farm production from output in terms of cash flow generated from off-farm activities. This thesis particularly focuses on this second strand of the investment linkages. Some authors (Reardon *et al.,* 1996; Oseni and Winters, 2009; Pfeiffer *et al.,* 2009) maintain that this is the most important link in rural areas of developing countries Tanzania included, where access to capital for farm investment is hindered by rural financial credit constraints.

The linkages between farm and non-farm activities have also been extended in terms of labour supply. Lanjouw and Shariff (2004) point out that increases in farm productivity may lead to release of labour or rising of wages; meanwhile the new agricultural surplus would be reinvested in the off-farm sector through expenditure linkages as described above. There is thus a positive labour supply relation and mutual reinforcement between farm and off-farm sectors.

The mutually reinforcing events, however, assume smooth growth of both sectors (farm and off-farm) in the environment of 'perfect' labour and credit finance market. Rural areas in developing countries Tanzania included are plagued by lots of imperfections. As a result, relevant labour competing needs may result from interactions between the two sectors. A study in Bangladesh showed that the proportion of off-farm income in total income led to a negative effect on efficiency for rice farmers (Coelli *et al.*, 2005). This was because engagement in off-farm activities appeared to reduce labour dedicated to crop production among farming households. This is a typical case of farm-off-farm competition as described by Reardon *et al.* (1996), in which growth in one sector (off-farm in this case) leads to a relative decline in the other (farm). Hence, in a situation of labour scarcity, off-farm activities may compete for labour with farm activities.

Cognisant of the possible negative relationship between farm and off-farm employment this thesis partly examines the labour effect of off-farm engagement considering labour as a nessesary input for labour intensive crop such as paddy in the study area. According to Bryceson (1997) and Bryceson (1997), in a situation where

engagement of a household in off-farm employment is motivated by survival and distress situation resulting from farming the positive income effect of off-farm activities may not be realised particularly among poor households. In a similar vein, one may argue that if households engage in off-farm activities as a survival strategy, then what matters most is the quest to reduce risk and uncertainty associated with livelihoods centred on subsistence farming. However some households may not invest in farm inputs if the threat is more related to seasonal income shocks, which are prevalent in seasonal farming activities in the study area. Nonetheless, by households inability to investment in form of input may results into the same being, susceptible to shocks exposure possibly due to low yields in the preceding season. This implies that even expenses on inputs could be considered within the framework of household risk management strategies. In considering these view points, the study employs a theoretical approach that evokes a non-separable farm household model and the risk management theory with an assumption of missing markets as described in section 1.9.

1.4   Poverty Trends and its Perspective in Tanzania

Tanzania is largely an agriculture-based economy, which employs abou 75% of the of the labour force (MAFC, 2013). Agriculture contributes approximately 25% of GDP (Table 1.1). Although annual per capita income has grown steadily averaging 7% over the past 8 years (Wuyts and Kilama, 2014), it has not been accompanied by a corresponding fall in income poverty.

Table 1.1: **Agriculture, growth and poverty in Tanzania for the period 2005-2012**

Year	GDP at current price in Tshs ml (mainland)	Population in ml (mainland)	Annual per capita income (Tshs)	Annual per capita income (USD)	Agriculture share to GDP (%)
2005	15 964 294	36.2	441 063	390	27.6
2006	17 941 268	37.5	478 100	381	26.2
2007	20 948 403	39.5	547 081	442	25.8
2008	24 781 679	39.5	627 787	520	25.7
2009	28 212 646	40.7	693 470	530	25.4
2010	32 293 479	41.9	770 464	550	24.9
2011	37 532 962	43.2	836 101	557	24.6
2012	44 717 663	43.6	1 025 038	652	23.7

Source: Adopted from public expenditure review (URT, 2014). Note: ml represents figures in millions. 1US$= 1 635 Tanzania shillings (Tshs) on average during months of data collection in 2014.

According to the 2011/12 Household Budget Survey (Table 1.2), 28.2% of people living in Mainland Tanzania fall below the basic needs poverty level (NBS, 2014a). The poverty incidence is much higher in rural areas than in urban ones. The reported poverty incidence of 33.3% in 2012 in rural areas is a mere decrease from 39.4% in 2007 (See Table 1.2), whereas urban poverty has modestly decreased from 27.7% in 2007 to 22.7% in 2012. The decline in both rural and urban poverty has been generally slow and does not keep pace with the average GDP growth of 7%. The 2012 per capita income in Tanzania of 1 025 038 TShs (652US$) (Table 1.1) places her among the world's poorest countries. However, per capita income gain has been limited by the high population growth rate which was estimated in the 2012 census to be at 2.7% per annum (URT, 2014).

Table 1.2: **Persons and households food and basic needs poverty-head count rates (in percentage) by area, Tanzania mainland (2007 and 2011/2012)**

Area	2007				2012			
	Population		Households		Population		Households	
	Food	Basic need	Food	Basic need	Food	Basic need	Food	Basic needs
Other Urban areas	8.9	22.7	6.6	18.3	8.7	21.7	6.0	16.0
Rural areas	13.5	39.4	10.3	32.7	11.8	33.3	8.8	26.7
Dar es salaam	3.2	14.1	2.0	9.8	1.0	4.1	0.7	2.6
Tanzania mainland	11.8	34.4	8.7	27.5	9.7	28.2	7.2	21.5

Source: National Bureau of statistics (NBS), Household and budget survey, main report, 2011/12

Other income poverty indicators such as inequality still reflect an increasing poverty trend as the Gini coefficient has increased from 0.36 in 2008/9 to 0.39 in 2012/ 13 (NBS, 2014b). While the rates in urban areas have decreased from 0.37 in 2008/9 to 0.36 in 2012/ 13, the Gini coefficient in rural areas has increased from 0.31% to 0.34 in the same period of time (NBS, 2014b). This suggests a steady increase in inequality particularly in rural areas. One may thus conclude that the reported high GDP growth is not inclusive and there is generally lack of trickle down effect to the rural poor.

According to, URT (2011b), GDP growth between 2005-2012 was generally caused by rapid growth of industry and the service sectors rather than the agricultural sector. This declining contribution of agriculture (see Table 1.1) combined with higher incidence of rural poverty implies a threat to subsistence farming and a risk of more vulnerability for rural farm households who are the main contributors of agricultural growth in Tanzania. One of the main culprits for the lag in agricultural growth is low investment on inputs. For example, data from the National agriculture survey census

of 2007/08 shows that inorganic fertilizers were only used 7.2% of cropping area (URT, 2011c). As the consequence of the above, farmers get low which is generally between 20% to 30% of their potential (World Bank, 2009). This thesis set the broad proposition that off-farm employment may enable households to enhance their income thus, indirectly address farm investment challenges as far as input and crop income shocks are concerned.

1.5   Off-farm Employment in Tanzania

As in other developing countries, rural households in Tanzania are increasingly diversifying their livelihoods into off-farm activities. According to NBS (2014b) there has been a gradual increase in households' engagement in off-farm employment over the past 8 years. For example, more than 64% of the households were engaged in off-farm employment in 2012/2013, which was about twice the rate reported in 2007/8 as shown in Table 1.3. Using country representative survey data, Kinda and Loening (2010) have shown that 28% of households had at least one member engaged in a rural non-farm enterprise (excluding wage employment). The available data on the relative importance of off-farm income shows that the share of rural non-farm self-employment income has increased, from about 6% in 1992 to more than 20% in 2005 (World Bank, 2007). Engagement in high return off-farm activities that are expected to have more well-being and poverty impact is, however, constrained by several entry barriers. These include institutional barriers resulting from the burden of tax, levies and poor infrastructure that increase transaction costs that limit households from engaging in activities such as rural small trading (Ellis and Mdoe, 2003; Kinda and Loening, 2010).

Studies (Dercon and Krishna, 1996; Lanjuow *et al.,* 2001; Dimova and Sen 2010; Katega and Lifuliro, 2014) on the relationship between farm and off-farm employment in Tanzania have dwelt on several dimensions of poverty. The studies can broadly be divided into those that utilised national representative surveys (Dercon and Krishna, 1996; Dimova and Sen, 2010) and those based on village level data (Lanjuow *et al.,* 2001; Katega and Lifuliro, 2014). Dercon and Krishna (1996) show that the poverty reducing potential of off-farm employment varies across regions, indicative of difference in endowment of resources required for off-farm employment activities. For example, it has been shown that areas with favourable agricultural conditions have vibrant and prosperous off-farm opportunities (Kinda and Loening, 2010; Mathenge *et al.*, 2015). In addition, most of off-farm activities in rural Tanzania involve low skills, have low risk and low returns (Dercon, 1998). This suggests that, the motives behind households' engagement in off farm employment is to counteract crop income risk.

Table 1.3: Percentage of farm households earning income from off-farm activities

Percent of household earning income from:	2008/2009			2010/2011			2012/2013		
	Wage	SE	Either	Wage	SE	Either	Wage	SE	Either
Rural	31	34.6	55.0	43.8	38.9	65.4	46.4	37.2	65.0
Urban	45.0	54.7	78.1	50.7	60.5	85.6	52.8	55.8	83.3
All	35.4	36.9	57.7	44.8	42.1	68.4	47.2	39.7	68.2

Source: Tanzania National Panel Survey Report (NPS) - Wave 3, 2012 - 2013. (NBS, 2014b). SE = self employment

In sum, the review of off-farm literature on Tanzania has illuminated the following observations. First and foremost, the rate of off-farm employment is increasing at the national level. However, this obscures some off-farm employment activities such as

those related to farm wage labour which may not have been accounted for in most surveys cited in this section. Second, production and expenditure linkages between farm and off-farm employment prevails in rural areas. In such linkages, a vibrant off-farm sector is likely to be an important boost of farm sector and vice-versa. Third, due to existing farm-off farm linkages there is potential for improved farm input investment using off-farm income sources in situations where farm input credit market is weak. Fourth, in most circumstances participation in off-farm employment is driven by the need to reduce risks and uncertainty whereby off-farm employment is considered as a survival strategy for the poor. Fifth, off-farm employment can be assumed to have a direct effect on household's income. Finally, the effect of off-farm employment on farm input, risk reduction and income poverty depend on households' ability to overcome entry barriers to engaging in off-farm activities. The present thesis examines the points mentioned above, paying particular attention to the last four related observations.

1.6   Problem Statement

Rural development polices in Tanzania tend to be based on a perception of rural livelihood as a mere reflection of subsistence farming. However, the review of Tanzania's Development Vision 2025, has revealed that, agriculture development, considered for many years to be the backbone of Tanzania economy, has not lived up to the expectations of rural farming households (URT, 2011a). This could be due to seasonal and the rain-fed nature of farming and the shrinking agriculture resource base coupled with low input use and cropping risks and shocks. Off-farm employment which is becoming a key livelihood strategy among smallholder farmers

in Tanzania, as elsewhere in Sub-Saharan Africa, can potentially addresses the challenge of farm investment, shocks and ultimately income poverty. There is, however, a dearth of context specific empirical knowledge on how off-farm employment can contribute to farm investments in terms of input expenditure and reducing exposure to crop income shocks.

Despite having favourable agro-climatic conditions, Kilombero Valley (the study area) has low farm input use (MDS, 2008) and crop farming in the area is under severe strain due to uncertainties and output market fluctuations (Kato, 2007; Musamba *et al.,* 2011). Consequently, smallholder farmers in the Kilombero Valley suffer from low farm (paddy) productivity and income (Kato, 2007). This apparently contributes to shocks leading ultimately to income poverty.

Risks and shocks associated with farming can however be avoided by more intensification through the use of more inputs or other crop insurance mechanisms. This is however an uphill battle for poor farmers in the study area due to both, imperfect input markets that cannot support essential farm inputs, and insurance markets that can buffer against crop income shocks. The above, therefore, suggests precarious livelihoods for smallholder farmers. Thus, off-farm employment may be an appropriate strategy to address the above-mentioned challenges among farming households in the Kilombero valley. Indeed off-farm employment may have a direct impact of enhancing household income that provides a pathway out of poverty.

While a handful of empirical studies conducted elsewhere in SSA have described the general poverty effect of off/non-farm employment (Abdulai and Crolerees 2001;

Davis and Bezemer, 2003; Holden *et al*., 2004; Oseni and Winters 2009; Fabusoro *et al*., 2010) relatively little attention has been paid to micro level analysis of off-farm employment particularly the effects on farm input expenditure and risk management in favourable agro-climatic rural areas.

Generally, few Tanzanian specific studies have carried analysis that links off-farm employment and input or risk management. One of the few attempts for example, Katega and lifuliro (2014) provided a descriptive analysis of the contribution of off-farm employment to input expenditure in the semi-arid, less agricultural favourable area of central Tanzania. Notwithstanding its useful contribution at the micro level analysis in relation to off-farm employment, methodologically, the study did not disaggregate different categories of off-farm employment despite their heterogeneity in terms of earnings and investment needs. This categorisation was however addressed by Lanjouw *et al.* (2001) in a study examining determinants of non-farm income conducted in peri-urban areas of Tanzania. Similar to Lanjouw *et al.,* (2001) approach, an attempt is made to distinctly categorise functional groups of off-farm employment i.e. non-farm self- employment, farm wage employment and non-farm wage employment. By this disaggregation of off-farm employment this study hypothesises that the effects on farm input expenditure, shock exposure and income poverty among farming households is not uniform across different segements of off-farm labour markets.

1.7   Justification for the Study

Diversification to off-farm employment in rural areas has received little attention in development strategies and policies in Tanzania. For example, the cluster 1 goal of growth for reduction of income poverty as enshrined in the National Strategy for Growth and Reduction of Poverty (NSGRP II), (URT, 2010) is silent on the role of the rural off-farm sector. One reason for this lack of emphasis could be unaavailability of solid and up to date empirical evidence on welfare/poverty effect of off-farm employment in Tanzania. Hence, highlighting the role of rural off-farm employment as an area of relevant policy consideration in Tanzania's endervour to reduce income poverty particularly in the rural areas the study will enable policy makers in strategising for rural poverty reduction. This is through a good understanding of the premise set in the thesis that, rural welfare in terms of less exposure to shocks, more input availability and apparently income poverty reduction are being influenced by not only farm income but also the diversity of income that off-farm activities offer.

Of more relevance is the study's contribution in providing part of the roadmap to achieve broader long term economic growth enshrined in Tanzania's development vision (TDV) 2025. The vision's target is for Tanzania to attain a semi-industrialised country status by the year 2025 hence, becoming a middle income country (URT, 2011a). Understanding and unfolding growth potential of rural off-farm sector including those related to small enterprises provides a foothold that may enable the country to attain the target envisaged in the TDV 2025.

Moving beyond Tanzania's specific case at policy making level, the present thesis challenges the traditional integrated rural development approaches prevalent in SSA (Ellis, 2000). The assumptions of policy makers that rural households depend on farming alone, thereby formulating policies that narrowly focus on enhancing farm productivity, for example those related to input support may need to be re-examined. Though farming still plays a crucial role in rural households' incomes, the interaction and linkages it has with off-farm activities may be pivotal in formulating holistic policies that address rural income constraints and development.

The present thesis also attempts to contribute to the goals set in the 'North-South' research collaboration through DANIDA funded Building Stronger Universities (BSU) project. The thesis's title falls under the theme 'Rural livelihoods and uncertainties' which is one of the research areas of the Growth and Employment (GE) platform of BSU I project. The purpose of the platform was basically to conduct a PhD study that investigates livelihood and uncertainties in rural Tanzania.

1.8   Objectives of the Research

1.8.1   General objective

The general objective of the study was to examine the effect of off-farm employment on farm input expenditure, crop income shocks and income poverty for households in the Kilombero valley, Tanzania.

1.8.2   Specific objectives

The study on which this thesis is based specifically aimed to;

(i) examine factors that are associated with household's engagement in off-farm employment.

(ii) examine the effect of off-farm employment on farm investment in terms of expenditure on farm inputs and households' labour availability.

(iii) explore the role of off-farm employment in reducing exposure to crop income shocks.

(iv) assess and quantify the contribution of off-farm income on incidence, depth, and severity of poverty

(v) estimate the effect of off-farm income on household's income poverty.

1.9   Theoretical Framework

1.9.1 Farm Household Model

The Farm Household Model (FHM) has evolved to address agricultural development and poverty alleviation among peasant farm households. So, the model allows one to understand the welfare of the poor since they are disproportionately affected by poverty. The original version of the model considers peasant households as semi-commercialised, operating under perfect market condition (Taylor and Adelman, 2003). This means that food produced in excess of households' consumption is sold on the market while shortage of self-produced food forces the household to buy. Similarly, excess labour is likely to be sold, while shortage of labour forces household to buy leading to labour balance (Taylor and Adelman, 2003).

FHM was originally conceived to be separable. In a separable model, the household behaves as a pure profit maximizing producer and utility maximizing consumer.

Thus, a household is considered as a production unit that converts purchased goods and services as well as its own resources into use values or utilities when consumed (Singh *et al.,* 1986). Utility is maximised through the consumption of all available commodities (i.e., home-produced goods, market-purchased goods, and leisure), subject to a number of constraints. These constraints include cash or income constraint, existing production technologies for farm and non-farm activities, exogenous prices for tradables, and family labour (Singh *et al.,* 1986; De Janvry and Sadoulet, 1996).

Different variants of FHM have been adopted in considering peasant households missing (imperfect) markets. There is generally missing markets for output (households produced goods) and input (including labour and capital). In this case the assumption of separability between consumption and production decisions as previously assumed in traditional FHM is no longer valid. To describe rural households non-separability character, Ellis (1998) provides the following conceptualisation; 'it is the dual nature of the peasant production which is its central peculiarity. The peasant unit of production is both a family and an enterprise; it simultaneously engages in both consumption and production'. A FHM is said to be non-separable when household's production decisions (engagement in off-farm employment, spending on farm inputs,) are determined by its consumer characteristics (consumption preferences, demographic composition, etc.) as a result of presence of market imperfections (De Janvry and Sadoulet, 1996). Impefect FHM that consider market failure has been applied in various contexts. These applications include, examining the determinants of rural-off-farm income diversification

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(Escobal, 2001), analysing effect of off-farm income on agricultural production (Pfeiffer *et al.,* 2009; Corsi and Salvioni, 2014) and examining the risk reduction effect of off-farm employment (Saha and Stround, 1994; Mishra and Godwin, 1997).

The presence of market failures such as transaction costs, absence of labour or input markets, in rural economies of Africa make the use of a nonseparable model ideal for understanding the behaviour of rural households (Oseni and Winters, 2009). Thus, this dual character of households (as production and consumption unit) is the central pre-occupation of a large part of analysis in this thesis. Indeed given the situation of imperfect markets in Kilombero Valley in particular, and rural Tanzania in general the present study adopts the variant of FHM as proposed by Singh *et al.* (1986) and De Janvry and Sadoulet (1996) in analysing the effect of off-farm employment on poverty. Since household's labour allocation to off-farm affects and influences household's production and consumption it is appropriate to consider a non separable FHM (Singh *et al.,* 1986). A household choice to work off-farm is a rational economic decision as FHM predicts. Generally, this decision is assumed in this thesis to be based on relative weights attached to income gain or loss of household labour; these relative weights are grounded in the two separate theoretical orientations discussed below.

Income effect: this happens when a household supplies labour to off-farm activities and uses the income earned to invest in farming activities. In this case, the purpose of the households deploying labour to off-farm activities is to maximise their total income, which could be used as farm investment capital. Therefore, if a household is constrained with limited liquidity and/or credit, then the income earned from the off-

farm activities can be invested to pay for labour saving devices as a replacement to labour withdrawn to off-farm (Feng *et al.*, 2010) and other farm investments. These investments can be, for example, in terms of increased input (e.g. herbicides) expenditure using cash flow from off-farm employment. The empirical evidence to support this kind of investment was reported by Reardon *et al.* (1996) in Burkina Faso, De Janvry, *et al.* (2005) in China and Pfeiffer *et al.* (2009) in Mexico. These authors contend that participation in off-farm employment is associated with a higher likelihood of increased farm investment, suggesting that farmers with higher levels of off-farm income are more likely to profitably invest on their farms. However, Reardon *et al.* (1996) add a caveat on these farm-off-farm linkages by observing that complementariness is mostly found in farming carried out in favourable agro-climatic regions and fades away in areas with less favourable agro-climatic conditions. For the study area on which the present thesis is based it can be tentatively argued that income effects may be expected since the area has a high agricultural potential. The analysis in chapter three entirely rests on this theoretical orientation as the chapter discusses the input effect of off-farm employment.

Lost-labour effect: In an imperfect market situation and non-separability of household production and consumption decisions, utility maximization may not be achieved due to the lost-labour effect. The lost labour effect entails the competition of labour as a production factor shared by both sectors (farm and off-farm). As a result, engaging in off-farm employment may lead to irreversible labour loss available to households own farm production (Lopez-Feldman *et al.*, 2007; Hennessy *et al.,* 2008; Shi *et al.,* 2011). There are at least two main aspects of labour loss. One aspect is related to withdrawal thus, absence of the member who works off-farm.

The other is related to an increase in leisure resulting from an increased household income. In a situation of complete labour markets which is an unlikely scenario in the study area, households replace the lost labour through hiring. But, this does not always happen. Therefore, off-farm engagement may sometimes lead to less attention to a household's own farm work, this generally happens in cases where the income generated 'off' the farm is not re-invested in on-farm activities as previously argued under the income effect. In supporting this argument, a study by Hennessy *et al.* (2008) shows that, households with more engagement in off-farm activities invest less and earn less from their own farms. This scenario of lost labour effect is particularly relevant in rural areas of Africa, Tanzania included, where the off-farm labour market is poorly developed and households have generally few adult working members.

Generally, labour loss may induce a severe production effect for labour constrained households. The opportunity cost of labour loss is always high in situations where farming is dominated by labour intensive crop cultivation whereby the negative effect of labour loss may outweigh the income benefit of off-farm employment (Shi *et al.,* 2011). The effect may be severe in a situation where off-farm activities are occurring concurrently with farm activities. For example, when households engage in activities related to farm wage during the farming season, in response to what Lay and Schüler (2008) call desperation led off-farm diversification motive. A study by Dercon (1998) indeed demonstrates that off-farm diversification in rural Tanzania in which this study is based is dominated by desperate survival needs.

Despite the usefulness of using FHM in examining rural households' production behaviour as a generic model, it has been criticised on various grounds based the accompanying assumptions and premises. Two critics are of relevant consideration; one emanates from its assumption of a unitary household model. In this modelling FHM ignores the individualistic aspect and intra-households resource allocation and decision making (Bardhan and Udry, 1999). In addition, the focus on households does not address intra-households gender relations and division of labour which are key features of rural households. But, in a practical sense households in rural areas of Africa including those found in the study area rarely operate under the bargaining household model whereby, household members may have individual decisions especially in consumption and production and in off-farm employment. Therefore, the thesis maintains the unitary model in its analysis and methodological approach.

The other criticism in relation to the FHM is the assumption of a risk free environment in which rural households operate. This assumption detaches itself from the risks context that subsistence farming households face (Rosenzweig and Wolpin, 1993). These risks and uncertainties are aggravated by incomplete credit and insurance markets in rural areas of the developing countries (Singh *et al.,* 1986; De Janvry *et al*., 2005); generally, efficient formal institutional mechanisms such as input credit and crop insurance hardly exist in rural areas to provide households with a buffer against potential shocks. Nonetheless, there are two approaches to address the shortcomings of the FHM in the context of the analysis of the current thesis. One approach is to incorporate risk aspects in the traditional household model. This will capture a critical ingredient that explains household's off-farm engagement and

responses to various risks related to their production that affects their income stream. However, incorporating a new concept in a well-established model requires rigorous empirical evidence and review, something which is beyond the scope of this analysis. The alternative approach adopted in this analysis is to separately incorporate the risk management theory that considers off-farm employment as a risk management strategy.

1.9.2 Risk Management Theory

In the context of off-farm diversification, this thesis distinguishes between risk-management and risk coping strategies based on Ellis (1998). According to Ellis, 'risk management' is a decision taken to avoid production failure by varying and spreading income sources over time to reduce co-variate risks and stabilise households. Meanwhile, 'coping strategies' are defined as an ''involuntary response to disaster or unanticipated failure in relation to the major source of survival. Hence, off-farm plays a dual role as far as rural households' farm production risk is concerned. Due to lack of access to credit and insurance markets, households may rely on off-farm employment as an informal risk reducing strategy. For example, in rain-fed agriculture any climatic event may have a gross impact on households' productivity, income and entire livelihoods. The aboved is particularly relevant to the study area where farming is dominated by a single season of paddy cultivation to which the entire households' livelihoods revolve.

Based on the risk management theory, off-farm employment is considered as one of the strategies that households adopt in the context of risk and uncertainty brought by

various factors such as those which are climate related changes e.g. floods; and economic factors such as market fluctuations (Kochar, 1999; Porter, 2012; Dimova *et al.,* 2015). The possibility of off-farm employment as essentially a risk management strategy moves beyond the assumption of utility maximisation inherent in the FHM. Thus, off-farm employment and income thereof may have a potential *ex ante role e.g. preventing fall into shocks* and *ex post* insurability role e.g. providing needed income for consumption smoothing. This risk based approach is relevant in the present study in two ways. First, is the necessity to take into consideration common risks, shocks and uncertainties facing smallholder farmers in low income countries (Rosenzweig and Wolpin, 1993). Essentially, the structure of the rural households in developing countries is shaped and revolves around considerations of consumption smoothing (Binswanger and Rosenzweig, 1993; Rosenzweig and Stark, 1989). This being the case, engaging in off-farm employment as is the case for other coping strategies may be a response to income smoothing in an environment of exposure to shocks and not exactly geared towards utility or profit maximization and accumulation of income as suggested in the FHM approaches.

The second argument is rooted in Saha's (1994) two season model of semi subsistence agriculture; this model suggests that households' perceptions of risks greatly influences their production decisions including those related to off-farm employment. Saha perceives a risk-free model such as FHM to considerably underestimate households labour supply responses to output price and income variability. This variability is particularly relevant for farming households in rural areas of developing countries where income shocks have seasonal or transitory

patterns based on seasonality of crop production and market for the produced crops. Consequently, households shape their production decisions in relation to off-farm activities in response to these patterns. For many households, stability of the crop income and avoiding the crop income shock that are prevalent in the highly seasonal farm activities is of pertinent concern. This thesis draws on the risk trajectory because crop (paddy) production activities and markets in the Kilombero Valley have high seasonal fluctuations (Kato, 2007; Musamba *et al.,* 2013). Indeed, seasonality has income risk and shock implications.

1.9.3   Sustainable Livelihoods Framework

Anaylses using the FHM and risk management theory just tell half of the story about the effect of off-farm employment on poverty. Poverty in the present thesis is proxied by income, exposure to shocks and farm input constraints. Whereas the FHM focuses on utility maximisation and takes no broader consideration of the vulnerability aspects, the risk management theory treats off-farm employment essentially as a variable affecting exposure to shock. Off-farm employment should indeed be structured within poor peoples' livelihoods. A livelihood here is defined according to Ellis (2000) in which 'a livelihood comprises of assets, activities, and access to these assets that together determine the living gained by a household.

Using the livelihood approach, the poverty effect of off-farm employment should be framed within households' endowment of assets in the wider context of exposure to vulnerability and shocks. The livelihood approach provides a useful basis at this point. Basically, the Sustainable Livelihood Framework (SLF) considers rural

livelihoods to be influenced by three parameters that explain the portfolio of activities of households, income sources and resultant outcomes. The first is the capital stock (livelihood assets) in which a household is endowed with. The capital stock includes natural, physical, human, financial and social capital. The second parameter is the portfolio of income generating activities that a household decides to pursue, depending on their capital endowment. With regard to the second parameter the focus is on off-farm employment activities, which is part of the diversification strategy. The last parameter is related to vulnerability context. These parameters together determine the viability of livelihoods in terms of releasing the desirable outcome.

Livelihoods assets: Many empirical analyses of rural income-generating activities are based on the assumption that the household's stock of assets (see the left-hand side of Figure 1.1) is a key determinant of its involvement in such activities. In this study too, the household assets are used as variables in examining the determinants of off-farm employment as a diversification strategy which is the subject of the second chapter. These assets are defined as follows:

Human Capital: refers to the knowledge and skills, quality of labour, good health and ability to pursue different livelihood strategies (Scoones, 1998; Carney, 1999; DFID, 1999). Human capital also, includes psychological and social capabilities of people to pursue different livelihood strategies (IFAD, 2009).

Physical Capital: this capital asset considers infrastructure and facilities such as roads, transport system, housing, water, energy and communications, production

equipment and the means by which people pursue different income generating activities (Carney, 1999; DFID, 1999).

Social Capital: Based on the framework, social capital entails three different interrelated concepts. These are networks and interconnectedness, membership to social groups and relationship of trust, reciprocity and exchange (DFID, 1999). Social capital is more closely related and is the product of transforming structures and processes within the SL framework. Social capital reduces transaction costs and acts as insurance against shock events for the poor.

Households' resource base (Assets)	Access to resources modified by	Influenced by the contexts of	Resulting in	With effect on

Social relations
Gender
Class
Age
sex

Trends
Populations
migration
Technology
Macro policies
World economic trends

Livelihood security
Income level
Income stability
Seasonality
Degree of risk

Assets
Natural
Physical
Human
Financial
Social

Instituions
Rules and Customs
Land tenure
Markets

Livelihood strategiess

Env. Sustainability
Soils and quality
Water
Rangeland
Forests
Biodiversity

Shocks
Drought
Floods
Pests
Diseases

Organisations
Asssociations
NGOs
State agencies

Natural resource (NR)-based activities
Collection
Cultivation (food)
Cultivation (non-food)
Livestock
Non-farm NR

Non-NR-based
Rural trade
Other services
Rural manufacture
Remittances
Other transfer

Figure 1.1: A framework for the analysis of rural livelihoods
Source: Adapted from Scoones (1998) as cited in Ellis (2000)

Financial Capital: This is conceived in the SLF to involve financial resources available in the forms of stocks i.e. savings at the household disposal and flows. Flows are available through transfer income such as pension and remittances, whereas stocks include both saving and credit that people own and which enables investment in different livelihood strategies (Carney, 1999; IFAD, 2009).

Natural Capital: This refers to natural resources available within the communities that support various livelihood options. They include land, water, wildlife, biodiversity, forest and wider environmental resources (World Bank, 1997; Carney, 1999). The natural process to which natural capital is made available is also the main cause of the shocks that affect the livelihoods of the poor.

Trends and shocks: The trends, shocks and seasonality context (Table 1.4) frames the external environment in which people exist. People's livelihoods and the wider availability of assets are fundamentally affected by critical trends as well as by shocks (see Fig 1.1) and seasonality, over which they have limited or no control (DFID, 1999).

Table 1.4: Main trends, shocks and seasonality events

Trends	Shocks	Seasonality
Population trends	Human health shocks	Of price
Resource trends (including conflicts)	Natural shocks	Of production
National/international economic trends	Economic shocks	Of health
Trends in governance including politics	Conflicts	Of employment opportunities
Technological trends	Crop/livestock health shocks	

Livelihood outcome: The overall effects of successful engagement in off-farm employment are to bring about sustainable livelihood outcome. Based on Fig 1.1, these outcomes may be in terms of income level or reducing degree of exposure to risks. Three outcomes are of relevance to the objective of this thesis. These are; income level, income shocks and seasonality and lastly, farm production (input) effect. These above effects are considered as relevant welfare measures that need to be assessed as outcomes of livelihood strategies (off-farm employment) as explained in the context of the study area.

1.10 Conceptual Framework

The framework is built on consideration of three broad assumptions. First, engagement in off-farm employment depends on a number of resource endowments that rural households possess. Second, off-farm employment has an effect on income poverty, farm investment (proxied by input expenditure) and risk management. Third, engagement in off-farm employment may alter labour availability on farm under the assumption of labour market imperfection. The detailed relationships among the study variables are shown in Fig 1.2 in which numbers in the figure represent the corresponding objective as described in sub-section 1.7.2.

Engagement in off-farm employment is assumed to depend on a household's capacity variables (Readon *et al.,* 1996). From the sustainable livelihood framework (SLF) point of view described above and the FHM these variables are set broadly in terms of households assets. Assets are means by which one is capable of undertaking off-farm activities. Thus, assets comprise not only tangible elements such as physical or financial capital but also human capital in terms of formal schooling and social

capital, such as membership to associations and networks (Ellis, 2000). Nonetheless, involvement in off-farm employment also depends on opportunities that create demand for off-farm employment activities. These opportunities include availability of firms that may employ rural labourers e.g. plantations as in the case of for some selected villages in the study area.

The second part of Fig. 1.2 explores farm investment effect as the investigation in this study is under the contextual environment of imperfect input credit for the main cultivated crop (paddy) in the study area. Accordingly, off-farm employment is hypothesised to be associated with on farm investment. Due to income effect (Feng *et al.,* 2010), as explained in sub-section 1.9.1, it is pertinent to assume that off-farm income may be spent and may lead to an alteration in farm input expenditure. The off-farm employment or income can thus be approached as an independent variable that explains farm investment through expenditure on essential farm inputs as indicated by the direction of the arrows in Fig 1.2. There is also the lost-labour effect, this leads to a direct link between off-farm engagement and farm activities in terms of labour as a production factor shared between both activities (sectors). If there is shortage of labour, then off-farm employment may impose negative externalities in terms of labour constraints on farm activities leading to a negative farm investment effect i.e. reduction of labour for work on household farms. Labour is considered here as a variable farm input essential for farm investment.
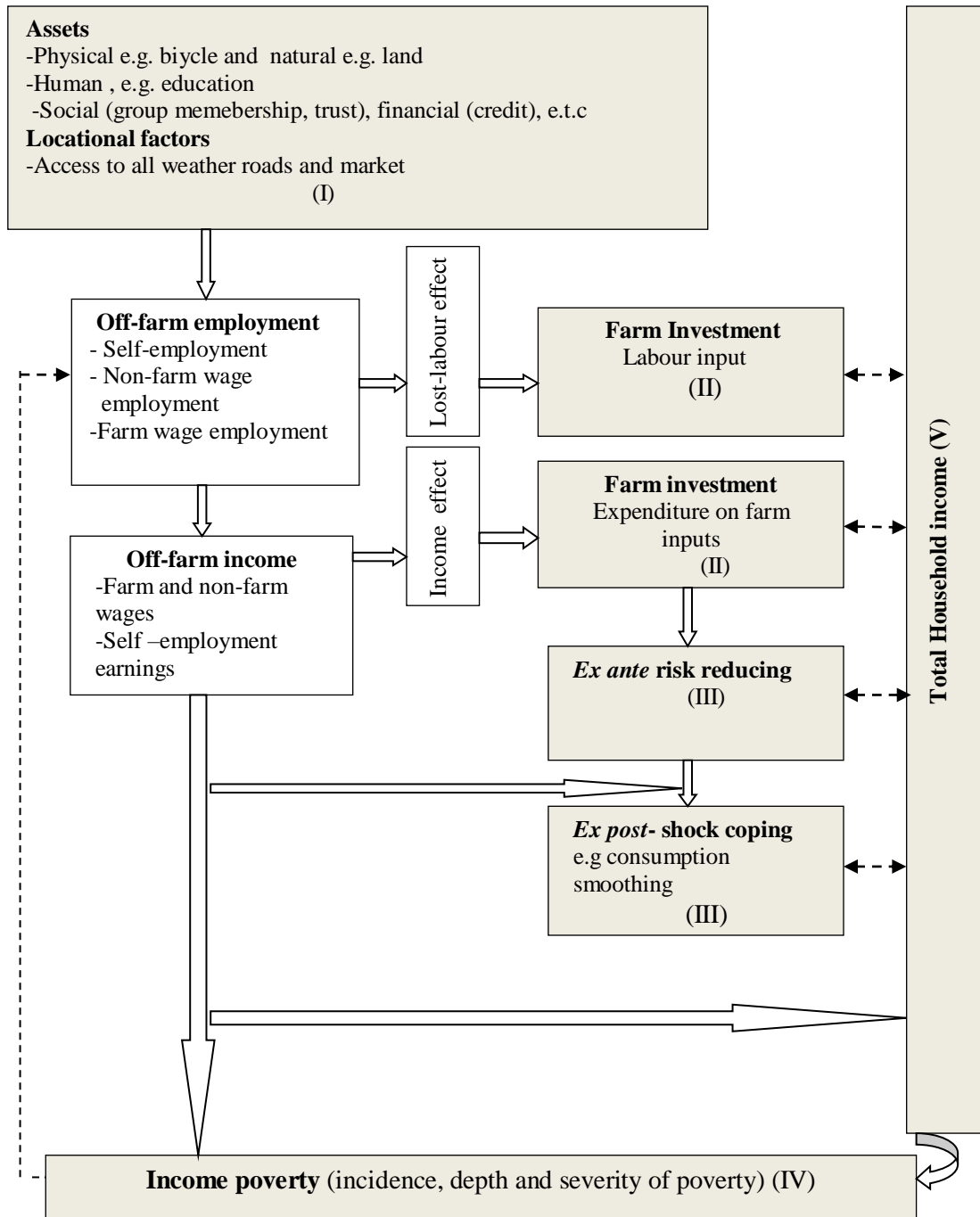
Figure 1.2:   Relationship between off-farm employment and farm investment, income shocks and income poverty

Note: The bold arrows depict relationships between dependent variables and explanatory variables. The dotted arrows show direction of implied associations that are not the focus of the present thesis. The numbers in the shaded boxes indicate the objectives addressed as described in sub-section 1.8.2

A related trajectory established in the conceptual framework is that of causality between off-farm income and income risks management. It is expected that off-farm income can act as *ex-ante* risk reduction or *ex-post* shock coping mechanisms. Thus, off-farm employment may lead to risk reduction and/or enable households to cope with transitory income shocks through consumption smoothing. *Ex post* and *ex ante* are linked in the sense that the strategy design for *ex post* may in a long run be an *ex ante,* thus reducing future uncertainty. For example, when households engage in farm wage employment during the season of income shortage they may use that income to smooth consumption while enhancing a household's ability to work and buy inputs for its farms.

Off-farm employment and income have been hypothesised to reduce income poverty for rural households (De janvry and Sadoulet, 2001; Lanjouw and Shariff, 2004; Idowu *et al*., 2011). Three income poverty parameters are relevant here: These are incidence, depth and severity of poverty as shown in Fig. 1.1. It should, however, be noted that there are separate off-farm categories whose effects on household income may vary. To consider this heterogeneity off-farm employment income has been treated based on its disaggregated categories as suggested in literature (Ruben and Van den Berg, 2001). These categories are farm wage, non-farm self-employment and non-farm wage as shown in Fig 1.2. One additional caveat is worth noting. So far Fig.1.2 depicts association between variables in an attempt to attain simplicity in empirical measurements. But, in practice, there are complex associations and intricate relations among variables when dealing with such a broad concept as off-farm employment effects. For example, there are cases of reverse causality in which

off-farm income may be a result of some attributes that were considered as independent variables, for example households income.

1.11 Hypotheses

Investigations that largely use deductive approach like the present study are usually founded on *a priori* premises and hypotheses that are based on theories. The hypotheses are then tested from the data and conclusions arrived at based on the tested hypotheses. In order to meet the specific objectives set earlier, four interrelated hypotheses were developed which are empirically examined in the subsequent chapters of the thesis.

1.11.1 Determinants of off-farm employment

Households' assets and incentive factors affect their engagement in off-farm employment as a diversification strategy (Reardon *et al.,* 2000; Reardon *et al.,* 2007). Generally, households differ in their possession of human (labour, skill, knowledge), financial and social capital. In terms of human capital, for example, Ellis and Freeman (2004) found that poorer households lacking education and specialised skills are compelled to diversify into low earning and low-return activities in farm and off-farm activities. Evoking social capital literature, Lanjouw *et al.* (2001) found that social groups, kinship networks and social trust in general define both individual and household incentives and constraints to engage in different off-farm activities. Social capital reduces transaction costs (Narayan and Pritchet, 1997) and is associated with credit access which may be used to finance non-farm self-employment activities. Accordingly, the present study assumes, under *ceteris paribus* a household's choice of engaging in a particular off-farm employment is a factor of

their endowment with different assets (which will also be referred to as capacity variables) and availability of opportunity for these off-farm employment (demand factor). Thus to sum up, the following hypotheses were set:

1a: *Capacity variables in terms of different assets that households possess are associated with a likelihood of engaging in non-farm self-employment and wage employment.*

Because of a particular attention to social capital, a second related hypothesis is set as:

1b: Households with a higher level of social capital are associated with an increased likelihood of engaging in non-farm waged employment, farm wages and non-farm self-employment activities.

1.11.2 Off-farm employment and income effect on farm investment

Previous studies (Pfeiffer *et al.,* 2009; Mathenge *et al.,* 2015) suggest that there is a linkage between farm and off-farm activities, i.e. outputs from one activity may be used as inputs for another. Hence, the following two scenarios are expected: first, households with off-farm income will have increased expenditure on farm input, which may enhance crop production. Second, income gained from off-farm activities may be directed to hire labour for the household's farms to compensate for labour withdrawal to off-farm activities. The first expectation is rooted in the literature on farm-off-farm complementariness (Reardon *et al.,* 2000; Pfeiffer *et al.,* 2009) and consumption theory, both of which suggest that, due to input credit/finance market failure households may rely on the income generated off-farm to invest in farming. Through this mechanism, households may improve their farm income and generate more income, thus reducing their income poverty levels.

The second expectation is based on the idea of lost-labour effect described by Hennessy *et al.* (2008) that some off-farm employments such as farm wage are reasonably labour intensive and households may have short labour supply. Although Mishra and Godwin (1997) contend that households should be able to use cash earned off-farm to hire labour during the time of intense labour requirement on their farm, this is not the reality for many rural farming households in Africa (Ellis, 2000). As regards the study area, the above observation by Ellis is of particular relevance as farm wage activities (which are dominant in some selected villages) have seasonal concurrence with farm activities, in which case labour competition may prevail. The hypothesis is set for the first expectation in which case estimation techniques will be used, whereas for the second expectation the qualitative data are largely inferred and thus no concrete hypothesis is set. Therefore, hypothesis 2 is set as follows:

Off-farm income is associated with increased investment in expenditure on farm inputs including labour.

1.11.3 The Role of off-farm employment in household's crop income shock reduction

Formulation of the third hypothesis is grounded with a premise that there are linkages between farm and off-farm employment. Thus, the hypothesis is formulated within the framework of this linkage combining with the risk management theory. In this case the crop income shock and seasonality are at the centre of the linkage. According to literature (Koshar, 1999; Porter, 2012; Cervantes-Godoy *et al.*, 2014), farm income tends to have seasonal variability. This means that off-farm income may offset this variability that may lead to undesirable reduction in household

consumption (shocks). Accordingly, from the risk management point of view off-farm employment is considered as an informal risk reducing strategy and a shock coping measure (Rose, 2001; Porter, 2012). Generally, households with off-farm income can for example avoid potential market related shocks of farm output price, which has seasonal fluctuation by selling their produce during the peak price season thus, reducing their exposure to seasonal crop income shocks. On the other hand, households may engage in off-farm employment with the mere incentives of smoothing their consumption during the season of low crop income. Hence, building from earlier studies (Ellis, 2000; Bryceson, 2002) that consider the risk mitigating role of off-farm employment and farm seasonality literature (Kwon *et al.,* 2006; Khandker, 2012) on the role of off-farm employment, the following is set as the third hypothesis:

Off-farm employment provides a buffer against transitory crop income shock.

1.11.4   Off-farm employment and households poverty status

Finally, the study's last hypothesis is based on livelihood literature (DFID, 1999; Ellis, 2000) as described in Fig 1.1. In this literature off-farm employment is considered as a livelihood strategy with a direct livelihood outcome in terms of income poverty reduction. Several studies (Lanjouw and Shariff, 2004; Idowu *et al.,* 2011) have empirically tested the linkage between off-farm employment and poverty in developing countries pointing to one and the same direction; that is, the positive contribution of off-farm income to the total income of the household. Generally, household's total income is related to a household's income poverty status. However, different off-farm employment categories may have different effects on

income poverty reduction. The details of disaggregation by off-farm employment/income categories are explored in chapter 5 which also conducts an empirical test for the hypothesis. Thus, for the purpose of this introductory section, a broad hypothesis is given which states:

Off-farm employment has a positive effect on total household income (Hypothesis 4)

1.12 Study Limitations

This research is based on cross-section data that involved a single field visit. Some of the questions in the questionnaire required respondents to give detailed accounts of their income and activities for over the previous year (12 months). This information was based much on recall data of income and activities conducted in different months. Generally, quarterly household income survey approach is mere suitable in generating more accurate data related to household incomes (Angelsen and Lund, 2011) and short term off-farm activities. However, this approach could not be followed due to financial constraints. Nonetheless, in case of one-shot surveys Angelsen and Lund (2011) recommended income data to be based on appropriately decomposed individual earning activities carried out over the previous twelve months. Thus, this study adopted the above approach. In addition, the limitation of recalling information was overcome by asking proxy questions for activities carried out in different months of the year. Where possible, effort was made to ensure the presence of both the household head and spouse during administration of the questionniare. The presence of both minimised recall errors as the items on household's income focused more on employment activities of the head of the household and the spouse.

1.13 Overall Description and Organisation of the Thesis

The thesis is organized into 6 chapters. With exception of Chapters 1 and 6, each of the other chapters is organised into a publishable manuscript. Chapter one introduces the context of the study and provides a rationale for undertaking the study and its objectives. These objectives are separately addressed in appropriate chapters with the exception of the two last objectives which are combined in one chapter. The broad theoretical framework and hypotheses are also addressed in chapter one. Chapter two presents the first research objective that examines factors that influence a household's engagement in off-farm employment activities. Chapter three addresses the second specific objective which explores input effect of off-farm employment. This is followed by chapter four that addresses the third objective on the effect of off-farm employment on crop income shocks. Chapter five, on the other hand, examines the link between off-farm employment and poverty which is the subject of the last 2 objectives. Lastly, Chapter Six presents the conclusion of the entire analysis of the thesis and the policy implications of the findings.

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CHAPTER TWO

2.0 Determinants of Households' Engagement in Off-farm Employment in Kilombero Valley, Tanzania

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2.1 Abstract

Off-farm employment can be an effective strategy to deal with uncertainty of income associated with subsistence farming households, and thus improving households' welfare. This will, however, depend on households' ability to overcome barriers associated with off-farm employment engagement. In recognition of these barriers, this study was set to examine the relative importance of off-farm incomes, and investigate households capacity and the constraining factors that determine their engagement in off-farm employment. A cross-sectional household survey from a

multi stage randomly selected sample of 309 households in Kilombero Valley, Tanzania was used. Descriptive statistics and logit regression model were used to examine the relative importance of off-farm income and determinants of off-farm engagement respectively. The findings show that off-farm income generally has relatively more income contribution among well-off households than the poor households. The poor seem to heavily rely on farm income instead suggesting inequality in off-farm income distribution. On the other hand, empirical estimation underscores the role of social capital as a household's capacity variable in influencing off-farm engagement. Results further show that social trust and group membership, as social capital dimensions, are positively associated with engagement in off-farm employment. Other statistically significant variables that explain off-farm engagement were age of the household head, credit access, education and access to an asphalt road. The study recommends that decision-makers and stakeholders concerned with the question on how to increase the engagement in off-farm employment in rural areas, should adopt mechanisms that take into account households' social capital for farmers' successful engagement and thus improvement of their household income.

Key words*: Social capital, Off- farm employment, Off-farm income, Kilombero Valley*

2.2   Introduction

Agriculture is still the main source of employement in rural areas of the developing countries. However, the sector's capacity the sector's to sustain livelihoods is limited because of insufficient agricultural land and low input use (IFAD, 2012). As a

consequence of the above off-farm employment can potentially provide cash to finance farm inputs, smooth intra-seasonal income variations, and enhance household income. Nevertheless, the feasibility of this potential depends on the ability of the poor to access opportunities for self employment and rural off-farm wage activities (Haggblade *et al.,* 2010). Hence, understanding determinants of off-farm employment and its pattern of income contribution has important policy relevance.

Accordingly, studies (Brycesson, 1999; Reardon *et al.,* 2000; Haggblade *et al*., 2007) in developing countries have reported increased contribution of off-farm income to total household income. A more recent survey set the contribution of nonfarm income to be roughly 35%[3] of rural households' incomes in Africa, and 50% in Asia and Latin America (Haggblade *et al*., 2007). Despite the increasing importance of off-farm income fewer people (9%) engage in the off-farm employment sector in Africa compared to Asia and Latin America with participation rate of 9% and 24% respectively (Haggblade *et al.,* 2007).

Off-farm employment according to Haggblade *et al*. (2007) refers to income earning activities that take place 'off' the owner's own farm and broadly include wage employment on other people's farms along with non-farm activities from the owner's non-farm enterprises or from non-farm wage employment. In the same conceptual understanding, off-farm income includes both non-farm income from non-farm-self employment (e.g. own enterprises) and wage earnings in agriculture and non

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[3]These statistics do not consider farm wage income in which its income contribution will be considered as off-farm income in this study.

agricultural activities. In some literature (e.g. Ellis, 2000; Ruben and van den Berg 2001), the term has been synonymously used with non-farm employment.

Apart from the direct income effect, off-farm activities enable households to lower risks and smooth consumption in situations where agricultural activities are associated with higher levels of risks and income uncertainties (Brycesson, 1999; Kazungu and Guuroh, 2014). The investment effect of off-farm income in enhancing farm input expenditure has also been recognised (Reardon *et al.,* 1994; Ruben and van den Berg, 2001, Pfeiffer *et al.,* 2009). Despite these potential benefits, poor households are handicapped in relation to engagement in some high return off-farm activities due to lack of financial, human and physical assets status. For example, skills requirement is important for earning a skilled rural wage employment whereas poor credit access may constrain rural households to take up activities that require initial investment and working capital (Ellis, 2000; Reardon *et al.,* 2000; Barret *et al.,* 2001). Poor households may thus limit themselves to low return/low earning acties e.g. farm wage activities whose income contribution may be less significant. Moreover, the likelihood is of different effects on these initial requirement for engaging in off-farm employment between agro-ecological and agriculture potentiality of an area due to farm and off-farm linkages. For example, some factors may be more dominant in less agriculture potential than in high agriculture potential areas.

In Tanzania, poverty reduction related policies that address rural livelihoods do not actively boost the growth of diverse activities, including those related to off-farm

employment (Ellis and Mdoe, 2003). For instance, even Tanzania's Development Vision 2025 does not explicitly describe the role of the off-farm sector in fostering rural development (URT, 2011). This may probably be caused by the dearth of empirical information on the necessary conditions for development of the off-farm sector in diverse rural areas of Tanzania. In terms of the rural development policy a better understanding of determinants of off-farm employment may yield useful insight for targeting pro-poor policies in an attempt to enable households to successfully diversify their income sources. An example would be to isolate a policy that may favour growth of off-farm sector even in areas that are considered to be in favourable agro-climatic location such as the Kilombero Valley. It has indeed been found that off-farm employment is adopted in the study area as adaptation to climatic stresses (Balama *et al.*, 2013).

To address the above mentioned concerns three objectives were set: firstly, as a prelude to further analysis, the types and patterns of off-farm employment in the study area are described. Secondly, an assessment of the structure of households' income distribution and relative importance of off-farm income across income strata and village locations was carried out. In this objective the intention is to ascertain whether the relative importance of off-farm income is differentiated on the basis of households income wealth and a household's location (i.e.village of residence). Generally, literature does not give conclusive results on the relationship between off-farm income and households' wealth. For example, Adams (1994) shows that off-farm income is more important to the poor households than to the well-off households in Pakistan whereas Reardon *et al.* (1992) shows the opposite trend in

Burkina Faso. This divergence shows the need to conduct more locational specific studies that recognise socio-economic and agro-ecological heterogeneity as attempted by the present study. Lastly, determinants of household engagement in off-farm employment are examined. These determinants are examined based on households' capacity factors with particular emphasis on social capital variables. This is motivated by the fact that, social capital as one of the important capital assets which does not easily lend to tractable measurement has received little attention in off-farm literature (Gordon and Craig, 2001; Lanjouw *et al.,* 2001). The study proceeds by presenting an overview of literature on the determinants of off-farm employment in section 2.3. Section 2.4 provides a description of the study area and the methodology employed. Results and discussions are presented in section 2.5 while conclusions and their policy implications are presented in Section 2.6.

2.3   Literature Review

There has been considerable attention devoted to the analysis of determinants of engagement in off-farm employment in literature. Building from Reardon *et al.* (2007), a household's decision to engage in off-farm employment may be examined based on two sets of factors, namely i) household incentive variables and ii) capacity/ability to engage. The former is triggered by intrinsic individual motivations, which relate to a household's survival or accumulation needs. When off-farm engagement is in response to agricultural risks and shocks then the incentives are related to distress *push* motives, where as *pull* motives dominate when engagement is geared towards income accumulation (Barret *et al.,* 2001; Reardon *et al.,* 2000; Reardon *et al.,* 2007). On the other hand, capacity factors which are the

main concern in this study, consider a households possession of a number of physical, social and capital assets that would determine the ability to partake off-farm employment.

The role of human capital variables such as education has been recognised in a number of studies (Yunez-Naude and Taylor, 2001; Fafchamps and Quisumbin, 2003; Nagle and Yunez-Naude, 2014). According to Yunez-Naude and Taylor there is a positive association between secondary school education of the head of household and engagement in both non-farm self employment and wage employment in Mexico. The authors observed the same relationship when education was measured in terms of schooling years. In another study conducted in Asia, Fafchamps and Quisumbin (2003) observed that individuals who are better educated are more likely to work off-farm as self employed and less likely to work as casual workers. This shows that rural wage employment is negatively associated with education. On the other hand, the effect of age as another human capital variable yields a mixed results; while some studies noted a positive effect of a household head's age in participation (Beyene, 2008), others for example, Ruben and van den Berg (2001) and Nagle and Yunez-Naude (2014) in Honduras and Malawi respectively observed aging to be negatively associated with off-farm engagement.

Generally, engagement in off-farm employment is not only explained by households' capacity factors but, also could be influenced by some locational characteristics that go beyond its control. For example, studies conducted in Tanzania, Lanjouw *et al.* (2001) and Mduma (2014) specifically established a causal relationship between proximity to asphalt road and access to electricity and off-farm business. However,

Lanjouw *et al*. (2001) observed these locational factors to have no influence whatsoever on non-farm wage participation. Presence of good roads generally increase demand for off-farm activities. It is thus expected that selected villages in the Kilombero Valley, the study area, which are differently endowed with infrastructure may differ in relation to households engagement in off-farm employment.

Notably, rural households are mostly poor with the more tangible capacity variables so far described. As a result, poor households may not benefit and earn substantial income from off-farm activities. Nonetheless, social capital can be an important asset for the rural poor. According to Narayan and Pritchett (1997), social capital means 'the quantity and quality of associational life and related social norms'. Membership to associations and norms can enhance a household's engagement in different off-farm employment activities in terms of access to credit or information. A review of studies conducted in Uganda and India by Wandsschneider (2003) showed the useful role of social capital in enabling individuals to access relevant market information and buyers, wage employment and business opportunities, formal and informal loans, cash advances, inputs on credit, skills, shared resources for production and marketing, and migration opportunities. Positive roles of social capital have also been reported elsewhere in developing countries (Narayan and Pritchet 1997; Lanjouw *et al*., 2001; Isham *et al*., 2002). However, data on social capital are rarely available, and hence few studies have tried to measure quantitatively the impact of social capital on rural non-farm employment and Income (Lanjouw *et al.,* 2001; Wandsschneider, 2003).

The current study emphasises on the role of social capital and based on the social capital theory (see Coleman, 1988; Narayan and Pritchet, 1997) where it assumes that, in the rural areas of developing countries such as Tanzania, social capital in terms of association and social norms is critical. It is through these associations in forms of, for example, membership to groups that households can access credit to finance off-farm enterprises. In addition, these networks also lower transaction costs. Even for wage related employment, social capital may be an important source of information for their availability.

Despite a handful of studies examining determinants of off-farm employment elsewhere in sub-Saharan Africa (Ellis, 2000; Beyene, 2008; Nagler, and Yunez-Naude, 2014; Nasir, 2014) and Tanzania in particular (Katega and Lifuliro, 2014; Mduma, 2014); there is a dearth of empirical investigation on the effect of social capital on off-farm employment. The study that has particularly paid attention to social capital in Tanzania (Lanjow *et al.,* 2001) was conducted in peri-urban areas of Tanzania. Yet, it is an established fact that social capital is strongly rooted in rural areas which are deprived of financial and other tangible assets. This study thus contributes to the broader understanding of the determinants of off-farm employment by paying particular attention to social capital by describing both its structural and cognitive domains.

2.4   Study Area and Methodology

2.4.1 The study area

The study was conducted in Kilombero Valley which is located in Kilombero and Ulanga Districts in Morogoro region, Tanzania. The Valley is located about 300km South-East of Tanzanian's commercial city of Dar es Salaam. There are a total of 108 villages in Kilombero Valley with 72 villages in Kilombero district (Siima *et al.,* 2012) and 36 villages in Ulanga district. The study area contains the largest freshwater wetland a at low altitude (< 300m above sea level) in East Africa and one of the largest flood plains in Africa (Kangalawe and Liwenga, 2005) implying favourable agro-climatic conditions. The majority of households (95%) in the valley rely on subsistence paddy farming. Other crops grown include maize, sesame, banana and sugarcane. Despite being a productive wetland, farming opportunities are severely affected by rainfall variability, poor infrastructure and lack of market opportunities, resulting into relatively low cash income earnings among farmers in the study area compared to other wetlands in Africa (McCartney *et al.,* 2010). As a Consequence, the above creates a necessity to seek off-farm earning opportunities. The selection of the study areas is also motivated by the implicit assumption that off-farm employment was relevant in areas with poor agro-climatic conditions. Thus, the relevance of this assumption needed to be proved in favourable agricultural area of the Kilombero Valley.

2.4.2   Data collection

The investigation was conducted from February 2014 to May 2014. The study used primary data collected through survey. The questionnaire enabled collection of

information on households' socio-economic characteristic, their off-farm engagement, and their possession of various assets. For social capital items data on structural social capital were captured based on information on a number of social groups the head or the spouse was involved in. For cognitive social capital, information on perception of trust and cohesion was sought.

2.4.3 Sampling

The study's population was all paddy farming households in Kilombero Valley. The sample for this study consisted of 324 households whose selection strategy involved a series of multi stage, purposive and random sampling. The first stage involved purposive selection of 5 villages[4] (Fig. 2.1) that represented socio-economic and land resource endowment characteristics of the study area. Two villages of Mwaya and Lumemo were chosen to represent accessibility in terms of better road infrastructures, whereas, the other three villages, Mngeta, Lupilo and Malinyi represented poor road infrastructure with poor seasonal roads as shown in Fig. 2.1. The next sampling stage involved Participatory Wealth ranking (PWR) and stratification of households at the level of sub-villages (hamlets) into three groups (see Appendix 6). With the exeption to Mngeta where 2 sub-villages close to the rice plantation (KPL) were purposively selected, selection of two subvillages in the other villages was random. The selection was purposive in mngeta since the aim was to have reasonable number of households who engage in farm labour in the plantation. From each wealth rank group, the proportional to size sampling technique was

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[4] There are a few agro-pastoralists migrant households in three of the sampled villages (Mngeta, Malinyi and Lupilo), but the purpose of investigation was on households engaging in and obtaining substantial income from farming. Thus, agro-pastoralist households were not included in the sample. Hence, the representativeness of the sample is only claimed for non-agropastoralist households.

carried out to select households. The rationale of PWR was to avoid biased sampling of households with a particular level of welfare. The village register available from each village and sub-village was used as a sampling frame.

Due to missing information from 15 households this study used 309 households. The final sample size used was based on a sampling intensity of 5% in each village which resulted in the following distribution: Mwaya (54), Lumemo (69), Lupilo (67), Mngeta (56) and Malinyi (63). In order to attain representativeness, Bailey (1994), recommends a randomly drawn sample to have at least 5% of of the total population.
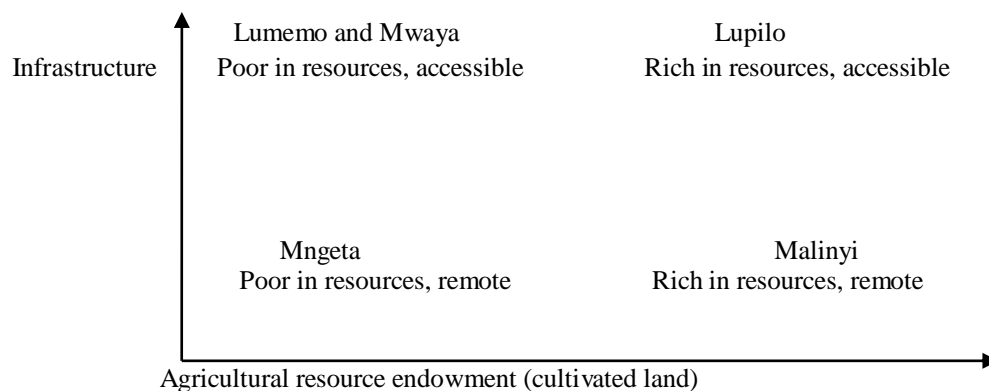
Figure 2.1. Village locations basing on comparative advantage

2.4.4 Variables and measurements

As already defined, off-farm employment is engagement in a wage or enterprise income generating activity outside one's own farm. In this study, if the head or the spouse is engaged in any off-farm employment apart from 'own' farm work, the household is considered as engaging in off-farm employment. To refine the measure, if a household engages in a number of multiple farm wages and self employment,

then an optimal decision of considering the most dominant activity in terms of income contribution and time spent was made. This ensured a household was allocated to only one discrete choice as the requirement of the analytical (Logit) model used.

According to literature, Ellis (2000) and Reardon *et al.* (2001), household's ability to engage in any of the off-farm employment is determined by its capacity and constraints in terms of number of assets (capitals) Four sets of explanatory variables representing different kinds of assets as expounded in different variants of sustainable livelihood framework (SLF) are used. Households' human capital was captured by the household head's age and the number of working adults. Education level of the head was also included and measured by number of schooling years. For physical capital endowment, the total farmland owned and the total farmland cultivated were used. As in Beyene (2008) dummy variable, whether a household had access to credit was used as a proxy for endowment with financial capital. This variable is closely related to social capital.

Social capital measures involved three separate indicators; these are membership density, social cohesion and social trust. Membership density represents structural social capital and was measured by number of associations the households head and spouse belonged to. For social cohesion and social trust, the tool developed by the World Bank (WB) (2004) for measuring social capital in developing countries was used. Social trust was meant to imply a household head's perception of trust towards fellow villagers and government leaders; three items representing each sub indicator

were used: The first item measured trust towards fellow villagers and the second and the third items were for village and central government leaders respectively. Each of the items had a score ranging from the highest level of trust '5' to lowest level of trust '1'. Then three items were aggregated to form a single household's level index for social trust. The total index accumulation of the social trust score as additive of the highest level scored on all three items was thus 15 and the lowest was 3. The same procedure was used to measure a household head's perception of social cohesion which was also captured by three items. For each item a score of '5' was meant for perception of high level of unit and '1' extreme conflict. Finally, two dummies to control for variations in connection to electricity and presence of an asphalt road across the villages were specified in the model. The presence of these infrastructures is expected to create demand and a conducive environment for off-farm opportunities.

2.4.5 Computation of adult equivalent values

Measuring income by expressing it in per capita terms does no reflect robust comparative figures across households. Following the procedure by Collier *et al.* (1990) income is expressed per adult equivalent. Through this procedure sex and age of all household members were determined. Then the adult eauivalent scales for East Africa (presented in Appendix 7a) were used obtain adult equivalent units (AEU) for each member. The next step was to adjust AEUs to economies of scale by multiplying adult equivalent units by average costs (See Appendix 7b). AEUs were then set as denominators for calculating values (income) per adult equivalent in relevant households.

2.4.6 Model of off-farm employment engagement

Off-farm employment was modelled based on the two binary choices which are 'engaging' or not engaging (i.e. the so called 1-0 dependent variable. '1' indicated the household was engaged in off-farm employment while 0 indicated it was not). This being the case, as in Ruben and Van den berg (2001) and Yunez and Taylor (2001), the logit model that considers engagement in terms of probability was found appropriate. Three separate models each representing one category of dependent variable, which are non-farm self employment, farm wage and non-farm wage were run. The model for non-farm wage was not significant and thus left out from further analysis.

The model was represented by:

$$log\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \varepsilon$$

Where; Log [p/(1-p)]= Natural logarithm of the odds of probability of engaging in off-farm employment

β_0, β_1, β_2, β_3, β_4, and β_5 are parameters to be estimated and ε is the error term

The explanatory variables x_1, x_2, x_3, x_4 and x_5 were as follows:

x_1 = a vector of human capital, such as education and households size

x_2 = a vector of physical capital, such as farmland holding

x_3 = a vector of financial capital such as access to credit

x_4 = a vector of social capital represented by membership density, social trust and social cohesion

x_5 = a vector for village level attributes, eg access to electricity

ε = an error term

2.5   Results and Discussion

2.5.1 Socio-economic characteristics of households

A summary of statistics of selected variables is presented in Table 2.1. Some of the variables have been included in the specification of the model (Table 2.5) presented further on. The independent sample t-test (last column) was used to test the difference of means for the variables measured at the interval scale. The results show that the total income for households with off-farm sources was significantly higher (p ≤ 0.01) for households with off-farm employment compared to those without. On the other hand there seems to be a lack of significant difference in farm income between the two groups. The implication of this particular observation is that, households engagement in off-farm employment has little effect on significantly improving their farm incomes signifying little farm off-farm production linkage as established in literature (Reardon *et al.,*1996; Pfeiffer *et al*., 2009).

On ownership of farmland, which is the most important physical asset, the results (Table 2.1) show lack of significant statistical difference between households with and those without off-farm income. The average farmland holding was 1.5 ha. This is slightly similar to a land ownership of 1.2 ha reported by Balama *et al.* (2013) in another study conducted in Kilombero Valley. As a proxy for a household's level of human capital, the mean number of working adults was less than 3 while total household size was about 5. Demographically, this shows the study area has a young population structure, which is typical for developing countries. It may also signify that households face labour constraints which limit labour availability for off-farm employment. There is however no significant difference between the two

employment categories with regard to household size and number of adults. On the other hand the age difference between the two groups was significantly different at p ≤ 0.01, with relatively higher age for households without any off-farm employment. This may indicate being young enhances off-farm participation, this is further examined in the model estimation section (subsection 2.5.5).

Three variables representing social capital deserve some attention as they are of main interest in the empirical estimation in section 2.5.5. Households seem to have a significant difference in their perception of trust and social cohesion with households engaging in off-farm employment displaying considerably higher levels of both the index variables. The implication of this is that trust levels enhance a household's ability to engage in off-farm employment compared to farming only households.

Further to the above, the t-test statistics indicated a significant (p ≤ 0.01) difference in terms of membership to groups between off-farm and non off-farm engaging households. Households with off-farm employment have joined more social groups than those without. Membership may be a source of credit that may enable households to respond to off-farm opportunities, for example, in securing capital for business particularly in an environment where formal credit markets are poorly functioning. Lastly, the results show that households with off-farm employment are more predisposed to demand pull factors such as roads that may facilitate and create opportunities for vibrant off-farm opportunities. About 60% of households with off-farm employment were located in areas with access to asphalt road which ensure connectivity that improves rural-urban linkage; an attribute that fosters growth of the rural off-farm sector.

Table 2.1: Descriptive statistics of socio-economic characteristics of the households

Variable	All households (n=309)		Households with off-farm employment (a) (n=220)		Household without off-farm employment(b) (n=89)		t-test statistics (a vs b)
	Mean (percent)	S.D	Mean (percent)	S.D	Mean (percent)	S.D	
Total household income[5] (Tshs)	1 137 046	1 920 335	1 353 413	2 188 695	586 064.2	689 340.7	-3.18 ***
Farm income (Tshs)	425 222.3	606 633	414 879.2	606 271.1	450 782.1	610 206.3	0.47
Landholding under cultivation(ha)	1.04	1.12	1.0	1.1	1.1	1.15	0.68
Landholding owned (ha)	1.5	1.5	1.5	1.4	1.7	1.5	1.21
Household head's age	47.5	14.7	43.3	0.39	51.9	1.72	4.8***
Household size	4.9	1.9	4.9	1.7	5.0	2.2	0.66
Number of working adults	2.7	1.5	2.7	1.5	2.7	1.7	0.05
Social trust	6.4	2.5	7.0	2.2	4.9	2.6	-6.89***
Social cohesion	5.9	1.8	6.2	1.8	5.6	1.9	-1.98***
Membership to association	1.5	1.5	1.8	1.6	1.0	1.4	-3.73**
Access to credit (%)	30.5	-	37.1	-	23.6	NA	NA
Male headed households (%)	71.5	-	73.0	-	70.9	NA	NA

NB: **, and *** represent significant levels at p equal to 0.05 and 0.01 levels respectively; The test statistics is between groups 'a' and 'b', S.D = standard deviation

2.5.2 Pattern and rate of engagement in off-farm employment

As it has been described, off-farm employment broadly involves wage employment and self-employment (own business activities). Wage employment was further broken down into non-farm wage and farm wage. The description of activity types is shown in Table 2.2. Generally, data showed that about 71% of the households had at least a household head or spouse engaged in one of the three off-farm broad categories. This percent is slightly similar to the rate of participation of 69.5% reported by Katega and Lifuliro (2014) in the semi-arid region of Tanzania. Most (58.2%) of the households engaged in non-farm self-employment activities. Non-

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[5]All income computations are based on Tanzanian shillings (Tshs) per adult equivalent: 1US$ was on average equivalent to 1 635 Tshs during months (Feb 2014-May 2014) of data collection.

farm self-employments as depicted in Table 2.2 includes petty trading (including selling of processed foods, brewing local alcohol and food vending, trading of grain mainly rice. Other non-farm self employment activities reported were selling of fuel wood selling, brick making and charcoal making and selling. This group also included shop ownership and skilled handicrafts work.

The proportion of households that were mainly engaged in non-farm wage employment was 15% whereas farm wage constituted 23.5% of all off-farm employment. Activities under non-farm wage employment, were further categorised into salaried professional employment (Teachers, government workers and administration) and skilled labourers, i.e. those employed in manufacturing enterprises such as carpentry and operating rice milling machines. There were also unskilled wage laboures including security guards. As presented in Table 2.2, the share of farm wage employment group could not be separated between farm wage in plantations and farm work on other people's farms due to the observed high rate of switching between these activities during the farming season. For example, in a single day, one might start plantation work and move to another farm late in the evening. This was particularly observed in Mngeta where Kilombero Rice Plantation (KPL) is in close proximity to the village. There are two other large scale plantations that employ farm labourers in Kilombero. These are Illovo Kilombero Sugar Company located close to Mwaya and Kilombero teak company in Lupilo village.

Table 2.2: Off-farm employment activities types (n=220)

Off-farm functional category	Activity Type	Frequency	Percent
Non-farm self employment (n=128)			58.2
	Petty trading	19	8.6
	Agricultural trading (excluding own produce)	15	6.8
	Kiosk and shopkeeping	14	6.3
	Fish product selling	12	5.4
	Fuel wood/charcoal making and selling	10	4.5
	Masonry	10	4.5
	Commercial motorcycling	8	3.6
	Bicycle renting	8	3.6
	handcraft	8	3.6
	Food processing and selling	8	3.6
	Carpentry/tailoring	7	3.2
	Hair dressing /barber	5	2.3
	others	5	2.3
Non-farm wage employment (n=40)			18.2
	Unskilled e.g security guards	15	6.8
	Skilled workers, e.g driver	14	6.3
	Professional e.g teacher	8	3.6
	others	3	1.4
Farm wage employment (n=52)		52	23.5

2.5.3 The income structure and relative importance of off-farm incomes

This section examines the income[6] structures of households disaggregated by income quartiles. The interest is on relative contribution for off-farm employment income sources. Overall results in Table 2.3 show that about 60%[7] of the households' income is earned by sources from off-farm activities. This value is comparably higher relative to the contribution rate of between 30-35% reported in developing countries by Hagglabade *et al.* (2007). The reported rate is not surprising, generally Kilombero has a good agro-climatic condition which creates more opportunities of off-farm opportunities. According to literature (Loening *et al.,* 2008; Reardon *et al*., 2007;

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[6] All income measures consider the estimated average income obtained in the year prior to the survey. It was computed as gross revenue minus costs for inputs and external labour for farm and self-employment income. For wage employment, remittance and other incomes was based on the yearly average of monthly earning obtained over the same period.

[7] Generally the price of paddy (rice), the main tradable crop in study area was relatively low in the year 2013. Consequently, the off-farm income share in the survey year was higher than it would have normally been.

Mathenge *et al*., 2015) off-farm employment prospers in areas with favourable agriculture conditions. The results in Table 2.3 and Fig. 2.2 further show that the share of non-farm self-employment income of 32% in total off-farm income was relatively higher compared to other off-farm employment categories. The farm wage had the smallest contribution, a feature that underscores the expected lower earnings from this activity. For the farm income the income from paddy was by far larger than the income from other crops and livestock earnings combined. This finding was expected, considering the dominance and importance of paddy as a staple foof and a main cash crop in the study area.

At disaggregated income levels, the results show a marked difference in the contribution of off-farm income across the income groups. Three important patterns can be gleaned from Table 2.3 and Fig. 2.2. First, for the poor households, the relative importance of farm income was much higher than it was for the less poor households. This may imply that for these households, engagement in off-farm employment may simply be a survival strategy responding to farming risks and not geared towards income accumulation. Conversely, compared to the higher wealth quartiles, the poor (first quartile) derive relatively more income share from farm wages. This finding is consistent with Lanjouw and Shariff's (2004) study in rural India whereby the relative importance of agricultural farm wage was observed to decrease linearly with increasing household income.

The second notable observation is that; non-farm self-employment income seems to dominate income of the highest income quartiles. This is expected as this category involves business operations that require start-up capital as a capacity variable, in

which the income poor cannot afford. This suggests that, capital is a barrier for the rural poor to take up opportunities and benefit from off-farm diversification activities in rural areas as observed by Ellis and Mdoe (2003) in rural Tanzania and Nasir (2014) in rural Ethiopia. Overall, the share of off-farm income increases with increasing household total income, implying a linear relationship, a finding that supports the observation made by Van de Walle and Cratty (2004) in Vietnam using panel data. A different trend of relationship though was reported in cattle dominated livelihoods in North-Western Tanzania by Dercon and Krishna (1996) who found the proportion of non-farm self employment income to be higher for the income poor groups than for the less poor income group. This is probably because the rich have more access to cattle and thus earn more from the cattle products which is a fundamental asset determining the livelihoods in the area. Other studies conducted in rural Asia by Adams (1994) and Lanjouw and Shariff (2004) found a U-shaped relationship between non-farm income share and asset and income wealth indicators.

Generally, the data on income distribution indicated different income portifolios of households in Kilombero valley. Households in low income quartiles appear to largely obtain the greatest proportion of their income from farm activities rather than off-farm actities in general, whereas the income richer households earn relatively more from off-farm incomes. Thus, it is important to investigate the determinants of engagement in different categories of off-farm employment as these may have an implication on households' off-farm incomes.

Table 2.3: Income portfolio by income quartiles (proportions of household incomes in %)

Income category	All households	Income quartiles			
		First (n=78)	Second (n=77)	Third (n=77)	Fourth (n=77)
Total farm income	39.1	79.1	56.8	45.2	32.7
Income from paddy	32.6	67.1	47.6	37.8	27.2
Income from other crops	6.5	11.9	9.1	7.4	5.5
Off-farm employment income	60.8	20.9	43.3	54.8	67.3
Farm wage income	1.6	6.4	6.9	3.3	0.1
Non- wage farm income	10.0	0.3	6.4	6.8	11.9
Self employment income	49.3	14.1	29.9	44.6	55.3
Remmitance income	2.2	7.1	6.4	5.2	0.5
Other income	2.3	0.9	4.0	2.1	2.1
Total income (mean)	1 137 046	178 065.1	458 259	877 511	3 046 966

Note: income computation is based on Tanzanian shillings (Tshs) per adult equivalent: The first income quartile represents the poorest income group amd the fourth, the richest. n=309.
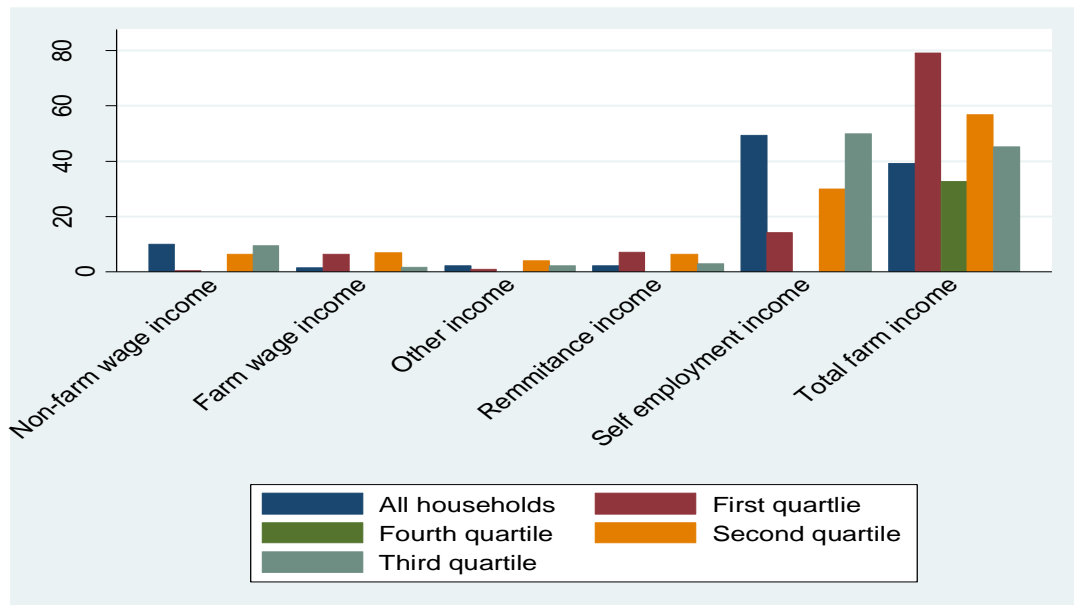
Figure 2.2: Income portfolio by income quartiles (proportions of household incomes in %)

2.5.4 Income structure across villages

Income data were further disaggregated into village sub-samples as shown in Table 2.4. The results in Table 2.4 reveal some variations in relative importance of off-farm incomes across study villages. For the purpose of this section, more attention is paid

to off-farm incomes. Starting with Lumemo, off-farm income contributed about 80% of total household income which was the highest across all villages. This may indicate a comparative advantage of this village's location (see Fig. 2.1), as it is more developed in terms of electricity and road infrustructure. These features apparently enhance both market and opportunities for both self-employment and wage employment (Mduma, 2014) and subsequently earnings for those who participate. The largest contribution (about 36%) of off-farm income sources in Lumemo was obtained from non-farm self-employment with only 2.1% obtained from farm wage. Lumemo also largely reflect features of Mwaya where as Mngeta is more or less similar to Malinyi and Lupilo.

Table 2.4 and Fig. 2.3 further reveal that farm wage had the largest income contribution in Mngeta than other villages. This comes as no suprise because the majority (52%) of farm labour in Mngeta are employed in the plantation which offers a more remunerative wage than farm work on other farms. The minimum wage paid by the plantation was 3,800 Tshs (2.3US$) per day which was about two times higher than what one gets for a similar task on other farms. From a policy perspective, this finding may indicate the need to create a conducive environment for growth of plantations agriculture, doing so may act as an important demand-pull factor and reliable income source for rural off-farm employment in the area with favourable agro-climatic conditions as Kilombero

Table 2.4: Income share across study villages (n=309)

Income category	Income quartiles					
	All household (n=309)	Mwaya (n=54)	Lumemo (n=69)	Lupilo (n=67)	Mngeta (n=56)	Malinyi (n=63)
Total farm income	39.4	53.7	20.6	45.3	52.3	43.1
Income from paddy	32.6	45.3	14.7	39.5	46.7	35.6
Income from other crops	6.4	8.4	5.8	5.7	5.6	7.4
Off-farm employment income	60.6	46.3	79.4	54.7	47.7	56.8
Farm wage income	1.5	1.9	0.8	2.1	2.8	0.6
Non- wage farm income	9.9	13.1	14.7	9.6	7.3	1.4
Self employment income	49.1	31.3	63.8	42.9	37.5	54.8
Remmitance income	2.2	0.6	2.3	5.2	0.5	3.0
Other income	2.4	2.5	1.9	6.8	1.6	0.4
	Participation rate by village (%)					
Farm only	28.8	25.9	24.6	34.3	19.6	38.1
Off-farm employment	71.2	74.1	75.5	65.7	80.4	61.9
Farm wage employment	23.5	25.0	17.3	9.1	40	28.2
Non-farm wage employment	18.2	17.5	17.3	29.5	15.6	10.6
Non-farm self employment	58.3	57.5	65.4	61.4	44.4	61.5
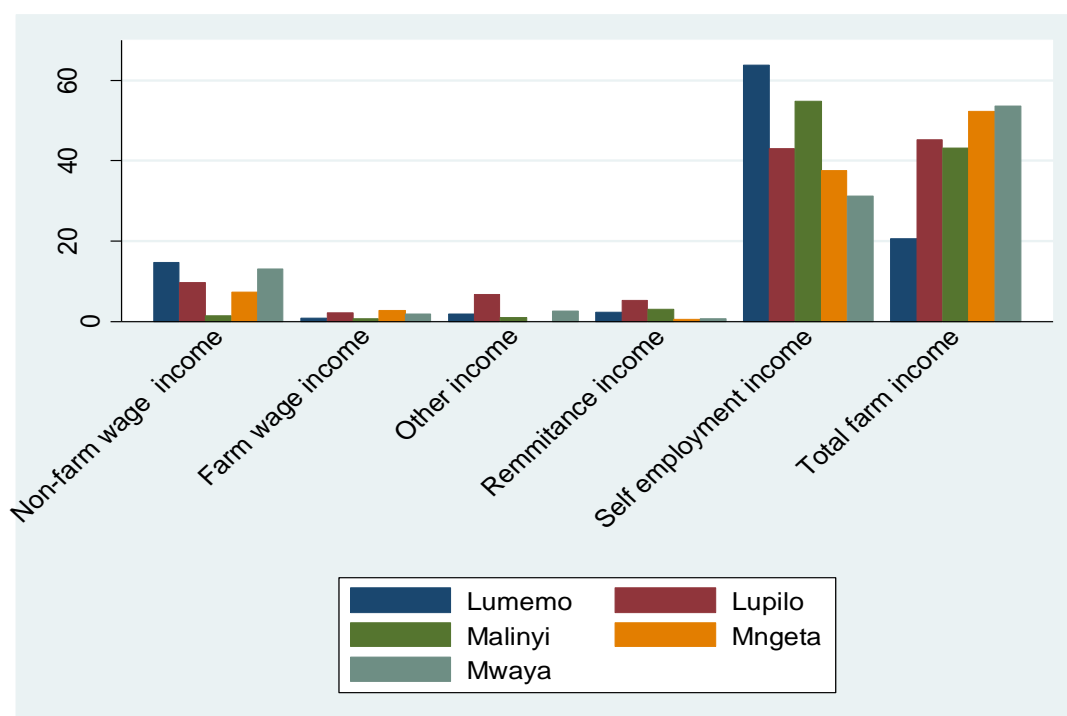
Figure 2.3: Income share across the study villages.

2.5.5 The Influence of capacity variables and location factors on off-farm employment

This section provides a detailed analysis of the correlates of households' engagement in off-farm employment. At first all three off-farm categories were set as dependent variables using the same set of covariates vector described under the methodology section. The model for non-farm wage, however, had a limited explanatory power. The results are displayed in Table 2.5 with model diagnostic tests presented in the last two columns. The diagnostic test generally confirmed the appropriateness of the logit regression used for the two estimations. The probability level (P $\leq$ 0.001) indicates the overall models are significant at 1%. Logit model involves non-linear estimation techniques, and thus coefficient of estimation results cannot have a direct interpretation. The interpretation is thus based on the marginal effect which is a post estimation procedure in logit model available in STATA (version 13) analysis software.

The results in Table 2.5 show that social capital variables were generally useful in explaining a household's off-farm participation. Social trust was positive and significant (P $\leq$ 0.078) and (P $\leq$ 0.006) in non-farm self-employment (NFSE) and farm wage (FWE) models respectively. The effect was much higher in farm wage with a margin of 25% compared to the non-farm self-employment with a much lower estimated value of 10%. This implies that social trust is relatively more relevant for farm wage. An individual's perception of how other villagers and leaders are trustworthy may create a conducive environment for working as a farm labourer on other farms. It should be noted that in the study villages one may labour on

someone's farm just by a mere non-binding agreement of being paid for one's labour after harvesting and some of the payment involves cash or in kind payment. All these may require high level of perception of trust particularly for farm wage labourers. This is probably a mechanism that villagers use to help one another. This finding is consistent with findings of a study conducted in peri-urban areas of Tanzania by Lanjouw *et al.* (2001) which found trust towards village officials and other public servants to have a positive impact on participation in non-farm activities.

The estimate of membership density in non-farm self employment model was positive and statistically significant at 1%. The implication of this finding is that joining an extra group is associated with increased probability of ones engagement in non-farm self employment. This reflects the fact that, since most of the respondents (69.2%) reported being in VICOBA (Village Community Banks) and other self help groups membership, they were more likely to benefit from credit to have capital for operating a business enterprise. VICOBA are informal credit and savings groups to which a majority of households are members, and one can be a member of several such groups, depending on one's ability to pay weekly or monthly contributions. In the environment of poor rural credit institutions, these village based organisations can be a reliable source of financial capital that enhances household ability to take up off-farm opportunities. This variable however could not predict participation in farm wage whatsoever (see last three columns of Table 2.5). Although group membership is not significant for farm wage it is worth understanding that individuals engaging in farm labour are those poorest in the village and are likely to be isolated in such social groupings. The other cognitive indicator of social capital, social cohesion was not significant in predicting any of the off-farm employment categories studied.

Table 2.5: Factors determining engagement in off-farm employment (n=309)

Variable	Non-farm self employment (NFSE) (n=128)			Farm wage employment (FWE) (n=52)		
	Estimates	Std. Error	P>|z|	Estimates	Std. Error	P>|z|
Household's head age	-0.006	0.002	0.004	-0.001	0.001	0.385
Household size	-0.005	0.020	0.819	0.005	0.006	0.375
Secondary education	0.198	0.071	0.006	-0.027	0.019	0.147
Number of working adults	0.012	0.026	0.649	-0.006	0.008	0.421
Access to credit	-0.004	0.007	0.539	-0.067	0.014	0.000
Land cultivated	0.032	0.032	0.312	-0.022	0.014	0.162
Land owned	-0.010	0.026	0.687	-0.006	0.009	0.517
Group membership	0.062	0.017	0.002	0.005	0.005	0.373
Social cohesion	0.021	0.016	0.194	-0.001	0.004	0.859
Social trust	0.021	0.012	0.078	0.025	0.009	0.006
Electricity in the village	0.095	0.073	0.194	-0.038	0.029	0.194
Asphalt road	0.121	0.072	0.091	-0.008	0.023	0.718
Mcfadden pseudo R^2	0.11			0.24		

Note: Estimates are based on marginal effects.

Human capital variables indicated different results between the two employment categories. First, the results show that secondary education of the household head was positive and significantly ($p \leq 0.1$) associated with ones increased likelihood of engagement in non-farm self employment keeping other variables at their mean values. This suggests a need for high skills in relation to operating some of the off-farm activities for exampple a business enterprise. However, this variable was not significant in predicting farm wage employment though its effect is negative. This shows that the effect of education, measured by whether the head has secondary education, is not uniform across the off-farm employment occupational categories.

Second, the estimate of age was negative and significant ($p \leq 0.004$) in the NFSE model suggesting that, one's age is negatively associated with one's probability of engagement in NFSE. Age seems to be a limiting factor in engaging in off-farm

activities in rural areas. These results support the finding by Ruben and Van den Berg (2001) in rural Honduras and a cross country study by Davis *et al.* (2010) in Mexico which found age to be negatively associated with NFSE but positively associated with farm wage. A similar effect of age in NFSE was noted by Nagle and Naude (2014) in rural Tanzania. On the other hand there was a lack of statistical significant difference of age in predicting farm wage in the current study albeit its effect was positive. Other vectors for human capital, i.e. household size and number of working adults are not statistically significant in either non-farm self-employment or farm wage models. Access to credit was positive and significant ($P \leq 0.000$) for farm wage model with 0.067 estimated value but not significant in predicting non-farm wage engagement. The interpretation here is that, keeping other variables at their mean level, then households that have access to credit compared to those without have a 6% decrease in probability of engaging in farm wage. This may be expected as farm wage employment is largely a refuge for the poor who are usually marginalised when it comes to access to credit. Credit is a critical financial asset needed to engage in more lucrative high paying off-farm activities.

Two variables representing physical capital (farmland owned and farmland cultivated) were both not significant with negative estimates (in terms of marginal effects). This observation merits some explanations as it does not support the commonly held hypothesis of negative effect of farmland ownership reported elsewhere in Tanzania (Mduma, 2014). In a different view point that considers labour allocation theory this makes sense as households with large farms would need more labour thus imposing off-farm labour constraints consequently leading to less

off-farm engagement. To the extent that this is prevailing land-off farm employment relationship in the study area, it was expected that households with least farm size as an agricultural asset would be more engaged in non-farm employment or farm wage. The limited explanatory power of land size reported here is not surprising, given the small size and lack of a statistical significant difference (see Table 2.1) of landownership between households engaging and those not engaging in off-farm activities.

Results in Table 2.5 further show the role of community level variables in influencing off-farm engagement. Being located in a village with an asphalt road has a positive and significant association with engaging in NFSE. This finding is not dissimilar to findings by Nagle and Yunez-Naude (2014) who found a 1 km increase in distance to the major road to decrease probability of non-farm enterprise by 0.2% in rural Uganda. This is plausibly explained by increasing connectivity with other urban areas whose commodities exchange with the rural increase opportunities for non-farm self-employment activities. Transport infrastructure acts as a 'demand pull' factor as Bryceson (1999) describes it.

The results presented have so far provided evidence to support the theoretical conception that a household's level of social capital has a direct effect on off-farm employment participation. Nevertheless, the effect is not uniform but varies according to functional categories of off-farm employment. While some dimension of social capital may be relevant in rural wage related employment, others may play dominant roles in non-farm self-employment. Generally, due to the potential

endogeneity of social capital variables, it is important to caution that, the question of causality, whenever discussed in this sub-section, is only loosely inferred to.

2.6   Conclusions and Recommendations

In conlusion, farming households in the Kilombero Valley behave much like elsewhere in rural areas of the developing countries with regard to off-farm income distribution: well-off households benefit more from self-employment activities, while poorer households depend more on farm wages and own farm earnings. It has similarly been argued that locational factors related to growth of off-farm employment have important contribution to off-farm income distribution. Generally, it has been shown that households located in villages with better endowed infrastructure earn relatively more from non-farm self employment activities.

Evidence from the econometric estimations underscores the role of social capital which seems to be a critical important non-tangible asset that the rural poor households can possess. The impact of social capital was, however, not uniform across all diverse categories of off-farm employment. This draws an important methodological consideration; that is empirical analyses that do not disaggregate functional categories are likely going to miss important information on the diversity and heterogeneity of off-farm activities. From a theoretical perspective, the findings sheds more light on mechanism in which social capital matters for the rural households; however, it is a cognitive dimension related to trust that is relevant in farm wage employment. This being the case, care should be taken in situating social capital theory in explaining off-farm employment in areas where there is increasing

dominance of low earning farm wage activities such as the Kilombero Valley. Social capital generally is the only asset that poor households can strive to possess without much financial burden compared to other assets such as education and land which have also been found to influence one's/households' off-farm engagement.

From a practical perspective, two sets of recommendations are offered at the district council and village administrative levels; first, is to remove entry barriers that limit poor households from high earning off-farm activities. This can be achieved, for example, by enhancing the formation of social groups which can facilitate availability of credit to invest in off-farm ventures. This role falls squarely to the community development department found in Kilombero District council as it deals with registration and monitoring of village based self-help credit groups. Likewise, it is critical to impose mechanisms that will increase responsibility of leaders as this will raise the level of trust and increase off-farm activities engagement by creating more democratic instituituions. Second, is to improve rural infrastructure such as roads that can reduce transaction costs and create conducive environment for development of rural off-farm enterprises. However, for the rural households, this requires more intervention from the ministry that is responsible for development of these infrastructures that ensure rural connectivity.

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CHAPTER THREE

3.0   Farm and Off-farm Linkages: The Effect of Off-farm Employment on Farm Inputs and labour allocation Among Farming Households in Kilombero Valley, Tanzania

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3.1   Abstract

Engaging in off-farm employment among farming households may either have a competing effect or complementary effect with households' own farm work. Both effects have policy implications on households' ability to enhance farm investment and reduce poverty. This study first examines the potential role of earnings from different functional categories of off-farm employment in financing farm inputs, and second it assesses the effects of labour devoted to off-farm employment on a

household farm labour supply. Survey data from 309 multi-staged randomly selected farming households in five villages of the Kilombero Valley are used. This was complemented by in-depth interviews with 20 households (who were also involved in survey) and focus group discussions (FGDs). A Tobit model was used to estimate the influence of off-farm income on households' farm inputs expenses whereas narrative analysis explored the labour effect. Results from the econometric estimation shows that, holding other factors constant, the increase of non-farm self-employment income is associated with more expenditure on inputs. Other variables which were significant and positively associated with input expenses were access to credit and a household head's education and locational factors. On the other hand, qualitative evidence suggests that some forms of labour-demanding off-farm employment such as those related to farm wage have an undesirable labour effect on labour supply on households farms, with repercussion on farm productivity. Although income effect of off-farm employment is crucial in rural areas of Tanzania where farm inputs are underfinanced, but its labour withdrawal is reasonably more pronounced as it offsets the positive impact of off-farm income in the study area. It is therefore recommended that, rural development policies should establish synergy between farm and off-farm activities taking into account the effect of both income and labour on off-farm employment.

3.2   Introduction

In Africa, smallholder farmers engage in a number of income generating off-farm activities in addition to their main farm production activities. Off-farm employment constitutes a significant source of household livelihood income. Among others, Hagglabade *et al.* (2007) have reported an increasing contribution of off-farm income to the total household income among rural households in Africa, According to the authors off-farm income accounts for about 35% of rural incomes in Africa and 50% in Asia and Latin America. Off-farm income not only helps farmers to avoid the risks of relying mainly on agricultural production, but also helps them to increase their investment in agriculture including purchasing of essential farm inputs.

Farm inputs expenditure and use is hampered by input credit market failure as farmers cannot access credit to purchase the required inputs as agricultural credit for smallholder farmers is severely lacking in Sub-Saharan Africa (SSA) Tanzania included (Mathenge *et al*., 2015). This challenge underscores the crucial role of off-farm earnings as an important source of capital to finance inputs and overcome capital and credit market failure (Ruben and Van den Berg, 2001; Oseni and Winters, 2010). Despite this significant off-farm income benefit, households' engagement in off-farm activities may have potentially withdrawn labour effect from households own farm production especially for labour intensive cropping such as paddy production in the study area. Thus, a middle ground is needed. This calls for investigations that address both aspects of off-farm employment; that is, its income effect and labour withdrawal effect in relation to input expenses.

In Tanzania, the structural adjustment programmes (SAPs) in the early 1990s resulted into liberalisation of both the agricultural inputs and output markets. This was followed by removal of subsidies that were previously provided by the government. Consequently, this led to limited access to essential farm supply inputs to farming households. As a result, the use of inputs is generally low with farm input intensity of 8 kg/ha of fertilizer, which is below the average for SSA (Minot, 2009; Todd *et al.,* 2013). By 2008, only 9% of farmers in Tanzania had regular use of inputs, with only 5.7% of rice farmers using improved seeds and fertilizers (Minot 2009, URT, 2014). Furthermore, only 9% of farmers in Tanzania had a regular use of inputs on their crops (URT, 2014).

The use of inputs including mechanised machines is very limited among households with only 6% using tractors in 2012/2013 (URT, 2014). In recognition of this challenge, the government introduced a state provisioning initiative termed The National Agricultural Input Voucher scheme (NAIVS)[8] in 2008/09, through which the government subsidised essential agricultural inputs, such as seeds and fertilizers to smallholder farmers in favourable agriculture potential areas. This was expected to enhance the availability of inputs in the agricultural productive region including the study area. However, due to a significant cost outlay, still only middle income farmers benefited from the subsidised scheme (Todd *et al.,* 2013). In addition, some inputs such as herbicides which is an important input used in the study area for paddy production was not covered by the NAIVS.

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[8] This was a public provisioning scheme initiated in the 2008/2009 in which the government subsidised some essential inputs (seeds and fertilizers) for maize and rice smallholder farmers in agricultural productive regions. In this scheme, the government contributed 50 percent of the cost of the selected input (Word Bank, 2014).

A review of Tanzania's specific literature shows a dearth of empirical studies on the relationship between off-farm income and household farm production, particularly with regard to the use of inputs. Most studies that have examined off-farm employment in Tanzania have focused on its impact on household income and vulnerability (Dercon, 1998; Madulu, 1998; Ellis and Mdoe, 2003; Seebens, 2009). One of the few empirical attempts that examine the role of off-farm employment by Katega and Lifuliro (2014)[9] was based on descriptive analysis and conducted in the less agricultural favourable semi-arid areas of central Tanzania. However, according to literature (FAO, 1998; Loening *et al*., 2008; Mathenge *et al*., 2015), households located in the agricultural potential areas earn more income from off-farm work than those in areas with less potential. So an attempt is made to address this knowledge gap by employing a range of descriptive and inferential analyses with a focus on one of the favourable agro-climatic regions of Tanzania.

In view of the above background, this study was set to investigate the effect of off-farm employment and resulting wages and earnings on farm input expenses and household labour supply. Specifically, the objectives were to: i) identify the different types of off-farm employment available in the study area, ii) estimate the influence of different types of off-farm income on farm input expenditure and iii) explore the impact of off-farm employment on household's labour availability. This sort of investigation has important policy relevance: if off-farm employment and income thereof is emphasised for farm intensification then there is also a need to address its

[9]In the study by Katega and Lifuliro (2014) the focus was on non-farm income which includes only non-farm self-employment income to which farm wage income was not part of. In this paper the broad concept of off-farm is used to include farm wage income as has been used in a number of off/non-farm literature for example Ruben and van den Berg (2001) and Winter *et al*. (2002)

labour demanding effect. The next section provides the theoretical framework, which is followed the methodology and results and discussion sections.. The last section presents the conclusions and policy implications based on the study's findings.

3.3   The Effect of off-farm Employment on Farm Input Expenses and Household Labour Allocation

In this study, off-farm employment[10] is conceptualised as an income generating activity that farmers engage in outside their own farm. Following Ruben and Van den Berg (2001), three categories of off-farm employment are distinguished. These are: i) wage employment from working on other people's farms (farm labour), ii) non-farm earning activities from the owners' non-farm enterprises and iii) non-farm wages. It is expected that the different types of off-farm employment may have different implications in a household's spending on farm inputs and labour supply.

Generally, literature on the relationship between farm and the off-farm sector rests on two theoretical assumptions. The first assumption is based on the income effect (Evans and Ngau, 1991; Savagado *et al*., 1994; Reardon *et al*., 1996; De Janvry *et al*., 2005; Ellis and Freeman, 2004; Feng *et al*., 2010;) whereas the second is related to the lost-labour effect (Ayieko, 1995; Hennessy *et al*., 2008; Pfeiffer *et al*., 2009).

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[10] In some literature, including that referred to in this document, the term off-farm employment has been used interchangeably with non-farm. In the strict sense, though, farm wage is usually regarded as off-farm employment and not non-farm. However, some authors e.g. Haggblade *et al.* (2007) have used the concept of non-farm and included farm wage in their definition. For detailed conceptualisation of these terms see Barrett and Reardon (2000).

Income effect refers to complementarities between the two sectors in which case income generated off-farm is invested on the farm. For example, Reardon *et al.* (1996) have reported that off-farm activities may have a complementary effect particularly in favourable agro-climatic areas. However, these complementarities fade away in risky and drier zones. Thus, in less agriculture potential areas returns from off-farm have a declining effect on farm investment. This may imply that off-farm earnings are reinvested in some other off-farm activities or used for households' consumption smoothing in poor agriculture potential zones. But since Kilombero valley is considered as being a favourable agricultural area positive off-farm effect may be expected. Off-farm income has also been found to support purchase of inputs in Kenya (Evans and Ngau, 1991), in Honduras (Ruben and Van den-berg, 2001), in China (De Janvry *et al*., 2005) as well as in Uganda, Kenya, Malawi and Tanzania (Ellis and Freeman, 2004). Furthermore, Savagado *et al.* (1994) have reported off-farm contribution to traction use.

Contrary to the above-mentioned positive role of off-farm incomes on inputs, Pfeiffer *et al*. (2009) provide evidence from a case in Mexico, where off-farm earnings were not invested in farm production, but were rather diverted to finance other off-farm enterprises or invested in education. This is an undesirable effect of off-farm employment that blend theoretical trajectory of the lost-labour effect. The lost-labour effect is manifested when engaging in off-farm employment leads to labour constraint on household farms. Ironically, this means if labour is generally scarce the two sectors may compete with each other. In case of such a kind of competition for labour which is a variable farm input, farming activities are likely

going to be affected (Pfeiffer *et al.,* 2009) and invariably leading to farming inefficiency (Godwin and Mishra, 2004). The effect, however, depends on labour market perfection and on the nature of off-farm activities. Labour market is perfect when households who deploy labour to off-farm employment use the income earned to hire other labour to replace labour loss. In this study however, following Singh *et al.* (1986), households have been modelled to behave under the imperfect farm household model (FHM) with labour market imperfection. In a situation where there is surplus labour albeit off-farm activities will perform an absorption function, thereby creating mutually reinforcing effects.

Based on the above theoretical discussion and considering analysis at the micro level, the following is assumed: since Kilombero valley has a good agro-climatic condition, households' earnings from off-farm activities could complement and support farm activities. Generally, there is a high likelihood for returns from off-farm employment being spent on paddy which is the main crop grown in the study area. Nonetheless, extending the lost-labour effects argument, by drawing on labour as another variable input and with the assumption of labour constraints among households, the trend of relationship may be different as highlighted by Pfeiffer *et al.* (2009). This assumption is made because of concurrence needs of on-farm and off-farm employment and labour intensive nature of farm wage as a category of off-farm employment. Consequently, this may have a significant household labour withdrawal effect. Henceforth, analysis in this study considers both the role of off-farm incomes on farm input expenditure and the labour cost effect caused by labour that is withdrawn to off-farm employment.

3.4   Methodology

3.4.1 Description of the study area

The study area, Kilombero Valley, is situated in south-central Tanzania (8° 32¹ S 36° 29¹ E) in Morogoro region lying within Ulanga and Kilombero districts (Frontier Tanzania, 2009) (Fig. 3.1). The area has an annual precipitation of between 1 200 mm and 2 600 mm between November-April (URT, 2010) and is usually flooded during the heavy rain season of March-May. The total coverage of the area is 11 600 km ^{2} and is dominated by subsistence paddy producing households (Kato, 2007), supplying 9% of all rice produced in Tanzania (Kangalawe and Liwenga, 2005). The main ethnic groups are Ndamba, Bena, Pogoro, and Hehe. There has, however, been an increasing trend of agro-patarolists migration over recent years, leading to increased pressure on cultivation land (Nindi, 2014).

Despite the area having a great potential for high agricultural productivity, a report by MDS (2008) indicates that Ulanga District which forms part of the valley has the lowest use of mechanization i.e. tractors for farm preparation among the districts in Morogoro Region. It has also been generally noted that Kilombero District (which forms part of the Kilombero Valley) has the lowest use of farm inputs in Morogoro region (URT, 2011). Consequently, this has resulted in an average yield of 1.3 tonnes/ha which is lower than that in other prominent rice producing areas in Tanzania such as Mbarali whose average yield is 7.4 tonnes/ha (URT, 2011). Other adversities confronting farming households in the area include frequent flooding by the Kilombero River, enlargement of teak plantations, and conflicts between crop producers and agro-pastoralists (Kato, 2007). Therefore, all the above increases the

need for more intensification which can be achieved through increased use of farm inputs. Doing so will lead to increased productivity and presumably income which can then be used to improve the concerned households' well-being.
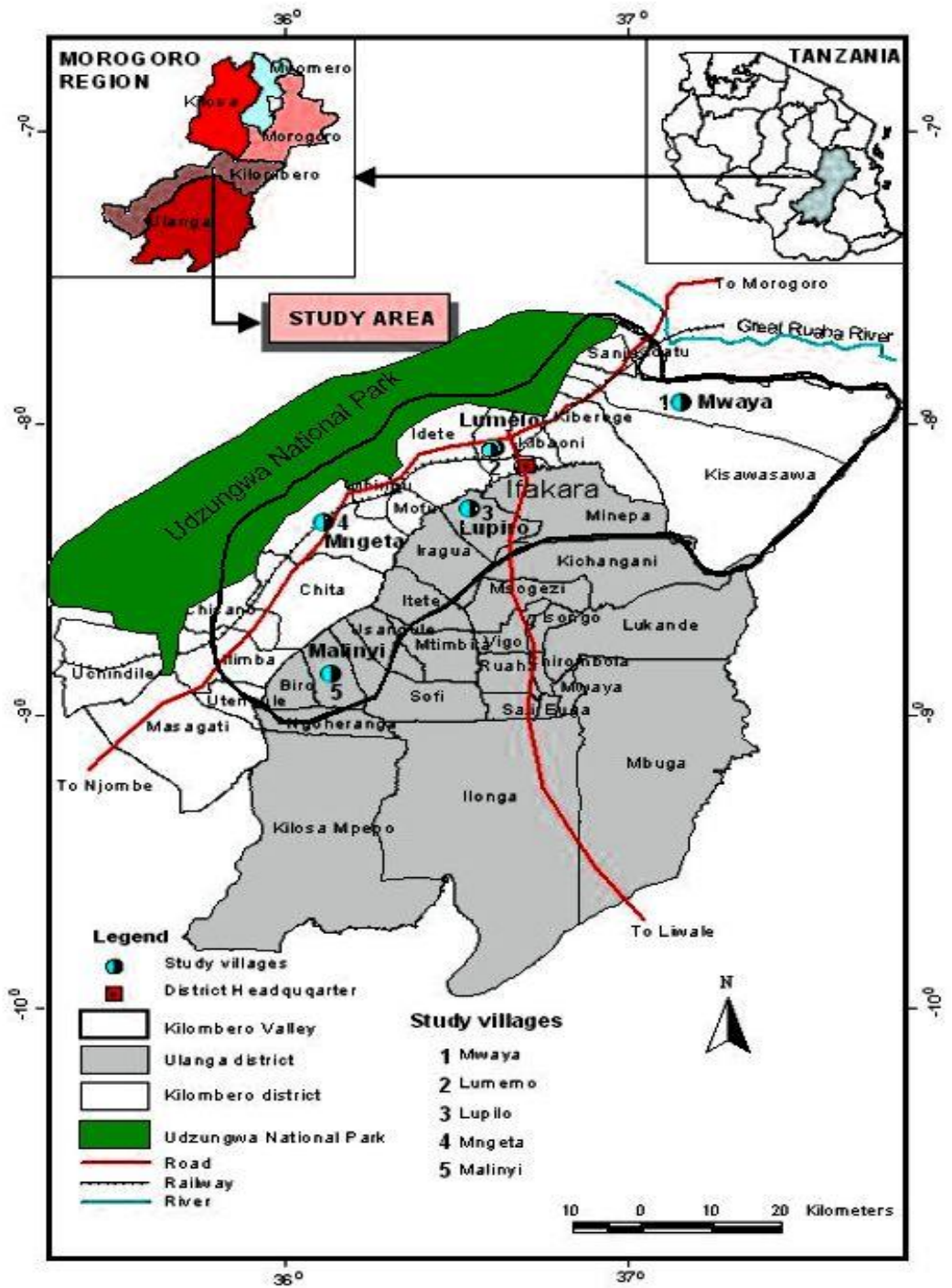
Figure 3.1: Map showing location of the study villages

3.4.2 Data collection methods

The data used for this study was collected in two phases. The first phase was preparatory and exploratory. Its purpose was to conduct a reconnaissance survey and gather information needed for the study. This included visit to the study area questionnaire preparation and testing. In the exploratory survey, discussions were held with different stakeholders including farmers, village leaders and district community development officers in Ulanga and Kilombero Districts[11].

The second phase, which took place between late February and early May 2014, worked on household survey, in-depth interviews and focus group discussions (FGDs). The household survey was carried out using a structured questionnaire. The questionnaire which was administered to household's head was used to collect information on socio-demographic characteristics, farm input expenditure and off-farm related characteristics. By asking the household head on behalf of the other members the unitary household modeling is evoked whereby decision making on production and consumption is vested in the household's head. A household is defined based on the Tanzanian household budget survey (NBS, 2014) in which it is referred to as "people who live together and share income and other basic needs and maintain the same centre of production and consumption". For the in-depth interviews a checklist was used to gather data related to farm and off-farm employment. In order to gather community level data, five FGDs, one from each study village were conducted. The FGDs were composed of 8-10 participants while observing gender balance among participants for each focus group.

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[11] Administratively three of the selected villages i.e. Mwaya, Lumemo and Mngeta fall within Kilombero District whereas Lupilo and Malinyi are in Ulanga District.

3.4.3 Sampling

A two-stage sampling procedure was adopted for the household survey. The first stage involved purposive selection of 5 villages based on two attributes i.e. attributes accessibility and/or remoteness and endowment with farm land resource. Three of the selected villages, Malinyi, Mngeta and Lupilo, are located in the South which is a difficult area to access, especially during the rainy season, during which access roads are often flooded. The other two selected villages in the North, Lumemo and Mwaya, are more accessible. These two villages are also more constrained with regard to access to land for cultivation. As theories predict, village socio-economic differences would have different implications as far as off-farm patterns and spending of farm inputs are concerned.

The second stage involved stratification of the households in each village and selection of respondents for interviews based on wealth levels. The stratification and sampling at this stage followed the following procedure. First, participatory wealth ranking (PWR) was conducted in each of the five villages to form three distinct wealth categories which were poor, middle and non-poor (see Appendix 6). Each wealth group formed a stratum to which a "probability proportionate to size" (pps) random sampling technique of the households was carried out. At the village level, 5% of the households were selected. The focus of the study was paddy farmers, i.e. those who had at least cultivated paddy during 2012/13 and 2013/14 seasons. The village registers available in the village office were used as a sampling frame, considering the fact that more than 95% of households in Kilombero Valley are engaged in paddy cultivation. Using this sampling procedure, 324 households were

selected, of which 15 households were dropped during the data cleaning exercise due to insufficient information. The distribution of these dropped out households was as follows: six were from Malinyi and three from Lupilo due to lack of sufficient data on off farm-incomes, whereas three households from Lumemo could not provide accurate data on farm incomes. Similar data were missing for 3 households from Mwaya even after a repeated follow up. Thus, the quantitative analysis is based on a sample size of 309 households which is within the sample size recommended in experimental researches by Gray (2014)

For the in-depth interviews, households with relevant attributes were purposively selected to give more insights on their off-farm engagement and labour allocation. A total of 20 in-depth interviews were conducted with households' heads; seven of the respondents were selected from Mngeta and three were selected from each of the following villages: Mwaya, Lupilo and Malinyi villages. The remaining five household heads were picked from Lumemo. Since the main interest was for those households with farm wage employment so as to glean an understanding on labour allocation and its impact on own farm work, relatively more respondents were picked from Mngeta. Mngeta appeared to be the best area because farm wage employment was the more dominant off-farm category.

3.4.4 Data analysis

The analysis was conducted using basically, two procedures. The first involved econometric estimation of inputs using a vector of explanatory variables including off-farm incomes. Prior to the econometric estimation, a preliminary descriptive

analysis was employed to determine statistical measures such as means, frequency and standard deviation. The second phase involved analysis of data from the in-depth interviews and FGDs, in which narrative analysis was used. Through this method, excerpts from respondents were analysed and combined to formulate meaningful themes relating to the study variables. The use of qualitative data and its analysis was intended to complement the quantitative data. Qualitative evidence helps in explaining relationships that are not uncovered in survey data (Bryman, 2006).

The main analytical challenge arising from the econometric analysis in this study is that, compared to off-farm income, labour supply or allocation as another main explanatory variable of interest could not be captured and thus simultaneously used as an independent variable in the estimation equation. The survey instrument did not include items on off-farm labour time allocation[12] which has often been associated with farm input use (Phimister and Roberts, 2006) or farm production (Yang *et al*., 2014) in developed countries. It was anticipated that respondents in the study area could hardly give accurate estimates of their time allocation between farm and off-farm activities. This particular methodological challenge was circumvented by adoption of qualitative techiques as already explained.

3.4.5 Empirical model and description of the variables

Adhering to standard procedures as used in other studies that modelled relationship between off-farm income and farm input supply or farm production (Ruben and Van

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[12] Labour time allocation is mostly used to capture the effect of labour supplied off-farm to household farm labour availability, with labour being one of the inputs. But labour time allocation is best captured in panel data and thus, use of cross-sectional data in this study entailed devising another empirical strategy including use of qualitative evidence.

de Berg, 2001; Godwin and Mishra, 2004); expenditure on inputs was fitted using a Tobit regression model. This model was more appropriate due to censoring of the dependent variable in which spending on input was missing for non-spenders in the total sample. The dependent variable (expenditure per hectare) was zero in the case of non-spending in any of the three farm inputs described in the preceding paragraphs. There were 70 households among the 309 sampled households which reported to spend nothing on inputs. The use of ordinary least square (OLS) in estimation of this kind (with censored dependent variable) according to Gujarat (2004) leads to inconsistent and biased estimates. The Tobit model is represented by:

$Yi^* = \beta 0 + \beta n\, Xi + \varepsilon i$

But Yi={ Y* if Y* >0} and {0 if Y*< 0}

Yi^* is a latent variable for the ith household. *X* represents a vector of independent variables that are expected to influence the dependent variable (see Table 3.1). The βn are parameters under estimation and ε is the error term which is assumed to be normally distributed, with a zero mean and a constant variance. For different values of independent variables the equation becomes,

$Yi^* = \beta 0 + \beta_i X_1 + \beta_1 X_2 + \beta_2 X_3 + \beta_3 X_4 + ... \beta_n X_n + \varepsilon ...$

The dependent variable is farm input expenditure. There are three different commonly used types of inputs expenses which were aggregated and measured in cash value terms. These included cash expenses incurred on: i) herbicides, ii) hiring tractors or animal traction for farm preparations and iii) hiring labour for various farm activities from farm preparation to weeding. For paddy production in Kilombero valley, weeds have a great effect on yield, making herbicides and hired

labour important inputs. A further description and measurement of input is provided in Table 3.1. The input expenses were expressed per unit farm area in the 2013/14 farming season so as to correct for differences in plot size.

Off-farm income (employment) is a major explanatory variable in empirical estimation. In the present study, off-farm engaging households are classified as those households in which the head or spouse has a wage or self-employment off-farm activity apart from working on the household's farms. The rationale for this conceptualisation emanates from the fact that it is the income (including off-farm income) from these two members that has a significant impact on households income and expenditure. This measurement approach is consistent with other off-farm employment studies including that by Bjørnsen and Mishra (2012) which suggest that it is the head and spouse who largely determine a household's production decisions as far as off-farm activities are concerned. Although households may have multiple activities which involve switching between off-farm wages and self-employment activities, each household was assigned to an off-farm category which was dominant and had a significant income contribution based on the household head's assessment. On the other hand non-participating (farming only households) are those which did not engage in any off-farm income gaining activity apart from farming and selling their farm produce.

For non-farm self-income the net annual profit was used, respondents provided estimates of their total costs and earnings. Monthly profit was computed from their business which was summed up to get annual average. For non-farm wage

employment income and farm wages, monthly net salaries or wages were summed up over 12 months to obtain total annual income for these two employment types/activities. Farm income involves the computation of market value of produced crops in 2012/13 farming season less the production costs. All income data were computed per adult equivalent (AEU) to control for inter-households differences. The standard scales used in computation of AEU are presented in Appendix 7a and 7b.

Several controls were used in the regression equation. The definitions of the variables are presented in Table 3.1. In order to control for the locational factor that may lead to differences in price across villages, a dummy variable was used for a household's location in Lumemo/Mwaya village or otherwise. These villages (Mwaya and Lumemo) are close to urban centres, and as a result inputs such as herbicides were expected to be relatively cheap with implied low expenses. In order to control for differential households labour endowment, the variable number of working adults was used. Consistent with Ruben and van den Berg (2001), this study assumes that number of adults negatively affects input expenses. Similarly, sex and education level of the household head are set to control for individual demographics. It was particularly important to consider education in this model as education has been reported to be related to awareness and skills which are generally associated with readiness to adopt some production enhancing technologies including input use (Yorobe and Smale, 2012).

Information on households' access to credit in the model was also relevant. Its relevance emanates from Ruben and Van de Berg's (2001) findings in which access to credit was found to trigger more expenditure on inputs. A significant number (71%) of household heads and spouses had membership and some obtained credit from a number of Village Community Banks (VICOBA) established in all the study villages. VICOBA are self-help credit groups common in rural areas of Tanzania. Lastly, household's endowment with cultivated land is included in the set of controls. Household possession of cultivated land, according to Ruben and van den Berg (2001), was found to have a negative effect on input use. This measure was refined by particularly referring to farm land under paddy which was the most dominant crop under cultivation in the Kilombero Valley.

Table 3.1: Definition and measurement of variables used in the Tobit model estimation

Variable name	Definition
Input expenditure	Expenditure on inputs per hectare of a paddy farm in Tshs (in 2013/14)
Household size	Actual number of household members
Shock	Whether households faced event related to loss of crop (Yes=1, Otherwise =0)
Other crop	Whether households cultivated other crops apart from paddy (Yes=1, Otherwise =0) in 2012/2013 season.
Education	Actual years of schooling of the household's head
Number of adult	Actual number of working adults (aged between 15 and 64 years)
Credit access	Dummy variable for access to credit in the survey year (Yes =1, Otherwise =0)
Age	Age in completed years of the household's head
Paddy farm size	Total paddy area cultivated in the 2012/13 season in hectares
Group membership	Number associations/community groups membership
Farm wage income	Annual wage earnings from farm labour employment in TShs
Non-farm wage income	Annual wage received from non-farm employment in TShs
Non-farm self employment income	Annual income received from non-farm self-employment in TShs
Mwaya/lumemo	Dummy for households location in study villages (Mwaya or Lumemo =1 Otherwise 0)

3.5   Results

3.5.1 Type and distribution of off-farm employment activities

With regard to engagement in off-farm employment, the descriptive results indicated that there was a large proportion (71.8%) of households who, in addition to farming, were also involved in different forms of off-farm employment. The remaining proportion of households (about 28%) were engaged in farm activities only. This group of farming households depended almost solely on paddy farming for their livelihood. This level of engagement is slightly similar to the one reported by Katega and Lifuliro (2014) in a study conducted in the semi-arid areas of central Tanzania where it was observed that 69.5 percent of households were engaged in non-farm activities. Based on FAO (1998) and Mathenge *et al.* (2015) off-farm activities flourish in agriculturally potential areas. It was thus expected that a higher proportion of households would be involved in off-farm employment in the study area. Among the 220 households who were engaged in off-farm employment, more than a half (58%) were engaged in non-farm self-employment; under a quarter (23%) worked as farm labourers and the rest (18%) were involved in non-farm wage employment. Types of activities in each category of off-farm employment are as shown in Table 3.2. These activities were further differentiated by skills requirement and start up capital/resources needed for investment in a particular activity. This differentiation into skills and capital needs is relevant as the off-farm sector is highly heterogeneous (Ruben and Van den Berg, 2001), with implications for input labour expenditure.

Table 3.2: Categories and sub-categories of off farm employment identified in the study area (n=220)

Functional categories	Sub categories/activities Low capital/resource requirement	High capital/resource requirement	Distribution of households in each category
Farm wage employment	Unskilled: paid work on 'other' farms, paid work on plantations	NA	52
Non-farm wage employment	Unskilled: rice milling, guards.	Skilled: professional such as teachers, administration, drivers	40
Non-farm self employment	Low investment activities: food vending, petty trading, fuel wood collection, charcoal selling, local alcohol brewing, transport (owning motorcycle), masonry, tailoring	High investment activities: shop ownership, ownership of carpentry workshops, mobile phone shops.	128

3.5.2 Farm households' socio-economic characteristics of the respondents

Socio-economic differentials among households with different off-farm employment can provide an important insight on their capacity in terms of labour and incomes to invest in farm inputs. These differentials may imply differences on input expenditure and labour allocation. Table 3.3 depicts these differentials and statistical differences. On average, households with off-farm income were found to have more total household income, younger household heads, and more group memberships compared to those with farm income only. More specifically, Table 3.3 shows that the variable, total household income was statistically different between households without and those with some form of off-farm employment. This suggest that, such households were more endowed with cash flow that might potentially be spent on inputs.

Households with off-farm employment (Table 3.3 columns, a, b and c) were also linked to more membership in various social groups, and this is shown by the

observed significant mean difference at different levels between households with no off-farm employment and those with at least one off-farm activity. This finding is consistent with those reported in a study by Lanjouw *et al.* (2001), in which membership was found to be associated with off-farm employment. Household membership as a proxy for social capital may provide an opportunity to access credit that may be invested on inputs. Related to membership is access to credit in which households with off-farm employment have relatively a higher percentage in terms of credit access as can be seen from Table 3.3. The mean for household head age as a human capital variable was significant at 1% between households with off-farm and those without any of the three types of off-farm employments. This implies that, households with off-farm employment have more labour which may enhance their labour supply resources for off-farm employment.

Notably, some variables were significantly different only for one category of off-farm employment and those without off-farm employment. For example, farm area owned significantly ($p \leq 0.032$) differed between households with farm wage employment and households without off-farm employment. This further suggests that heterogeneity in off-farm employment which impling a difference in other socio-economic attributes including use of inputs. Conclusively, this section has given the highlights of endowment of different assets across employment groups. The exact effects of these assets on farm input expenditure are presented in section 3.5.

Table 3.3: Selected household characteristics disaggregated by off-farm employment/income status

Variable	No off-farm engagement (a) (n=89)	Farm wage(b) (n=52)	Non farm self-employment (c) (n=129)	Non farm wage (d) (n=40)	T-test, mean difference between b & a	T-test , mean difference between c & a	T-test, mean difference between d & a
Age of household head (yrs)	51.98 (1.72)	43.30 (3.39)	43.77 (15.51)	43.77 (15.51)	-3.184*** (0.0018)	-4.670* (0.000)	-2.680* (0.0082)
Years of schooling of the head	6.14 (2.84)	6.36 (2.84)	7.58 (2.64)	6.1 (3.7)	-0.425 (0.671)	2.750* (0.006)	-0.070 (0.940)
Household size	5.05 (2.18)	4.75 (1.66)	4.90 (1.95)	5.03 (2.06)	-0.076 0.671	-0.450 0.651	-0.07 0.940
Number of adults	2.76 (1.7)	2.46 (1.11)	2.46 (1.58)	2.975 (1.59)	0.660 (0.500)	0.36 (0.718)	0.076 (0.939)
Area cultivated (ha)	1.11 (1.15)	0.86 (0.65)	1.48 (1.30)	0.98 (0.89)	1.660* (0.098)	0.361 (0.712)	0.660 (0.509)
Total farm own (ha)	1.67 (1.49)	1.22 (1.11)	1.53 (1.49)	1.53 (1.28)	2.160** (0.032)	-1.023 0.3070	0.767 0.777
Total income(in Tshs)	586 064 (689 341)	906 243 (1 051 128)	1 536 749 (2 608 294)	1 091 749 (1 493 752)	-2.450** (0.015)	3.310* (0.001)	2.260** (0.025)
Total farm income	450 782.3 (610 203)	365 047 (574 091)	472 786 (689 443)	294,357 (236 512)	-0.032 (0.974)	-0.560 (0.573)	-1.590 (0.113)
Group membership	1.5 (1.43)	1.65 (1.73)	1.89 (1.58)	1.67 (1.33)	-2.200** (0.028)	3.860*** (0.000)	1.940* (0.054)
Male head of households	71.0	38%	69.5%	72.5%	_	_	_
Credit access	23.6	31.5%	42.1%	38%	_	_	_
Other crop cultivation	53.4	55.8%	50.8%	47.5%	_	_	_
Cultivate maize	46.1	48.2%	41.4%	45.0%	_	_	_

Notes: Figures in parentheses are standard deviations for columns a to d. For the last three columns the figures in parentheses are the p-values. The test statistics in the last three columns is independent sample t-test for equality of means; income data are in Tanzanian shillings; Asterisks (*, **, ***) represent significance level at 10%, 5% and 1% respectively.

3.5.3 Surveyed households' expenditures on inputs across employment

  categories

The main inputs used by the households are shown in Table 3.4. A One way ANOVA test was conducted to test for mean difference between off-farm categories. This test revealed a significant difference at the 10% level between non-farm self-employment and farm wage categories only. It is noteworthy that, households engaged in farm wage seemed to have low intensity of input spending with a total average expenditure of 58 049 TShs/ha[13] (35.6 US$/ha) as shown in Table 3.4. This value is lower than the average for all income groups combined, which is 77 834 TShs/ha (43.4US$/ha) (not shown in Table 3.4). This may imply that engagement in farm wage employment not only deprives households of labour, but also the income gained is not used to replace the lost labour. Further analysis concerning this group is presented in sub-section 3.5.4.

At disaggregated off-farm categories, Table 3.4 shows that expenditure intensity generally is highest for households with non-farm self-employment when compared to other off-farm employment categories. This may suggest a complementary relationship between input expenditure and non-farm self-employment. Expenditure on machinery was generally high across all income groups indicating the necessity of this production enhancing technology for production of paddy in the Kilombero Valley. More than 90% of the households reported using tractors or animal traction as a replacement for the hand hoe in land preparation indicating increased needs for productivity enhancing farm inputs.

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[13] Tanzania shillings (TShs) is the currency of Tanzania. The exchange rate at the time of the survey (February 2014): 1US$ was equivalent to1 635 Tshs on average

Expenditure on labour was rather modest across all income groups compared to machinery. This is because human labour can often be substituted. For instance, weeding can be substituted by herbicides. At this point the results may imply income effect of off-farm employment on input expenditure in terms of labour. This substitution should however in no way be interpreted as a situation of perfect labour markets in Kilombero Valley. Section 3.5.4 specifically addresses this caveat under which the labour imperfection arises.

Table 3.4: **Summary statistics of expenditure on inputs by farm and off-farm income status**

Type of input	Farm/off-farm income status							
	NFS (n=128)		FW (n=52)		NFW (n=40)		F (n=89)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Expenditure on herbicides	14680.3	17439.6	14 747	22 298	17 032.6	31 308	18 955	42 659.5
Expenditure on hired labour	8 678.6	2251	7138	14 706	8 672	33 244	1 773.2	19 647.3
Expenditure on Machinery	54 475.5	60 676	36 164.5	45 272.3	36 128	44 312	52 320.2	60 548.9
Total input expenditure	77 834.5	69 447	58 049.6	60 138.3	61 833	68 513	78 448.5	10 758.6

Note: all values are in Tanzanian shillings. The abbreviations stand for; SD=standard deviation, NFS=Non-farm self-employment income, FW=farm wage employment income, NFW=Non-farm wage income and F= farm income only

3.5.4 Influence of off-farm income sources on paddy farm inputs

The estimation results of the effect of off-farm income and other socio economic variables on input expenditure are presented in Table 3.5. The Variance inflation factor (VIF) revealed no collinearity between the independent variables. The VIF was less than 5, with a mean value of 1.23. The overall model was significant at the 1% level indicating a good fit. Overall, 13 covariates were used as independent variables in the regression. Out of 13 independent variables seven had a significant association with input expenditure (Tshs/ha) on paddy farms.

Non-farm self employment (NFSE) income was positive and significant at 5%. The implication here is that NFSE income has an increased effect on input spending holding other factors constant. This of course could work the other direction as well: whereby NFSE income may have been the result of more farm income that is linked to more input spending. These findings are consistent with observations made by Ruben and van den Berg (2001) in Honduras who reported that it is NFSE income and not agricultural wage that is associated with input intensity. Without disaggregating off-farm into its functional categories and controlling for endogeneity, Pfeiffer *et al.* (2009) also obtained a similar result of a positive effect of off-farm income on farm input, using instrumental variable approach in a study conducted in rural Mexico.

Table 3.5: **Off-farm income and other factors influencing farm input expenses (Tobit regression)**

Dependent variable; expenditure on inputs per adult equivalent(Tshs/ha)				
Variable	Coefficient	Standard Error	*P*-value	VIF
Household size	15 531.48	13 276.21	0.243	1.88
Crop shock event in 2012/2013	-25 848.80	34 692.42	0.457	1.06
Other crop cultivation	16 884.37	39 470.94	0.669	1.07
Household head's years of schooling	15 818.36	6 949.52	0.024	1.21
Access to credit	96 966.16	41 632.62	0.021	1.15
Household head's age	504.83	1 445.82	0.727	1.24
Cultivated farmland size	29 441.42	5 296.01	0.000	1.16
Number of adults	19 199.76	16 666.42	0.25	1.88
Group membership	29 854.38	12 661.01	0.019	1.10
Non farm-wage (FW) income	-0.013	0.03	0.646	1.04
Non-farm self employment (NFSE) income	0.025	0.01	0.024	1.06
Farm wage (FW) income	-0.801	0.39	0.044	1.11
Mwaya/lumemo	1 23 467.6	40 422.81	0.002	1.08
Left censored observations		70		
Uncensored observation		239		
Mean VIF		1.23		

In fact, one of the most interesting results in the model (Table 3.5) is the significant and negative effect of farm wage (FW) on spending on inputs. This is particularly suprising as it shows that for households which have spent on inputs, a rise in FW leads to decline in the expenditure on inputs. This finding points to an important issue of competing needs between farm and off-farm investments hence warranting more attention. It also indicates that income gained from FW may probably be used for households' consumption smoothing (*ex post* risk strategy) rather than being invested in *ex ante* farm production.

Control variables largely behaved as expected. For example, access to credit was associated with more spending on inputs. This variable is positive and significant (P=0.05). Credit constraint is one of the critical limiting factors that affect spending and use of inputs. Nevertheless, the results should be interpreted with caution because credit acquired may not be directly spent on farm investment, as 69% of households reported using credit on other items such as paying for health needs and for children's schooling and not directly in support of their farm expenses.

Consistent with the social capital theory (Coleman, 1988) group membership was found to be positively associated with expenditure on inputs. It is through membership in various organisations such as farmers groups, or credit groups that a household may access credit that may be diverted to farm input expenditure.

The results in Table 3.5 also show that as a proxy for physical capital, the variable cultivated paddy farm area was positively and significant (P=0.05), incicating that

more farm area is associated with more input spending. This finding further reinforces the importance of paddy farming among households in Kilombero Valley as large farms generate relatively more output that can be sold to fund farm operations. Education of household head was positive and significantly (P=0.05). associated with inputs expenditure. The positive effect of education signifies that more awareness and skills raise the need and use of productivity enhancing technology including farm inputs. This result may loosely tie up with the findings by Mwaseba (2005) in a village in Kilombero Valley in which education was found to increase probability of using herbicides.

Lastly, a household location was also observed to be associated with input expenditure. The dummy variable Mwaya/Lumemo was positive and significant (P=0.01). This can be explained by the fact that Mwaya and Lumemo households are located in an area where farm land is in short supply. Thus, they need more intensification which is translated into more input expenditure. But being located at a more urban area, for Mwaya and Lumemo may simply imply more opportunities for off-farm employment whose income may be spent on inputs.

3.5.5 Understanding the effect of farm wage employment on investment in paddy farming from qualitative data

So far the preceding section has assessed the effect of different categories of off-farm income on input in addressing the main question of farm input investment. However, due to the intensive nature of paddy farming in the Kilombero valley and the general lack of mechanization (Kato, 2007), household labour availability is an

important factor that also influences farm investment in general and input expenditure in particular. Drawing on the theoretical insight of labour market imperfection, this section uses perspectives from in-depth interviews and the FGD that represents typical cases in the study area to examine households' specific situations in relation to off-farm labour supply that affect households' farm activities. In the same vein, the section further aims to complement the findings on the off-farm effect in Table 3.5 as far as farm wage (FW) income is concerned. This variable (farm wage income) was found to have an inverse effect, an interpretation that was less insightful, since the econometric model could not tell specific household/farm related factors that led to the reported relationship.

Generally, engagement in off-farm employment has an implication for labour endowment, since labour is the key productive asset, especially for rural farming households. The effect may be particularly more aggravated when off-farm employment is labour intensive, and households are suffering from labour constraints. In the study area nearly a quarter (23.5%) of the households engaged in FW employment, commonly known as *kibarua* (casual labour) either in plantations or on other farms, particularly in weeding, tilling, or harvesting works. This type of off-farm employment takes place in a season parallel to the households' own farm activities, especially those related to paddy farming. Thus, there were serious own farm investment threats for some households engaging in farm wage as expressed during one of the in-depth interviews:

> "……I am the only adult member in the house with the responsibility to
>
> support my family with all needs. During the farming season I have to work

in the KPL plantation as a casual labourer, weeding paddy. But at the same time I need to weed my own paddy farm located far from this village (about 7 km). However, since I spend many days on the plantation I only go to my farm irregularly thus risking poor harvest from my farms…..." (a female key informant aged 36 years in Mngeta, March 2014).

The respondent in the above quotation showed that there is a potentially negative impact on own farm investment as a result of off-farm engagement. Thus, when there is limited households' labour supply, a trade-off between farm and off-farm arises. This tradeoff is actually caused by desperation that pulls households to low earning farm wage employment. To emphasise this desperation one female respondent in answering the question on how farm wage is spent put forward the following response;

"…the wage I earn from the plantation work is largely used to support my household's food needs. This is because the food stock I kept from my last season's harvest has all been spent... this is *masika*[14] and the price of food is rising much higher…. " (a female key informant aged 44 years in Mngeta in March 2014).

It was further revealed during the FGDs that the daily minimum wage paid to a farm casual labourer of 3 800 TShs (2.3US$) per day, however, this may not be sufficient to pay for replacement labour in one's own farm which cost 2 000 TShs (1.2US$) per day. The wage is barely enough to sustain a household's basic needs. This desperate

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[14] *Masika* is a Swahili word literally meaning rainy season. This season is mostly associated with hardship in the study area as there are less off-farm gaining activites and general shortage of income among households.

situation of low wages is similar to the one noted by Alwang and Siegel (1999) in Malawi where smallholder farmers value liquidity offered from these wages so as to attain food (security). Despite the observed shortage of labour, households are still forced to sell their labour to meet their households seasonal income needs.

labour constraints as far as the relationship between off-farm employment and farm investment is concerned is far more complex as there are other intrinsic factors related to seasonality that influence a household's investment. Seasonality has been recognized as an important feature of farm activities in rural areas of developing countries (Khandker, 2012). Off-farm employment activities that have the counter season with farm activities may have different impact as far as labour effect is concerned as one respondent said as shown in the quotation below:

> "I work as a mason mainly during the off-farm season. This is because there is less work during the farming season as most people have no money for house construction works. As the only working adult in the household this seasonal variation enables me spend time on my farm which provides my family with its food needs throught the year……" (a male key informat aged 32 years in Malinyi village, March 2014).

The above is an exceptional case whereby, despite the household's labour shortage still some households managed to sufficiently deploy labour on their farms. This particularly happens when there is a difference in seasonality between farming and off-farm activities in which the undesirable negative effect (lost labour effect) of off-

farm employment may be weaned. To show how seasonality pattern interacts with household labour and its effect on investment, three cases of households which display different employment behaviour are used. In describing these cases paddy output has been used as a proxy for labour investment. To attain comparability among cases, three households from one village (Malinyi) are used. Table 3.6 present the results. According to Table 3.6, case 1 household has low productivity due to its low labour investment on its own farm. The productivity is used in the Table to give a reflection of farm investment on labour as an input. In household case 1 in Table 3.6 there are competing needs between farm and off-farm as the household deploys labour to off-farm work during the peak of the farming season. Consequently, this creates labour shortage to household which then affects its productivity.

Table 3.6: Off-farm seasonality and households labour constraints.

Household type	Season for off-farm	Labour requirement	Nature of farm-off farm linkage	Productivity in 2013 (in bags per ha)
Case 1	During peak farming season	Intensive labour	Competing/lost labour effect	4
Case 2	Partly conducted in off-farm (post-harvest) season	Less labour requirement	Income and lost-labour effect	8
Case 3	Mainly off-season	Less labour requirement	Income effect may dominate	12

Note: Farmers usually give their production figures in husked rice packed in 110-120 kg nylon-net bags as shown in the last column.

The productivity for case 1 (labour constrained households) was 4 bags per ha which is much lower than the average paddy productivity of 8 bags per hectare for the study area in 2013/14 cropping season. This finding supports the contention put forward by Wang *et al.* (2011) in rural China and Pfeiffer *et al.* (2009) in rural Mexico that off-farm activities compete with farm production in a situation of family labour scarcity.

On the other, hand, case 3 (Table 3.6) households seems to be well cushioned from lost labour effect since its off-farm activities were largely concentrated during the off-farm, post harvest season. As result, it had a good harvest of 12 bags which was larger than the average harvest.

The results in this sub-section suggest that farm wage employment (FWE) had an undesirable effect as it imposes labour constraints on households. For intensive cultivation of paddy, this is an expected scenario. The income needs and households labour requirements lead to tradeoffs, between farm and off-farm activities. This tradeoff, which is propelled by desperate immediate cash needs, has far reaching ramification for future farm productivity due to low current investment (in terms of labour) as indicated in Table 3.6.

3.6   Discussion

The overall farm investment effect of off-farm employment is discussed by combining quantitative and qualitative results. Of the three off-farm employment categories, it is FWE that provides a more interesting case for discussion. This is because while income from NFSE was spent on inputs, there is little evidence whatsover to suggest the same trend for FWE income. The case of NFSE income being spent on inputs resonates well with the argument that considers off-farm income as having a positive input expenditure on favourable agro-climatic areas (Reardon *et al.,* 1996). Indeed this may be the case in Kilombero Valley which is considered as a favourable agricultural potential area.

Theoretically, one would think that households will use the wages earned to hire labour to work on their farms as a substitute for off-farm labour loss. But, econometric results show that compared to NSFE income, FWE income had a regressive effect because labour loss from a household seems to lack substitution by similarly investing in off-farm earnings to pay for hired labour and other inputs. This kind of inability to spend on inputs among farm wage households is referred to, in labour-off-farm literature, as labour market imperfection (Singh *et al.,* 1986; Ellis, 2000; Wang *et al.*, 2011). This finding is important because it indicates that FWE is practised out of desperation, with rather survival needs, i.e. to support food purchase and not input needs. Households thus forego the opportunity cost of not working on their farms to go for FWE. This conforms to arguments posed earlier by Pfeiffer *et al.* (1999) that there is indeed competing needs for labour. In a similar context, Kochar (1995) considers this as a labour shock, as it increases households' vulnerability to poverty. Vulnerability in Kilombero Valley may result from manifestation of the antagonistic needs between farming and off-farm activities that threaten paddy production (see Table 3.3).

Paddy is not only the main cash and food crop, but is also an essential component of livelihood in the Kilombero Valley Hence, while NFSE supports income effect as set forth by Reardon *et al.* (1996) and Feng *et al.* (2010), FWE seems to rather lead to a lost-labour effect. This being the case, the findings in this study do not entirely support lost-labour effect as the dominant effect in Kilombero; rather it is suggestive that this may be a future trend considering the observed context of labour contraints. With higher investment demand for NFSE, more households are likely going to be

pulled to FWE in poor rural areas which impose more labour constraints. Therefore, study's finding espouse the theoretical notion that off-farm activities put a heavy labour demand and have competing and indeed lost-labour effect with on-farm production in Kilombero Valley. The implicit premise of surplus labour in rural households reported in literature including Reardon *et al.* (1996) and Singh (1999) does not hold in Kilombero Valley giving rise to competition between farm and off-farm activities. This kind of competition is, however, conditioned and structured within seasonality aspects of farm and off-farm activities.

Seasonality, which is grossly ignored in examining farm investment and labour supply from a theoretical stand point of lost-labour effect, is found in this analysis to have a fundamental effect on the nature of labour (as a farm input) linkage between farm and off-farm employment. This kind of linkage determines the nature of effect that off-farm employment may have, particularly on labour supply to farm and off-farm activities. In addition, since lost-labour and income effects have different implications on different functional categories of off-farm employment there is a relevant methodological consideration. From the methodical standpoint, disaggregation of off-farm employment based on labour requirements provides rigorously assessement of trends that could not be unveiled by homogenously grouping all households into one broad category of off-farm employment.

3.7   Conclusions and Recommendations

This study has employed a set of quantitative and qualitative techniques to examine the role that off-farm employment and income thereof plays on farm input

expenditure and labour availability in Kilombero Valley, Tanzania. Labour was treated as an intergral part of farm inputs. The study's findings show that income from off-farm employment is important in augmenting expenses in farm input as it determines the expenditure on paddy inputs. Controlling for the set of individuals, households and locational characteristics, the findings show that it is income from non-farm self employment (NFSE) activities that has a positive effect on spending on inputs. This suggests that as a disaggregated category of off-farm employment, NFSE is not just a residual activity, but it is rather intimately integrated within household livelihood strategies and their investment behaviour. Expenditure on input was also found to be influenced by a household's access to credit, education level of the household head and size of the paddy area cultivated.

On the other hand, farm wage employment (FWE) which is another off-farm functional category has undesirable labour withdrawal effects. This effect creates negative impact on households on-farm labour supply with an implication on paddy productivity. Due to labour market imperfection, households are not able to hire labour to replace those withdrawn from on-farm activities. Hence, the effect of off-farm employment differs according to functional category of the employment and a household's labour requirement. Income gained from off-farm employment may not necessarily offset off-farm household labour loss. Theoretically, this lack of labour replacement indicates competing needs between farm and off-farm activities that result into lost labour effect. The labour effect is further shaped by seasonality of rain-fed subsistence farming that prevails in the study area. A better understanding of the farm-off-farm linkages bringing on board the effect of both factors of

productions, which are income (capital) and labour endowment of households is important in examining off-farm production effect. Overall combining all off-farm employment categories there is evidence to support the dominance of lost labour effect over income effect, on the role of off-farm in farm investment in the study area.

The results from the current study have a critical importance on agricultural policies, particularly those addressing smallholder, subsistence farmers. For example the policy on input support through provision of subsidies in Tanzania was phased out in 2014. This policy change on input supply may increase constraints on access to essential farm inputs consequently leading to an increasing need for off-farm employment so as to augment farm input provisioning. Therefore, the government both at central and at the district council level should first, ensure increased access and opportunities for off-farm employment particularly those related to non-farm self-employment activities. In the same vein, the synergy between farm and off-farm activities, in particular the role of the latter to support the former needs to be recognised in a holistic approach to enable rural development.

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CHAPTER FOUR

4.0   Off-Farm Employment Response to Idiosyncratic Shocks to Crop Income in Kilombero Valley, Tanzania

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Target journal- Journal of Rural Development

4.1   Abstract

This paper examines the relationship between crop income shocks and off-farm employment as a salient feature of rural livelihoods in developing countries. In particular it examines the interaction between seasonal farm and off-employment activities and how this interaction enables households to address crop income shock. The study uses a household survey based on a random sample of 309 households and a set of participatory rural appraisal approaches drawing on data from the Kilombero valley, Tanzania. Results from focus group discussions and seasonal calendars show

that availability of some off-farm income such as those related to farm wage do not covary with farm income, a feature that is critical for *ex post* shock strategies as it enables households to smooth income during the farming season. Evidence from the econometric estimation shows that engagement in non-farm self-employment, which is largely available during the farming off season plays an essential risk management role and cushions against crop income shocks. This is also supported by a number of in-depth interviews held with selected households. From these findings, it is concluded that insurability of off-farm employment depends not only on the type of off-farm activities, but is also shaped by seasonality. Therefore, formulation of rural development policies that enhance growth and diversification of income sources out of farming is of utmost importance. This is because of lack of formal institutions such as credit or crop insuarance markets in rural areas that can buffer crop income related shocks. It is also imperative for policies to recognise farm/off-farm inter-linkages structured within seasonality.

Key words: *Off-farm employment, Off-farm income, paddy price, seasonality, Kilombero valley.*

4.2 Introduction

Rural households in Tanzania, like in most other developing countries, are exposed to a broad range of shocks resulting from climate and market related factors. Crop production failure mainly due to unfavourable weather and seasonal crop price variation (as a result of imperfect output markets) are two important variables that contribute to households shocks (Dercon *et al.,* 2005; OECD, 2011). These shocks lead to variation in crop income. Nonetheless, formal mechanisms to deal with these

shocks are poorly developed. One strategy, for example, would be through credit institution or crop insurance but this is poorly developed. Alternatively, governments may intervene through output price regulation or loan facilitation to reduce household exposure to output market related income shocks (Kwon *et al.,* 2005), though this is not affordable for most poor countries Tanzania included. As a consequence, rural households devise a number of informal strategies to reduce and cope with shocks. The informal strategy that households engage in include *ex ante* self-insurance via savings, mutual insurance system combined with *ex post* dissaving, selling of assets, reducing consumption or engaging in off-farm employment (Fafchamps and Quisumbing, 2003; Dercon *et al*., 2005). When households fail to capitalise on these strategies and are unable to cope with shocks, they can find themselves in what Carter and Barret (2006) call poverty traps, a situation in which households find it hard to escape chronic poverty and are pulled into destitution. Apparently, this leads to income poverty.

There is a handful of literature (Lanjouw *et al.,* 2001; Ellis and Mdoe, 2003; Katega and Lifuliro, 2014) on the role of off-farm employment on poverty and vulnerability in Tanzania Nonetheless, little has been done on the interaction between off-farm employment/income and income shocks brought by seasonal crop output market fluctuations among rural farming households. A closely related attempt by Dercon (1998) that attributed crop income risk and shocks to off-farm activities focused largely on cattle dominated livelihoods, whose shock behaviour response may be different from crop growers. These crop growers are more likely to be affected by the shocks related to the seasonal market price, an idiosyncratic shock type which is the main focus of this paper.

Based on the above stated background, the study on which this paper is based attempted to fill the knowledge gap highlighted using farming households in Kilombero valley as a case study. In addressing the role of off-farm employment and income on shock and seasonality three specific objectives were set: i) to describe the type of off-farm activities and the main sources of crop related shocks among farming households, ii) to explore the processes of the intra-annual seasonality of paddy sell price, farm income and income needs and how these are construed with availability of off-farm income and iii) to examine the association between off-farm employment and crop income shocks management. In addition to exploring off-farm patterns, seasonality and shocks, the study tests the following null hypothesis (Ho):

Engaging in off-farm employment does not reduce exposure to crop income shocks.

The study's theoretical framework which underlies further analytical work is presented in section 4.3. The section starts by providing a conceptual understanding of the off-farm employment and income as used in the analysis. Section 4.4 describes the study area and the methodology used for data collection and analysis. Section 4.5 presents the results, which are followed by a section on discussion of the results, and the last section provides the conclusions.

4.3   Theoretical Framework

Generally, off-farm employment and income fall within a broad range of different income generating activities which are grouped into three broad functional categories in this study. These are: (i) farm wage labour, (ii) non-farm wage employment and (iii) non-farm self employment. Category one consists of income generated from

casual labour on other people's farms or plantations. Category two refers to wage earnings from different employment activities including salaried work whereas category three consists of income generated from self-employment activities, i.e brick making, brewing and charcoal burning and selling and other trading activities. This categorization is adopted from Ruben and Van den Berg (2001). In this study, three different forms of off-farm employment and income sources are explored and linked with processes of seasonality in grain (paddy) price/sale fluctuation and resultant shocks.

Other concepts that need some clarity are seasonality and shocks. Seasonality[15] refers to any regular pattern or variation that correlates with season. The patterns of concern in the current analysis are: farm activities, off-farm activities, paddy sale price and household income needs. The central focus is to treat all patterns as a system with seasonal interaction between the elements (patterns). A shock is defined based on Dercon *et al.* (2005) to mean adverse events that are costly to individuals and households in terms of loss of income, assets or reduction in consumption. Generally, households' response to seasonal fluctuation of output (paddy) market has a consequence and brings adverse income loss and threatens consumption. Price (paddy market) fluctuation is considered to be variability in price offered to farmers for their paddy sales within one year period. Thus, in essence, the shock described is both idiosyncratic as it is specific to individual households and transitory as it results from the seasonal effect of crop income availability. Off-farm income is considered

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[15] Seasonality can also be interpreted as a shock. For example, Devereux, (1999) considers seasonality as a 'regular' shock because it is predictable. The author differentiates it with unpredictable shocks such as drought and floods which are random shocks. Household responses to address the two are thus different.

as one of the informal strategies to counteract the effect of such shocks. To analyse the interaction between shock and off-farm employment, the risk management theory is evoked as shocks result from inability to offset risk.

Based on the risk management theoretical insight, it is expected that households may invoke off-farm strategies in an attempt to reduce or cope with price shock, as a result of seasonal price fluctuations. Therefore, under a risky environment, households may engage in off-farm activities as an *ex ante*[16]*risk* reducing measure strategy (Lanjouw and Lanjouw, 2001; Rose, 2001; Cervantes-Godoy, *et al*., 2013) or *ex post* risk coping strategy (Kochar, 1999; Porter, 2012; Dimova *et al*., 2015). For example, as an *ex ante* strategy, households may avoid selling their produce at a low price (the period immeadiately after harvest) by having off-farm income sources during the low price season and hence less exposed to the potential crop income shock. Similarly, engagement in off-farm employment, such as farm wage employment after full blown shocks entails an *ex post* strategy in response to income loss. The income loss here refers to less profit from the sale conducted during or immediately after the harvest (post harvest season). This is a legitimate concern in the context of Kilombero Valley since households incur costly production of paddy, but mostly earn little profit from paddy sales (Kato, 2007).

Considering off-farm as a shock coping strategy, Kochar (1999) found that farm wage has an important *ex post* shock role among rural farming households in India. The author noted that males increased their time working off-farm for a wage (farm

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[16] *Ex ante* refers to the period before a shock whereas *ex post* means the period after a full blown shock

labour) responding to unreliable variations in income from their produced crops. This is particularly relevant when households do not have income during the farming season as they may have less crop stock to sell, during this high price season.

As an entry point, this study extends the argument put forth by Ruben and Van de Berg (2001) in recognizing the heterogeneity role of off-farm employment and the apparent need to distinguish different categories of off-farm employment: that is those related to farm (wage) labour employment on one hand and those related to wages outside the agricultural sector and non-farm self-employment activities. Theoretically, this distinction matters as these activities thus, available income may have seasonal variability. Hence, their response to a particular kind of shock also depends on seasonal availability of these off-farm employment. Consequently, this may result in different implications as far as *ex ante* risk management and *ex post* coping strategies of off-farm employment are concerned. Thus, based on this brief theoretical review, it is hypothesised that off-farm employment has an insurability role by preventing households' exposure to shocks. This role though is shaped by the aspect of seasonality.

Although seasonality does not feature in risk management theory, it is highly related to crop income shocks (Devereux, 1999). This being the case, it is assumed that the ability of off-farm employment to provide a buffer against shocks is also determined by the aspect of seasonality. This is largely because of seasonal variation of crop income which is an important feature in the study area. Seasonality is not treated as a shock *per se* but rather as a precursor to shock events.

4.4   Study area and Methodology

4.4.1 Study area

The study was conducted in the Kilombero Valley which is a swath of fertile lowland spreading across Kilombero and Ulanga Districts in Morogoro Region. Historically, the valley is dominated by subsistence paddy farming, although maize, sugarcane, bananas and sesame are also produced in small quantities. The 1999-2005 paddy production data show that the valley produces more than 40% of Morogoro Region's rice (ACT, 2007).

Paddy farming households in Kilombero Valley face a number of challenges including unreliable market and low output prices, (Kato, 2007; MAFC, 2011) leading to low surplus income from prodused crops. This apparently increases vulnerability and unsustainability of paddy farming households' earning and consequently leading to seasonal income shocks. Based on the above context it was imperative to conduct this study which also coincided with the 2012/13 cropping season that experienced a considerable fall in rice (major output) price in the study area. This price fall was mostly severe around three post-harvest months[17] (June, July and August). Thus, the need for carrying out this investigation on seasonality of the price and crop income shock was important.

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[17] Because the main harvesting period for paddy in the study area is June, the post-harvest season is considered to be between June and August. The other dominant crop grown by few households is maize which is rarely used as a tradable crop and may have two harvesting season depending on availability of rain.

4.4.2 Data collection

The study collected two sets of data from five villages which are Lupilo, Malinyi, Mngeta, Mwaya, and Lumemo. These are quantitative households' level survey data and qualitative data gathered from FGDs and in-depth interviews. Data collection was carried out between February 2014 and May 2014. Prior to data collection, a pleliminary survey was conducted in August 2013 to gather data on community characteristics via interviews with village and district leaders in Kilombero and Ulanga Districts.

Quantitative data: a structured questionnaire was used in gathering quantitative data. The tool was administered to the heads of the household. The purpose of the survey was to examine types of shocks and attributes that determine crop income shock exposure including off-farm employment engagement. Information was thus gathered on the households' socio-economic profile, types of off-farm employment as well as types of shocks most experienced by the same in the year prior to the survey.

Qualitative data: to have a better understanding of the processes and pattern of shocks, qualitative data were also collected: At community level, focus group discussion (FGD) was held in each village. Each FGD contained 10 participants. Apart from being a useful source of qualitative data, the FGDs, which preceded the household survey, provided information that assisted refinement of the questionnaire, based on the context and key attributes of the study villages. In addition, a seasonal calendar was also used to gather community level data. The seasonal calendar was

useful in identification and categorizing livelihood tasks by season (Slocum *et al.,*
1995). This method was employed in the study in order to highlight the distribution
of different farm and off-farm activities during the year. The same participants for
the FGDs took part in describing the seasonal calendar, whereby participants
described activities and trends for the 12 months calendar, based largely on specific
seasons, rather than months in which they undertook certain activities. In-depth
interviews with selected 20 households heads were also employed to compliment
community level data gathered though the FGDs.

4.4.3 Sampling

Five villages with more dominance of paddy cultivation and which represent the
socio-economic diversity of the study area were purposively selected. These villages
were Malinyi, Mngeta, Lupilo, Mwaya and Lumemo. Malinyi, Mngeta and Lupilo
villages were regarded as remote with poor road accessibility. In these three villages,
roads are often damaged to the extent that they are impassable during the rainy
season which is mostly associated with flooding in Kilombero. The two villages of
Lumemo and Mwaya were regarded as accessible, land constrained and poorly
endowed with agriculture resources. The contrasting differences between these
villages were expected to have a differential impact on their exposure and response
to shocks.

Sampling at the village level was done in stages, involving households' wealth
ranking, followed by random selection of households. Households in each village
were stratified based on their wealth levels. In this stage participatory wealth ranking

(PWR) was conducted to establish three wealth categories which were very poor, moderately poor and non-poor (See Appendix 6). From these strata, probability proportionate to size (PPS) random sampling of households was conducted. Therefore, the probability of selecting a household from a particular village was proportional to its share of the total population in that village. In sampling households the target was to have a sampling intensity of 5% for each village. The study's focus was paddy farmers i.e. those who had at least grown paddy in 2012/13 and 2013/14. Generally, available village registers were adopted as the sampling frame. This sampling procedure ended up with 324 households but 15 households were dropped during data cleaning due to some missing information. The sample size for each village was: Mwaya (54), Lumemo (69), Lupilo (67), Mngeta (56) and Malinyi (63). The result of sampling distribution by wealth groups is found in Appendix 6. Thus, the analysis is based on a sample size of 309 households which, according to Gray (2014), is a sufficient sample size for statistical analysis for a population with a low degree of heterogeneity. Kilombero Valley as the study area is considered more homogeneous in terms of households' occupations and other socio-economic characteristics. Participants in the FGDs and in-depth interviews were selected purposefully. Each FGD had 8-10 participants purposefully selected from both sexes. On the other hand, 6 households were sampled from each village for the in-depth interviews.

4.4.4 Analysis of qualitative data

Qualitative data collected from the FGDs and in-depth interviews were organised in meaningful themes and presented in narratives. The use of narratives is ideal in

capturing the lived experience of participants (Gray, 2014). Since the overall aim of the study on which the paper is based was to explain processes that revolve around farm/off-farm seasonality and resultant shocks, an approach that captures assessment of temporal sequences of households' livelihoods was useful. The study thus analysed this temporal aspect using community level data from the seasonal calendar.

4.4.5 Analysis of quantitative data

Because of the binary nature of the dependent variables a probit model was appropriate to examine the association between off-farm employment and income shock. The dependent variable was constructed based on whether a household made a low price paddy sale or otherwise. It was assumed that selling greater proportions of 2012/13 season crops immediately after harvest indicated potential income loss and shock exposure during the preceeding season (2013/14), since the interest was on such transitory and idiosyncratic shock. Thus, households which sold more than 75% of the harvest before the start of the proper 2013/14 farming season (December 2013) were considered as shock affected, and those which did not were unaffected. Therefore, the outcome variable took the value '1' and '0' for shock affected (exposed) and unaffected (not exposed) households respectively.

The probit model specified in the analysis is represented by the following equation:

$\text{Log} [p/(1-p)] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + u_i$

where:

Log [p/(1-p)]= Natural logarithm of the odds of probability of being exposed to income shock. For the dependent variable '1' represents shock affected and '0' otherwise (unaffected)

β_0= constant

β = estimated parameter.

X_1 = a vector off-farm employment categories

X_2 = a vector of individual and household characteristics, including ownership of assets

X_3 = a vector for the location of farm households in different study villages

u_i = error term

Explanatory variables: The main explanatory variables are farm wage employment, non-farm self-employment and non-farm wage employment. These variables were measured as dummies. That is '1' if households participate in the relevant employment category and '0' otherwise. It is expected that households engagement in any of these off-farm categories to be associated with less exposure to shock, as income generated from these activities can provide a buffer against potential income loss.

To control for individual characteristics, households' heads education was included. This was a dummy variable for secondary education. The variable was 1 if a household head had secondary education and 0 otherwise. Education has been shown to influence the extent by which households can buffer economic shocks in rural Africa (Yilma *et al*., 2014), as it enhances income. Similarly, age was specified in the

model expecting that a higher age is associated with more farming experience and thus greater ability to control shocks.

Households in at least three villages in the study area usually own large tracts of land than what they are actually able to cultivate. In addition, such households may make substantial amount by renting out extra farm land to land-constrained farmers. Thus, large land ownership was hypothesized to be associated with less exposure to shocks and two variables, farmland owned (ha) and farmland under cultivation (ha) were adopted. To capture for a household's ability to preserve harvested crop (paddy), a variable for possession of good storage facility was included. Households with crop storage facilities may be less prone to sell their harvest early when prices are low. As done elsewhere in literature (Islam and Maitra, 2012), the variable access to credit is specified as this provides a buffer and assists households to smooth consumption. Access to credit reduces the urgue for post harvest low price sale, and hence susceptibility to crop income shocks. A dummy variable, advanced crop sale, was also included. This variable was equal to '1' if the household had borrowed money during the pre-harvest 2012/13 season and '0' otherwise. This loan is usually repaid later with harvested crops of an equivalent value.

Finally, to account for village differentials in infrastructure endowment, a dummy variable of household location in Lumemo or Mwaya was included. Compared to the other three villages, these villages (Lumemo and Mwaya) have access to an all weather road. This access ensures better functioning markets and profitability in selling harvested crops, leading to reduced exposure to income shocks.

4.5 Results

4.5.1 Off-farm employment distributions among households

All households were categorized into different main income generating activities (IGAs). The percent distribution of these major employment categories is shown in Table 4.1, whereas the specific activites by employment types are described in Table 4.2. The results in Table 4.1 show that close to three-quarters (71.2%) of households had a household head or a spouse engaged in off-farm employment. This engagement is slightly similar to the 69.5% reported by Katega and Lifuliro (2014) in a semi-arid area of rural Tanzania.

Table 4.1: Distribution of the main employment categories (n=309)

Employment Categories	Frequency	Percent
Households without off-farm employment	89	28.8
Households engaging in off-farm employment	220	71.2
Households with non-farm self-employment	128	58.3
Households with farm labour employment	52	23.5
Household with non-farm wage employment	40	18.2

Farm wage which employs 23% of the sampled respondents is dominated by 'piece work' on other people's farms and seasonal farm wages in plantations. Three main plantations were identified in the study area. These are Kilombero sugar plantation which is close to Mwaya, Kilombero Plantation Limited (KPL), which deals with rice cultivation in Mngeta, and Kilombero teak plantation which is a tree plantation located near Lupilo village. All of the farms are owned by multinational companies. On the other hand non-farm wage is dominated by unskilled workers as there were few opportunities for skilled employment except in a few government institutions such as schools. The largest off-farm employment category constituted largely households employed in low investment enterprises which had both low entry barriers and earnings. This supports the findings by Fabusoro *et al.* (2010) in rural

Nigeria who found that the majority of rural households are trapped in low income earning activities e.g charcoal making and food vending, due to numerous barriers in relation to the well paid employment opportunities.

4.5.2   Main causes of shock exposure

Households were asked to mention the main shock events that led to severe income loss which they might have encountered in the previous 12 months. More than three quarters (89.4%) of the households reported to have been affected by one event or another. The proportions of households reporting a particular shock is presented in Table 4.2. With the liberalized market structure for agricultural products in Tanzania, market price was a cause of great concern to paddy farming households in the Kilombero Valley. This was a concern to about a third (34%) of the households. A similar concern has been reported elsewhere in Africa. For example, Salimona and Falusi (2009) reported households in rural Nigeria affected by market failure and price fluctuation to be 54% and 46.6% respectively. A plausible explanation for this high percent of market related shock reported in the study area is that, during the year (2013/14) in which household survey for this study was conducted the price of paddy had greatly plummeted. The price for a100 kg bag of paddy during cropping season was 70 000 Ths in 2011/12 whereas in 2013/2014 the price was 40 000 Tshs. To explain the cause for this, respondents from the five FGDs complained that there was too much of imported rice in the market that led to the decline in their output's value. To emphasise on this, one participant in FGD claimed:

> "……last season was the year of loss for all paddy farmers, the price was
> predominantly low even during months in which we normally get a good

price. That is why some people in the village have not been able to grow paddy this season as they had little money obtained from paddy sales from last season. Hence lack of money for this year's farm preparation" (A male FGD participant aged 37 in Mwaya, 2 April 2014).

The most critical concern is how paddy price varies over seasons, which is explained in sub-sections 3.5.5 and 3.5.6). Since price related shock is one of the main adverse events that may have considerable implication to households' income, in the above mentioned subsections, further empirical analysis dwells on this particular shock type.

On the other hand, crop destruction due to infestation by pests and infection by diseases was a significant shock reported by more than a quarter (28%) of the households as their main shock event during the 2012/13 season. This is consistent with the findings by Salimona and Falusi (2009) who reported pest and diseases to be among major risks related to shocks in rural Nigeria. Relatively, few households, less than a fifth (17.5%), reported to be affected by weather related shock events i.e. drought and floods.

Table 4.2: Events that cause crop shocks among households (n=279)

Shock type	Frequency	Percent
Crop failure due to pests,	80	28.6
Crop failure due to flood	49	17.5
Illness/death of household member	31	11.1
Low price for paddy	96	34.4
Others (i.e crop theft, land conflicts)	24	8.6

The last category 'other' includes idiosyncratic shocks related to crime or conflict with other farmers or agro-pastoralists. This category also includes some households whose shock of concern was weighing determination unit of their produce by the buyers. From the field observations, it was revealed that some buyers used a 30 kg size tin instead of the conventional 20 kg size tin to weigh paddy. Generally, farmers are on the receiving end and have less power to control this measurement as they are in a desperate need for cash after harvest.

4.5.3 Socio-economic characteristics of households and shock exposure

Socio-economic characteristics determine the likelihood of being a victim of income shock resulting from selling harvested crop products at a low price. Table 4.3 shows statistics of the socio-economic characteristics differentiated by whether households are affected or not affected by the crop income shock. Few variables including those which show significant differences are of interest and deserve attention. One of these significant variables is total household income. For those households unaffected by shock, their total household income is higher than affected households. The difference between the two was significant ($p=0.05$) as shown in Table 4.3. This is probably because they were able to fetch a good price for their crops, which potentially enhanced their total income.

Table 4.3 Summary statistics of selected socio-economic characteristics

Variable name	All Households (n=309)	unaffected (n=198)	Shock affected (n=111)	t-test statistics
	Mean (S.D)	Mean (S.D)	Mean (S.D)	
Working adult (persons)	2.7 (1.6)	2.7 (1.9)	2.6 (1.4)	1.19
Landholding under ownership	1.5 (1.4)	1.6 (1.6)	1.4 (1.1)	1.38
Land holding under cultivation	1.0 (1.1)	1.1 (1.0)	1.1 (1.3)	-0.53
Education (years of schooling of the head of household head)	6.7 (3.0)	6.9 (3.1)	6.4 (2.8)	1.68*
Total household income (Tshs)	1 137 046 (1 439 017)	1 376 427 (2 275 815)	882 709.6 (985 072)	2.17**
Farm income (Tshs)	425 220.2 (608 238)	532 346 (592 301.4)	333 314.7 (624 173)	0.86
Other crop cultivated	52.1	39	65.1	NA
Head with secondary education	22.5	29.3	15.2	NA
Storage facility	24.1	24.2	24.3	NA
Access to credit (%)	30.5	35.8	25.2	NA
Advanced crop sale (%)	21.9	25.2	18.6	NA

Note: a) ** and * denote statistical significance at 5 and 10 percent level respectively; the null hypothesis is that the means for unaffected households are equal to those of affected households b) Incomes and landholding are calculated per adult equivalent. c) 'NA' indicates that the variables were not suitable for t-test statistics. [a] n = 220

The other variable which differentiates between the two groups is education level of the households head. That is shock affected households' heads were relatively poorly educated than unaffected ones. This suggests an inverse relationship between education and exposure to shocks which are further tested in section 4.5.6. On crop diversification. Table 4.3 also shows that shock affected households were comparably more diverse in terms of other crops grown than the unaffected households. About 65% of the affected households reported growing other crops such as maize, banana, and cassava in addition to paddy and only 39% of unaffected households did the same.

With regards to a few selected assets, households on average owned 1.51ha of farmland and cultivated 1.04 ha. The cultivated land is about three-quarters of the

farmland owned. It seems households are not able to invest on all the land (farm) they own, and this may predispose them to shock as cultivating small areas could also lead to low crop income. On the other hand shock affected households were more predisposed to advance crop sale. These households borrow money using unharvested crop as collateral. This behaviour, which is practised by more than a fifth (21.3%) of the sampled households in Kilombero valley, is usually damaging as the lender usually buys paddy at a relatively low price as the terms do not favour the desperate households who need cash during the cash shortage pre-harvest season.

4.5.4 Shocks, seasonality and off-farm employment

This section draws on the data from the focus group discussions (FGDs), in-depth interviews and seasonal calendar to show the seasonality in the price of the paddy (the main food and cash crop), households' cash needs and off-season employment. Whereas, Table 4.4 provides the annual distribution of different households' activities and related consumption and income needs, Fig. 1 used price data[18] which were validated by rice traders in Malinyi and Lumemo villages to discern the specific variation of paddy price across seasons.

With respect to off-farm employment, Table 4.4 shows two marked trends among off-farm activities: whereas activities related to non-farm wage employment are less seasonal compared to farm wage and non-farm self-employment, and are evenly distributed across the year, farm wage was nonetheless mostly seasonal as it goes parallel with the farming season. It is further shown that non-farm self-employment

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[18] Visiting the study area during post-harvest season (August 2013) and pre-harvest season (February-April 2014) enabled the researcher to further validate the price trend of paddy in different seasons.

which encompasses business activities flourish more during the post-harvest season between June and November/December. This is because most households obtain cash from selling harvested paddy which could be used as a start up capital.

Farming is dominated largely by a single season of paddy production. Farming activities can loosely be spread into two seasons: these are the farm season proper which is between December and June and the off-farm season between August and October. As shown in Table 4.4 the main activities during the farming season are planting (January), weeding (February and March) and harvesting (May-June). Farm preparations during December and January are usually done by tractors or animal traction, and thus, less human labour requirements.

The second column in Table 4.4 shows a marked variability of paddy price across seasons. These data are complemented with more quantitative results in Fig. 4.1. Generally, combining Table 4.4 and Fig. 4.1 one sees that the paddy price was highest during the farming season, specifically from March to May and lowest during post-harvest season as expected. This finding is consistent with results of another study conducted in the Kilombero Valley by Musamba *et al.* (2011) in which the price of paddy during April and May was found to be three times higher than the price in July-August. Overall, prices of paddy in 2013/14 season were lowest relative to the preceding four years prior to the survey as noted during the FGDs conducted in all the villages. For example, the average price during post harvest months July and August was 80 000 TShs in 2011/12 where as for the same period in the 2013/14 season the average price was 40 000 TShs as reported in Mngeta and Malinyi

villages. More attention is paid to this trend as it has implications on households

shock exposure.

Table 4.4: Intra-annual seasonality of different livelihood aspects

Month	Paddy sale price	Cash needs	Farm activities	Availability of off-farm employment
December-January	High:	High: farm input needs i.e tilling school fees,	Planting season	Some non-farm self employment dominates
February-April	Highest, but most households face shortage of supply	Moderate: farm input needs for herbicides, labour	Weeding season, but largely February and March.	Period of most farm casual waged activities, i.e. those related to weeding
May-June	Lowest, start of harvesting season, sales often at farm gate price	High: it is a festival seasons i.e marriage, Second term school fees: capital for business start up	Harvesting season.	Period for most farm casual wage activities in paddy harvesting, i.e. cutting, transportation
July-September	Low, plenty of supply	low:	Post-harvest, virtually no farm activities	Vibrant non-farm self employment activities, i.e petty trade
October-November	Higher compared to June, July and August	Low: a few households start farm preparation	Households may start farm preparation	Some non-farm self employment dominates

The other seasonal trend depicted in Table 4.4 is that of households cash needs which

is high during December and January. This is the start of the proper[19] agricultural

season in which cash to hire tractors for farm preparation is critically needed.

Similarly, prior to paddy harvest (June-July), there is a high demand for cash for

paying school fees, and some post harvest festival activities and ceremonies e.g.

wedding. Thus, most households begin to sell paddy[20] in large quantities around

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[19] The typical paddy farming season may start as early as September when a few well-off households may start tilling their fields. But in most cases the majority of farmers would start farm preparation around December, the time during which even the cost of hiring a tractor for tilling is relatively higher compared to earlier months.
[20] Paddy sale price nonetheless varies across villages depending on village location in relation to the main urban centre (Ifakara town). However, during harvesting season (June and April) the cost for a

June in order to satisfy their cash needs around this time. Survey data show that by January 2014 more than three-quarters of households had already sold about three-quarters of their paddy stock. Generally, sales made shortly after harvest are usually regarded as distress sales because of the low sell price as shown in Fig. 4.1. One interviewee in an in-depth interview in Lupilo village complained that; 'one bag of paddy was sold at a price that would not even enable one to hire a tractor for 1 hectare farm preparation during the start of the next farming season'.
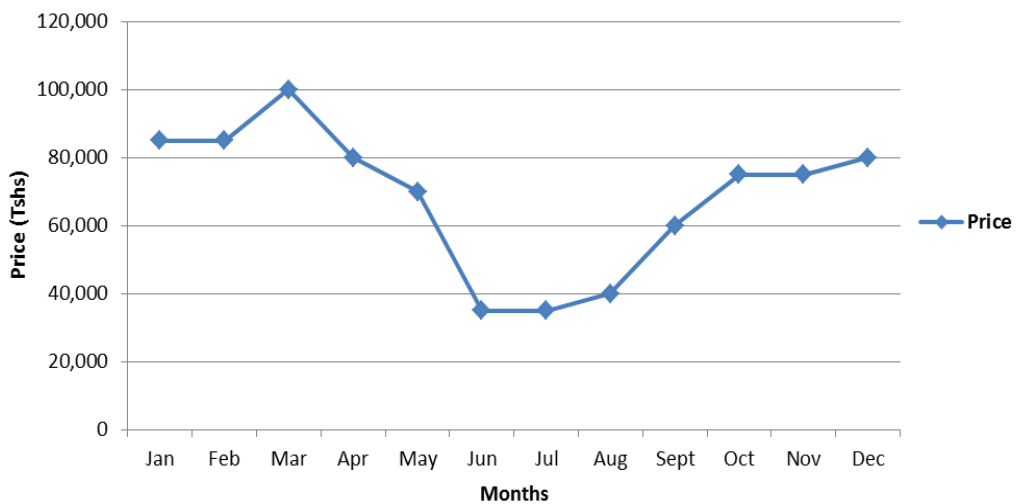
Figure 4.1: Seasonal (intra-annual) variation of paddy price in 2013/2014.
Notes: Price in the Y-axis is in Tanzanian shillings per one bag of paddy. Paddy in the study area is stored and measured in a 100-120kg bag of unhusked rice.

The results on seasonality presented in Table 4.4 and Figure 4.1 are relevant in the discussion of households' exposure to transitory income shocks. Seasonality patterns shape and determine the *ex ante* and *ex post* strategies responses that households adopt. These responses are presented in the sub-sequent sections.

bag of paddy was between 30 000-40 000 Tanzanian shillings. The peak price was recorded in February 2014 in which the price ranged between 50 000 – 70 000Tshs. These average estimates of the price were confirmed by key informants. The value of 1 USD was equivalent to 1,635 Tanzania shillings during months of the survey period. Tanzania shillings (Tshs) is the currency unit for Tanzania.

4.5.5 Off-farm employment responses to households shocks

So far the pertinent question is how different forms of off-farm employment and income thereof play a role in reducing income shock. To address this question, narratives from the FGDs and in-depth interviews are used. The FGD conducted in Mngeta was particularly relevant to explain cases of farm wage as a considerable number of households were engaged in farm wage employment in this village. This is because of the presence of a rice plantation (KPL) close to the village that provided seasonal waged labour employment. This type of off-farm employment is an important part of livelihood strategies as far as income shock is concerned. One participant elaborated this scenario in the FGD held in Mngeta as:

> "A lot of people engage in casual labour at KPL during *masika*[21] not because the wages are high, but rather as a result of shortage of food due to selling a large proportion of their harvest during the post-harvest season. Thus, the little wage they get supports their basic consumption till the next harvesting season…" (A 46 old female FGD participant, 13 March, 2014)

Generally, households with farm wage employment have to divide most of the intense period of farming season (February-March) switching between their own farm work and plantation. This has an implication on food production as they have less time for own farm labour as pointed out by one participant in the quotation below:

> "….For some of us, paddy fields are located far from the village, so we always have low harvest because we do not have time to attend our farms.

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[21] *Masika* is a *kiswahili* word *that* literally means long rainy season. The term is also used as a metaphor to imply time of acute income shortage associated with farming season in which there are few income generating opportunities.

We need to do weeding in our farms and at the same time we have to work in

the plantation….” (A 29 old female FGD participant, 13 March, 2014)

Discussions with a key informant, a sub-village (hamlet) leader, in Mngeta revealed

that the daily wage of 3 800 Tshs (2.3US$) from the plantation work during the

income shortage season was barely enough for basic necessities, and the same was

not sufficient to hire labour to work in their paddy farms to replace the labour used

in plantation work.

Off-farm employment may as well be a preventive mechanism against shocks. In this

sense non-farm self employment income enables households to reduce exposure to

risk as income gained from these activities can prevent shortfall during a season of

shortage. This was pointed out in another FGD held in Malinyi in which a male

participant said:

“Having other off-farm income gaining activities is important in this village

because you cannot rely on selling paddy. The price is very low now (August

2013) compared to the cost we incurred in farming. In this village off-farm

income helps people to have alternative sources of income which enables

them not to sell their paddy immediately after the harvest until February and

March when its price is high. The harvest also needs to satisfy your food

needs till the next season, as people in this village depend on paddy for food

and cash…” (A male participant, 10th August 2013, Malinyi village).

The key result in this sub-section is that poor households which are motivated by

seasonal income shortfall rely on supplying off-farm labour during paddy farming

season. This thus, partially corroborates Samal and Pandey (2005) claim made

among rice farming community in India that marginal farmers rely on rice wages whereas big farmers cope with shortfalls of consumption by engaging in non-farm self-employment activities. In addition, the result is also consistent with an Indonesian study on income shock (Bertoffa and Modena, 2013)

4.5.6 The Role of off-farm employment on households' income shocks exposure

While discussion in section 4.5.4 described the processes under which households cope with income shock, depending on their off-farm income endowments, it did not provide the quantitative estimate on the extent to which having off-farm employment determines a household's exposure to shocks. As described earlier, exposure to shock is proxied by a household's decision to sell their output during the low price season. Results of probit estimates are presented in Table 4.6. The overall model is significant (P ≤ 0.01), suggesting that the variables specified are jointly significant in explaining households exposure to shocks.

**Table 4.5: The Role of off-farm employment on reducing exposure to shocks-
          Probit model results**

	Coefficient	Standard Error	Z	P>|z|
Household head's Education	-0.371	0.196	-1.89	0.059*
Household head's age	-0.010	0.005	-1.95	0.052*
Access to credit	-0.264	0.167	-1.58	0.114
Other crops cultivated	-0.502	0.163	-3.07	0.002**
Advanced crop sale	0.346	0.188	1.84	0.066*
Farm holding owned	-0.047	0.022	-2.13	0.033**
Farm holding cultivated	0.050	0.027	1.85	0.064
No. of working adult	-0.049	0.052	-0.94	0.345
Farm wage	-0.318	0.229	-1.39	0.165
Non-farm self-employment	-0.482	0.193	-2.50	0.012**
Non-farm wage	-0.296	0.253	-1.17	0.243
Households in Mwaya/lumemo	-0.332	0.160	-2.07	0.038**
Storage facility	0.123	0.191	0.65	0.518
LRchi(13)	37.04			
Prob>chi2	0.0004			

Note; *= Significant at 10% (p=0.1);   ** = Significant at 5% (p=0.05)

On explanatory variables of interest, only non-farm self-employment income was negative and significant ($p \leq 0.05$). This implies that engagement in non-farm self-employment was associated with an increased probability of selling their crop during the peak price season. Thus, households with this status are more likely to make profit and avoid exposure to income shocks during the next paddy planting season (other things remaining constant). Such households are likely to be able to manage price seasonality shock and their consumption needs. This result is consistent with Kijima *et al.* (2006) who found out that households in Uganda responded to agricultural shocks by expanding self-employment business thereby increasing their household income. A study conducted by Porter (2012) in Ethiopia showed similar results.

Possesion of secondary education by household head was negative and significantly ($P \leq 0.059$) associated with exposure to shocks, suggesting that, household heads without secondary education compared to those with that level of education are more likely to fetch good price during high price season and avoid being affected by income shocks. Education increases awareness and skills in different production decisions including those related to the selling of farm produce. Similarly, an inverse relationship was found between farm area owned and the probability of being exposed to shock, with farm size holding being significant ($P \leq 0.05$) as shown in Table 4.5. This implies that those with large farms are unlikely to sell their crop at low prices and thus, avoiding income loss. The plausible reason for this is that ability to cultivate large farms may be associated with more income as households may rent extra land and earn income, which can buffer against potential shock.

The results in Table 4.5 further show that advanced crop sale was positive and significantly (P ≤ 0.1) associated with the likelihood of being exposed to shocks. This means that households, which accepted cash in advance for the unharvested paddy were more likely to fall victims of income shortfalls. This was particularly common for poor households, in which households borrow money during the farming season and repay that money with harvested paddy on terms set by the borrowers. The last variable which significantly determines exposure to income shock is village location. This variable was negative and significant (P ≤ 0.05), indicating that residing in Mwaya or Lumemo was associated with decreasing the likelihood of being exposed to income shock. This may plausibly be associated with vibrant off-farm businesses that may provide enough income that satisfies household needs during the period of low price season.

4.6 Discussion

The findings have revealed a high rate of engagement in off-farm employment. The higher rate of engagement may be attributed to the study area having a high agricultural potential. It has been reported by Loening *et al.* (2008) and Mathenge *et al.* (2015) that off-farm activities prosper in favourable agro-climatic regions. This is plausibly explained as results of production linkages between farm and off-farm employment; that is output of one set of activities (i.e farm) can be invested in another set (off-farm). More engagement in off-farm employment insures households against different types of shocks.

Shocks identified can be categorized into two broad types which are covariates shocks and idiosyncratic shocks. Notably, floods and draught are covariates shocks as they affect large groups of the population. These kinds of shock are though not the main focus of the analysis on this study. The majority of households had more concern with income loss resulting from low price for their paddy which caused income shortfalls during the farming season. Selling paddy at a low price by itself may strictly not be a shock. However, income shortage resulting from the low price and which occurs during the farming season in the study area could be treated as a shock. In such a case these, types of shock that are seasonal and affecting certain segments of the population can be regarded as transitory and idiosyncratic. This seasonal nature of the shocks has a different implication on the insurance role of off-farm employment.

The study findings have shown that most of the off-farm employment activities are largely seasonal. Their availability is closely related to seasonal variation of farm activities. For example, activities related to non-farm self-employment including those related to trading were dominant during the off-farm season. This may be due to two reasons. First, during the post-harvest season most households have enough cash obtained by selling the harvested paddy, and thus their purchasing power for off-farm goods and services is high. Second, most of those who engage in petty trade get their capital by selling paddy around the harvesting time (June-August). This is a typical farm–off-farm backward linkages as described by Haggblade *et al.* (2007) in which earnings from farm activities are invested in off-farm business ventures. When asked on the source of their capital, 76% of those who were engaged in non-farm

self-employment mentioned income from their own paddy sales as their main source, implying production farm/non-farm linkages.

With respect to the role of off-farm employment in reducing or buffering against exposure to shocks, the study findings generally suggest two important issues. First, seasonal variation in availability of farm income and off-farm employment matters. Households with some forms of non-farm self-employment income during the post-harvest or off-farm season are strategically able to avoid selling their paddy immediately after the harvesting season. By doing so they compromise their farm income. Generally, the highest net gains (profit) is obtained by selling at the start of the farming season or pre-harvest season (when the price is high). In this case they covary their main (two) income sources in an attempt to reduce *ex ante* their exposure to income and consumption shortfall. Further empirical evidence from estimation results (Table 4.5) show that it is engagement in non-farm self employment that reduces households' exposure to shocks, whereas farm wage and non-farm wage are statistically less relevant as *ex ante* mechanisms.

Second, farm wage employment income is inherently meant to vary with farm income, and this variation has a different implication to that of non-farm self-employment income. Because of the risky environment, households are by necessity compelled to engage in farm wage during the start of the farming season. This makes sense considering that the start of farming season corresponds to the time of most difficulty to meet household needs (See Table 3.5). Thus, different from non-farm self-income, the evidence from Kilombero Valley confirms that farm wage income

is essentially an *ex post* coping strategy as it serves to smooth contemporaneous consumption and income during the farming and pre-harvest seasons. One should observe that this farm wage role may not be a unique case applicable to Kilombero Valley only; farm wage labour supply and demand has been responding well to destitution and or transitory negative shocks in rural Malawi (Dimova *et al.,* 2015) and in rural India (Kochar, 1999) as well.

At this point the study's findings and the resultant discussion adds to the theoretical perspective of risk management posited earlier by Cervantes-Godoy *et al.* (2013) and Kwon *et al.* (2005), whereby it is argued that the *ex post/ex ante* role of off-farm employment is structured and intricately featured within seasonality of these activities, their incomes and type of households shock events. This being the case, analysis of risk management role of off-farm employment must not only disaggregate off-farm employment activities but also their linkage with farm activities construed within the aspect of seasonality.

The distinction between *ex ante* and *ex post* shock reducing management roles is also relevant for policy interventions. For example, for farm wage and a few non-farm self-employment activities conducted during farming season, the goal is to smooth income *ex post*. In this case, activities to be encouraged should be low return and low risk, whereas for non-farm self-employment during the post-harvest season creation of employment should focus on high return activities as the goal is to mitigate farming seasonal income shock (*ex ante* measure). Thus, it is imperative to consider seasonal availability of different off-farm employment so as to accurately examine

the robustness of off-farm income/employment as a coping or a risk management strategy.

4.7   Conclusions and Recommendations

This study has investigated the role of off-farm employment and income in responding to households' income shocks and how these responses are shaped by seasonality. Two main conclusions can be drawn. First, some off-farm activities and income sources have a seasonal variability which largely counters the farm season. Similarly, harvested crop (paddy) market price which affects crop income in Kilombero valley has a seasonal variation, and this seasonality is translated into shocks during the farming season for households that cannot take advantage of the price variations. Second, households employ different off-farm strategies in an attempt to counteract or manage the effect of income shock during the peak of farming (cultivating) season. For example, farm wage income enables households to cope with this shock by smoothing their income and consumptions. However, engagement in farm wage at the peak of the cultivating season compromises farm productivity for households with shortage of labour supply. Consequently, this leads to more vulnerability during the harvesting period which traps households into a cycle of income risk, uncertainties and shocks.

On the other hand, income from non-farm self-employment activities during the post-harvest season enables households to manage risks and prevent exposure to shocks during the farming season. The mechanism by which these risks and shocks are managed is through taking advantage and profitably exploiting crop price seasonal variability. Similarly, econometric evidence has confirmed that controlling

for the set of individual, locational and household characteristics, off-farm employment increases the probability of selling paddy at a high price during the peak price season. Notably, this significantly reduces exposure to transitory income shocks.

From a risk management point of view, one broad insight can be made based on the specific scenario of Kilombero Valley; off-farm employment/income as a risk strategy does not only respond to the seasonal onset of shocks but also it is shaped by these shock events. This seasonality indeed determines its *ex post* and *ex ante* role when it comes to households that highly depend on cultivation of one seasonal crop (paddy) that they largely depend on for their income as is the case in the study area.

In terms of the current study's findings policy relevance, first and foremost, it is hard to prevent intra-annual seasonal change in price of agricultural commodities such as paddy, which is the main cause of income shock at least in the study area. Generally, to some extent the market price is determined by structural forces related to global food prices. However, the state institutions such as local district councils (local government authorities) can play a role of facilitating growth of entrepreneurial off-farm activities, particularly during the off-farm season. Income from such activities may not only enable households to offset the adverse effects of the seasonal variations of consumption but could also enhance households' ability to manage and cope with the seasonal income shortfalls. This might in turn have a positive implication on reduction of income poverty. it is thus recommended that, more opportunities for off-farm employment should be made available in rural areas such as Kilombero Valley.

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CHAPTER FIVE

5.0   Off-farm Employment and Income Poverty the Kilombero Valley, Tanzania

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5.1   Abstract

Poverty reduction strategies in rural areas have generally focused on the role of agriculture and its contribution to household income. However, off-farm employment has the potential to contribute to increasing poor households' income. This study was set to examine the effect of off-farm employment and income on households income poverty. Data were collected from a random sample of 309 households in the first quarter of 2014 in five villages of Kilombero Valley, Tanzania using a structured questionnaire. Income poverty was analysed using the Foster-Greer-Thorbecke

(FGT) poverty index and two stage least square (2SLS) regression. Households with off-farm employment income were found to be less poor based on all the three FGT parameters which are incidence, depth and severity of poverty. Similarly, estimations from the 2SLS model show that, holding other factors constant, engagement in off-farm employment led to increased total income for households, and hence a significant predictor of the same's poverty status. Other variables which were significant are crop shock, farmland location and land ownership. It is thus recommended that, rural development policies should be broad based to consider the diversity of households' income strategies including engagement in rural off-farm employment activities. Increasing opportunities for the off-farm income generation may be a route out of poverty among rural households.

Key words: *Off-farm employment, off-farm income, FGT poverty measure,*

Kilombero Valley

5.2   Introduction

Extreme poverty is a major challenge faced by developing countries reliant on agriculture as their mainstay of the economy. The agricultural sector not only fails to employ surplus rural labour but also its income stream is subjected to high risks resulting from climatic factors, price fluctuations, pests and diseases. Consequently, income poverty is a common feature for households that rely on subsistence farming alone. It is, however, a well established fact that rural households have highly diversified income sources combining farm and off-farm activities in their portfolio of livelihood strategies (Ellis, 2000; Barret *et al*., 2001; Urassa, 2009). Off-farm

employment has been recognized to play a great role in raising rural households' income and reducing poverty (Lanjouw and Murgai, 2009; Himanshu *et al.,* 2011) and provides a buffer against income fluctuation (Lanjouw and Lanjouw, 2001). These roles are achieved because of the substantial contribution of off-farm employment to household's income in the developing countries. For example, by the mid 2000s, non-farm income[22] as a share of total household income averaged 35% for Africa and 50% for Asia and Latin America (Haggblade *et al.*, 2007). This shows that off-farm employment substantially complements rural household's income in African economies, Tanzania included. However, these economies are dominated by subsistence agriculture.

The Tanzanian economy is largely characterized by rural, mostly subsistence based agriculture which sustains the livelihoods of more than 70% of the population (URT, 2011a & 2011b). Despite the impressive historically high economic growth (GDP) of 7% in over the past 6 years (Wuyts and Kilama, 2014), income poverty has declined very slightly over the same period and poverty levels remain notoriously high. In addition, this decline is marked by a significant rural-urban disparity. Recent data from the 2012 household survey show that, the incidence of poverty (headcount ratio) was 33.3% and 21.7% for rural and urban areas respectively (NBS, 2014a). These statistics depict just a minor decline from the rates of 39.4% (rural) and 22.7% (urban) reported in 2007 (NBS, 2014a). Other poverty indicators such as inequality still reflect an increasing poverty trend as the Gini coefficient increased from 0.36 in 2008/9 to 0.39 in 2012/13 (NBS, 2014b). While the inequality rate in urban areas has

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[22]This share of the contribution reported by the author excludes farm wages which is considered as part of 'off-farm' employment in this study

remained constant at 35% between 2008/09 and 2012/13, the Gini coefficient in rural areas has increased from 31% to 34% in the same duration (NBS, 2014b).

The above statistics suggest a steady increase in inequality, particularly in rural areas indicating that reported high GDP growth is not broad based and the growth effect does not trickle down to the rural poor. The implications that one draws from these poverty statistics is that the agricultural sector which is the mainstay of the economy, employing the majority (75%) of the workforce is associated with poverty.

This study was carried out in the rural areas of Kilombero Valley, which is regarded as one of the areas with favourable agro-climatic conditions in Tanzania. The main objective of this study was to examine the off-farm income effect on poverty status of households. To meet the broad objective there were three specific objectives: first, to compare the incidence, depth and severity of poverty for households groups with different off-farm income sources in the study area; second, to examine the distribution of incidence, depth and severity of poverty across the study villages; and lastly, to estimate the contribution of the different categories of off-farm employment, i.e wage employment, non-farm self-employment and other individual and household capital assets on a household's total income. For a clear empirical strategy a hypothesis stating: 'engagement in off-farm employment has a positive effect on household total income' was developed from the third objective.

The rest of the manuscript is organized as follows: Section 5.3 provides a literature review focusing on the relational aspect between off-farm employment and poverty with emphasis on poverty measures used in different studies. Description of the

study area and methodology is presented in sub-section 5.4 whereas the results and discussion are covered in sub-section 5.5. Lastly, sub-section 5.6 presents the study's conclusions.

5.3   Off-farm Employment and Poverty

This section provides an overview of the studies that have explored the link between off-farm employment as a diversification strategy and poverty. But first and foremost, the two main concepts used in the study are defined; definition and conceptualization of such broad and multidimensional concepts as poverty and off-farm employment is of relevance as the definitions determine empirical measures to be used. Generally, the study's conception of poverty is based on monetary terms and is defined as a state of having an income shortfall or low income. By this conception, income poverty line is used as a benchmark to distinguish poor and non-poor households. Further measurement issues are described in detail in section 5.4. On the other hand off-farm employment is defined as activities from which households engage and generate income apart from their 'own' farm work. These activities include i) farm wage jobs on plantations or other people's farms, ii) non-farm wage-employment and ii) non-farm self-employment in trading, construction, transport, and the services sector. In the same vein, off-farm income is thus obtained when the household heads or spouses work off-the farm in one or all of the three off-farm activities described above.

Studies that have explored the off-farm–poverty link can broadly be put into two dimensions; these are those which treat off-farm employment as having

disaggregated functional categories as described in the definition above (De Janvry and Sadoulet, 2001; Ruben and Van den Berg, 2001; Lanjouw and Shariff, 2004) and those that consider off-farm employment as a single homogeneous sector (Portocarrezo *et al.*, 2006; Akaakohol and Aye, 2014; Katega and Lifuliro, 2014).

Treating different functional off-farm categories separately and using country representative data in India, Lanjouw and Shariff (2004) show that, generally, off-farm employment does not benefit the poor in terms of income accumulation because they are simply pushed to low earning casual agricultural wages for survival needs. Another related study by Ruben and Van den Berg (2001)[23] shows that it is non-farm self-employment and not farm wages that contribute to reduction of income poverty by enhancing agricultural production and income.

Among studies that have not separated off-farm categories, Akkakohol and Aye (2014) provide empirical evidence from Nigeria that diversification into off-farm activities is associated with increased level of welfare. The authors, though, could not explicitly state the welfare measure used. De Janvry *et al*. (2005) used a detailed household survey from rural China to simulate counterfactual data of rural households' income, poverty and inequality without non-farm income. The authors found that without non-farm employment, rural poverty would be much higher and deeper, and that, income inequality would be higher as well.

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[23] The authors used the term non-farm employment and not of off-farm employment. However, similar to the present study they also included farm wage category in their conceptualization of 'non'-farm employment.

In another perspective of associating poverty and livelihood, a micro level study of 10 rural sub-villages conducted in Tanzania by Ellis and Mdoe (2003) concluded that rural poverty was attributed to lack of non-farm alternatives. Another related study by Katega and Lifuliro (2014) found that off-farm employment has an income poverty reducing effect in less productive agricultural areas of central Tanzania. In contrasting evidence, Portocarrezo *et al.* (2006) found that non-farm self-employment was not an important sector for jobs and income among rural populations because of predominance of low earning marginal activities in which people are engaged. As a result of these contradicting views ambiquity still exists on the poverty effect of off-farm employment.

Using decomposable poverty index, Foster-Greer-Thorbeke (FGT) developed by Foster *et al.* (1984) which is the approach that this study adopts, Mat *et al.* (2012) found that when non-farm income and unearned income is added to households income there is reduction of poverty incidence and depth by about 55% and 63% respectively. These findings provide evidence that not only does off-farm employment have an effect on head count ratio (poverty incidence), but more importantly it also reduces the extent to which households fall into poverty (depth), implying an inequality reducing effect.

Literature on Tanzania (Dercon and Krishna, 1996; Ellis and Mdoe, 2003; Katega and Lifuliro, 2014; Mduma, 2014) shows that the specific contribution of off-farm employment on income poverty has not been based on decomposable poverty measures. This calls for the need for a more robust approach that considers

decomposable income poverty measures such as FGT index in the contenxt of rural Tanzania. Furthermore, two additional important conclusions can be made. First, the effect of poverty depends very much on, and needs to be disaggregated by categories. This is based on the fact that off-farm employment itself, according to Ruben and Van de Berg (2001), is very heterogeneous largely in terms of capital and skills requirement. Secondly, for a targeted and guided poverty policy, identification of extent and depth of poverty using different population subgroups based on their income sources is relevant. The study on which the manuscript is based thus intended to address Tanzania's specific knowledge gap in relation to the impact of off-farm employment on income poverty reduction and at a much broader perspective to enrich off-farm-poverty literature. Hence, conducting a location specific micro level study such as the present one was of empirical and policy relevancy.

5.4   Methodology

5.4.1 Description of the Study area

The Study was conducted in the Kilombero Valley which is a swath of fertile lowland spreading across Kilombero and Ulanga Districts in Morogoro region. The study area is located about 300 km southeast of the Tanzanian commercial city of Dar es Salaam. The area contains the largest freshwater wetland at low altitude (<300 m above sea level) in East Africa and one of the largest flood plains in Africa (Kangalawe and Liwenga, 2005). This feature implies favourable agricultural productivity of the area. Subsistence farming is the main source of income, with paddy being the main crop. Other crops grown include maize, sesame, banana and sugarcane. Despite being a productive wetland, farming opportunities are severely affected by unreliable rainfall, poor infrastructure leading to lower crop income

among farmers in the area compared to other wetlands (McCartney *et al.,* 2010). It has further been reported that, due to the influx of agro-pastoralists migration into the valley farming activities have been affected by a serious land scarcity problem (Nindi *et al.,* 2013). Consequently, this contributes to poverty income for farming households in the area.

5.4.2 Data collection

The data used for this manuscript originated from a survey conducted in two phases. During the first phase, a reconnaissance survey was conducted in August 2013 to give a broader understanding of the off-farm activities and poverty status in the study areas. During this exploratory survey, discussions were held with different stakeholders including farmers, village leaders and district community development officers in Ulanga and Kilombero Districts. Participatory wealth ranking (PWR) was also conducted in two villages (Malinyi and Lupilo) out of five study villages. This preliminary survey also involved pre testing of the questionnaire. The findings from this stage were used to refine the study objectives, sampling methods and the survey instrument. The second phase involved actual household survey which was undertaken from February 2014 to May 2014. The questionnaire was administered to household heads by a team of three trained enumerators who were trained prior to the survey and the researcher. The questionnaire captured salient aspects of socio-economic and demographic attributes of the households. Information of household members' engagement in and type of off-farm income was also captured. PWR for the other three villages was also conducted during this phase.

The household was used as the unit of analysis whereby the questionnaire was administered to the household head. By asking a household's head on behalf of other members the unitary household modeling is evoked. Based on this model, decision making on engagement in off-farm employment is vested on the household head. In absence of the head, a spouse or any adult member was interviewed. Other members of the households were also encouraged to be around during the interviews to assist in items that needed recalling of information. A household was defined based on Tanzania's household budget survey (NBS, 2014a) in which a household is referred to as people who live together and share income and other basic needs and maintain the same centre of production and consumption.

5.4.3 Sampling

Based on reconnaissance survey and discussion with key informants at the districts and village levels a total of 5 villages representing two attributes of interest (Table 5.1) were purposively selected. These attributes were endowment with agriculture resources, which is farmland and accessibility in terms of presence of an asphalt road connecting a village to other urban areas. Mwaya and Lumemo villages were considered as being well connected in terms of infrastructure but poor in resources whereas Mngeta, Lupilo and Malinyi were regarded as less connected and resource rich villages. These two attributes of resources and accessibility were set as selection criteria because they were expected to influence both households engagement in off-farm employment and poverty status as detailed in the discussion section.

Table 5.1 Location and sample size selection by study villages

Village	Accessibility	Agriculture potential	No. of households	Sample size
Mwaya	Accessible	Poor in resources	1 135	6
Lumemo	Accessible	Poor in resources	1 487	74
Lupilo	Accessible	Rich in resources	1 389	69
Mngeta	Remote	Poor in resources	1 211	60
Malinyi	Remote	Rich in resources	1 307	65
Total			6 529	324

Source: Household numbers were obtained from the available village registers. The sampling intensity (the last column) was 5% for each village.

Since the study's interest was on paddy farming households, the analysis considered households which possessed some land under cultivation in 2012/13 and 2013/14 agriculture seasons. Accordingly, a total of 324 households were selected using stratified random sampling (see Table 5.1 and Appendix 6). However due to lack of some information for 15 households, the analysis was only done for 309 households. Based on Gray (2014), a sample of 30 or more is recommended in experimental researches.

In each village, households were ranked and stratified into three wealth categories. This stratification was conducted through participatory wealth ranking (PWR) with selected sub-villages in each of the five villages. In Mngeta 2 sub-villages close to a rice plantation, Kilombero Plantation Limited (KPL) were purposively selected. Four individuals (1 sub-village leader and three villagers) who were knowledgeable of the poverty status of most households in a village participated in PWR. Based on the PWR households were randomly picked but, in proportion to size of each stratum. In carrying out the random process all the names of eligible households were written on a piece of paper and thereafter random picking was done to obtain the required sample for each village. Results of the PWR are presented in Appendix 6. For the household survey a sampling intensity of 5% for each village was found adequate

(see Table 5.1). In addition, purposive sampling was employed in selection of key informants. Apart from four key informants who were involved in PWR 2 district community development officers and 1 village executive officer in each study village were involved in sampling preparatory stages.

5.4.4 Data analysis and poverty measures

Data were analysed using descriptive statistics, Foster, Greer and Thorbecke (FGT) poverty index and a two stage least square (2SLS) regression. Descriptive statistics were used to describe households' socio-economic profiles and included means and percentages. These three analytical procedures were employed to address specific objectives set as described in the subsequent sections that follow. STATA statistical software package version 13 was used to carry out the analysis.

5.4.5 Foster-Greer-Thorbecke (FGT) Poverty Index

The first and second objectives were analysed using the Foster-Greer-Thorbecke (FGT) decomposable poverty index. FGT measures are useful to assess the overall level of poverty by sub-groups of populations e.g. groups defined by income sources or village boundaries on which this analysis focuses. Sub-groups of sampled households in the current manusrcipt constitute households with different income sources with the main interest being off-farm sources. FGT poverty measures have been used in a number of studies such as Sanusi (2011) and Mat *et al.* (2012) to ascertain the relative importance of off/non-farm income.

To obtain the income sub-groups, the sampled households were disaggregated by income sources and poverty measures were assigned to each group. Three FGT poverty indices (measures) examined were incidence, depth and severity of poverty. Based on Foster *et al*. (1984), the FGT index is given by the following formula.

$$P_\alpha = \frac{1}{n} \sum_{i=1}^{q} \left(\frac{z - yi}{z} \right)^\alpha$$

Where: P_α = FGT parameter to be computed

n = total number of households in a population

q = number of poor households living under the poverty line

z = the poverty line for the population

yi = household total income per adult equivalent

$\frac{z - yi}{z}$ = proportion shortfall in income below the poverty line.

α is a parameter that takes the value of, 0, 1 and 2 to measure incidence, depth and severity of poverty respectively. Larger values of α represent increase in the relative weight on the poorest among the poor population. When α is 0 the measure becomes poverty incidence (P_0), which simply measures the proportion of households that are poor. This measure pays no particular attention in describing the poor, as they are regarded as all being below the poverty line. When α is set at 1, the measure becomes poverty depth or poverty gap index (P_1). P_1 measures the extent of poverty for those households which are below the poverty line. It considers the distance to which the poor are from the defined poverty line. The last parameter when α is set to 2 is poverty severity (P_2) an FGT parameter that gives more weight to the poorest households. Poverty severity is a sensitive measure for income distribution of the

poor in that a unit income increase of the poorest households has more effect on poverty than the same unit increase in a less poor household.

One of the inputs in the construction of the FGT poverty measures described in the equation above is a poverty line which basically serves to distinguish the poor from non-poor households using a particular welfare indicator. It is defined as the minimum threshold of consumption on food or per capita income below which an individual or household is described as poor. While consumption is a more preferred welfare measure in household surveys, and has been extensively used in studies examining off-farm diversification and the poverty link, this study on which the manuscript is based adopted the income approach. Henceforth, income is used as a general poverty indicator and in defining poverty line. Income approach has been used in other studies on defining poverty line, for example, Sanusi (2011) and as a poverty indicator e.g. Ruben and van den Berg (2001), Yunez-Naude and Taylor (2001) and Kassier *et al.* (2011).

Since there is no established household income poverty line in the study area, the srudy adopted a basic needs poverty line of 36 482 Tanzanian shillings (TShs) per adult equivalent (AEU) per month (or 437 784 TShs per AEU per annum) in 2011/12 prices as set and used by NBS (2014a). This poverty line was then adjusted to consumer price index (CPI)[24] of the year (2014) in which data for this study were collected to obtain a value of 581 510TShs. So, households in the total sample

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[24]Consumer price index (CPI) account for the cost of acquiring goods and service at the year interval (between 2012-2014). CPI for Tanzania was 112.7 and 149.7 for the years 2012 and 2014 respectively (WB, 2015)

earning more than this value (581 510TShs) per adult equivalent per annum were regarded as non-poor and those earning below this value were considered as poor.

Income was a preferred poverty indicator in the present study because of three main reasons. First, the focus of this study is on the relative importance of off-farm employment on household's poverty status. Thus, use of income provides room for description of the direct effect of off-farm income on poverty using decomposable poverty indicators. Second, for livelihood analysis, income is comparably more relevant than consumption in understanding how households diversify their livelihood strategies (Ellis, 2000). Third, the use of the income approach emanates from the assumption of non-separability of consumption and production among most rural households observed in developing countries. For households which depend much on their own production, Cavendish (2000) argues that income and consumption are rather similar in magnitude. For households in the Kilombero Valley, paddy is the main cash and food crop, and predominantly contributes to their total income. This being the case, what they basically consume (trade) is what they produce from their own farms. Furthermore, because the analysis aims at comparing poverty between households with different income sources, then measuring income was more relevant than consumption.

Total household income: Total household income is defined as the value added during a specific time period from assets that a household owns or has access to, such as labour and land (Angelsen and Lund, 2011). As in the NBS (2014b), this study measures total household income as composing of farm income, off-farm

income and income earned from transfer e.g remmitance and rentals. Hence, the overall income and its components (particularly those obtained from off-farm activities) can be comparatively analysed and their relative poverty impacts be assessed. Total households income is based on annual cash earnings of the households from farm and off-farm activities and includes remittances and pension. Off-farm income includes net profit generated from self- employment activities and cash earnings from wage employment. Thus, monthly earnings for all activities were summed up to get annual incomes for each employment category. Farm income is computed from the market value of produced crops less the cost of production. Labour cost is not included in the household income computations due to difficulties in accounting for the labour shadow price. Remittance includes transfer income from migrated household members where as other income includes pensions and rental income received by households by renting out land, housing or any other household asset. For the purpose of comparability across households in the study area, total household income is based on the adult equivalent units (AEU). The conversion of income to AEU is based on the weighted household members sex and age scale adapted from the NBS (2014b) (see Appendix 7a and 7b).

 The questionnaire used in the household surveys included questions on income based on recall of the previous year. Data based on recall of the previous year may not always be reliable (Ellis, 1998). Nonetheless, an attempt was made to ensure the presence of both the head and the spouse wherever possible in order to at least improve recall and hence the reliability of these income data. In addition as suggested by Angelsen and Lund (2011) for one-shot surveys, the income data was

appropriately decomposed by individual income sources/activitites to minimise recall

errors.

5.4.6 Estimation method of poverty effect

To address the third objective, data were analysed using a two-stage least square

regression (2SLS). This model was found appropriate since the dependent variable

has a continuous scale value and non zero observations for all respondents. The

potential threat of endogeneity which will be described latter also determined the

selection of the model. The dependent variable was total household income per adult

equivalent. The specification can simply be described as;

$q_{it} = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_7 + \beta_8 x_8 + \beta_9 x_9 \; \beta_{10} x_{10}$

$+ \beta_{11} x_{11} + \beta_{12} x_{12} + \beta_{13} x_{13} + \beta_{14} x_{14} + \varepsilon$

where $q_{it} = $ total household income per adult equivalent

$x_{1-13} = $ vector for explanatory variables

$\beta_{1-13} = $ parameters that were estimated

$\varepsilon = $ error term

The detailed description of definition and measurements of explanatory variables

specified in the model are presented in Appendix 9

One of the main explanatory variables is non-farm self-employment activities

(NFSE). Engagement in NFSE, however, requires possession of start-up capital. In

such a case household's wealth status may determine both their total income and

their engagement in NFSE. Furthermore, NFSE may be determined by someone

enterpreurial ability which also affect his/her total income. Therefore, NFSE

becomes endogenous because it correlates with the error term (ε). The use of ordinary least square regression in the precence of endogeneous variable may lead to biased estimates. To take care of such endogeneity, 2SLS is employed which requires specification of exogenous variable (s) or instruments that do not have a direct effect on the dependent variable, but correlates with the endogenous variable (Wooldridge, 2012).

Two instruments were used to control for the endogeneity of NFSE. These are a household's access to electricity and distance in kms to the main town (Ifakara). Theoretically, access to electricity is believed to be important for off-farm employment participation (Lanjouw, 2001). Statistically, access to electricity is relevant because it correlates with NFSE engagement but is very unlikely to affect total household income outcomes after controlling for other households' production assets such as farmland. Similarly, distance reduces transaction costs to urban centres (Haggblade *et al.*, 2007) and hence positively affects operation of rural trading activities which are part of the non-farm self employment. Its effect on total household income is thus via NFSE, and this satisfies the condition of a valid instrument.

5.5   Results and Discussion

The results and discussion are combined and presented in three parts. In the first part the socio-economic characteristics and distribution of different off-farm income are presented. This part includes the descriptive analysis of the variables used in the poverty estimation. The second part presents the computation of the FGT poverty

indices where effect of different off-farm income sub-groups on selected FGT indices were examined and compared. The last part gives the estimation of off-farm employment effect on household poverty status.

5.5.1 Socio-economic characteristics of households and distribution of income sources

This section presents the socio-economic characteristics for the whole sample and as differentiated between households with off-farm and those without off-farm employment. These characteristics may determine households' poverty status. Summary statistics of these variables are presented in Table 5.2. Some of these characteristics are the covariates of the regression models presented further on. The results in Table 5.2 generally show that the income generated from off-farm employment was much higher than the farm income. Among the off-farm employment components, non-farm self-employment showed the highest income contribution followed by non-farm wage employment. As regards ownership of land, which is the most important physical asset, the results showed no statistical difference between households with and those without off-farm income. The average land holdings of 1.5 ha is slightly similar to the land ownership of 1.6 ha reported by Balama *et al.* (2014) in another study conducted in Kilombero district. The PWR conducted earlier showed that it is land cultivated and not land owned which is the key determinant of wealth in the study area. Results in Table 5.2 further show that, paddy, as the principal crop occupied a greater share (89%) of total cultivated farm land in the 2012/2013 farming season. Sharecropping between maize and rice was though observed among households.

Table 5.2 also shows that about a third (34%) of the households reported to have cultivated other crops apart from paddy. This indicates the dominance of paddy and a low level of crop diversification. The poverty implication of this reliance on one crop is that when there is a price fall of the dominant crop (paddy) which is the regular trend in Kilombero Valley (Kato, 2007), households income is severely affected as paddy is the main cash earning crop. The seasonal price fluctuation of paddy price has been reported elsewhere in Kilombero valley (Kato, 2007, Musamba *et al.*, 2013). Other crops grown include maize, banana, sesame, cassava and sugarcane and various species of seasonal vegetables. As a proxy for household level human capital, the mean number of dependants was 3 while total household size was 5. This implies that households were populated with a greater number of non-working members. It has been observed elsewhere in rural Tanzania that household size has a negative effect on diversification strategies including off-farm diversification (Urassa, 2009). This apparently results into negative implication on household poverty as noted by Adetayo (2014) and Ibrahim and Srinivasan (2014) in Rural Nigeria. On the other hand the results further show that the average education (actual years of schooling) of household heads was 6.7 years (with standard deviation of 3), implying that the majority of the household heads had primary education level.

At a disaggregated level of the two employment statuses (off-farm and non-farm only) sub-groups, three variables deserve attention as far as this section is concerned. First, total household income for households with no off-farm income sources (farm only) was significantly (p=0.001) lower than income among those with any kind of off-farm income (Table 5.2). Secondly, there was a significant mean difference in

education of the households head between households with off-farm income and those without off-farm income. However, this difference does not mean that off-farm employment was associated with a higher level of education since there are off-farm activities such as farm wage that require very little skills and education. Lastly, the results in Table 5.2 show that a greater proportion (about 75%) of the households with off-farm employment were members to one or more associations compared to only about a half of households with membership in at least one association in the farm only category. This shows that membership to associations in social groups may be associated with engagement in off-farm employment. Section 5.5.4 further shows the extent to which membership in associations and other variables in Table 5.2 are related to poverty status.

Table 5.2. Descriptive statistics of surveyed households socio-economic status

Variable name	All households (n=309)	Household with off-farm employment (n=220)-A	Households without off-farm employment (n=89)-B	Difference in means A vs B	P-Value
	Mean (percent)	Mean (percent)	Mean (percent)		
Total Household income (Tshs[a])	1 137 046	1 353 413	586 064.2	-3.211	0.0015*
Farm income (TShs)	425 220.1	414 879.2	450 782.1	0.413	0.670
Farm wage income (TShs)	134 420	NA	NA	-	-
Non-farm self-employment income (Tshs)	1 041 851	NA	NA	-	-
Non-farm wage employment income (TShs)	1 080 440	NA	NA	-	-
Remittance income (TShs)	209 267	168 235	653 658	0.434	0.671
Other incomes (TShs)	282 660	283 638	280 216	-0.026	0.979
Landholdings	1.5	1.4	1.7	0.062	0.942
Crop shock (%)	89.0	45.5	51.6	-	-
lowland field (%)	71.8	72.3	70.8	-	-
Other crop cultivation (%)	52.2	51.2	53.4	-	-
Household size	5.	4	5	0.661	0.508
Number of dependents	3.	2	3	0.085	0.932
Education of household head (schooling years)	6.7	7	3.01	-2.342	0.019**
Male headed households (%)	71	73	70.9	-	-
Access to credit (%)	30.5	37.2	23.6	-	-
Association membership (%)	46.0	74.1	51.1	-	-
Households located in Mwaya and lumemo (%)	40.4	71.0	22.0	-	-

* Mean differences between households with (A) and without (B) off-farm income are statistically significant at 10% level.

** Mean differences between households with (A) and without (B) off-farm income are statistically significant at 5% level.

[a] 1 USD = 1 635 Tanzania shillings (TShs) during the months of household survey

This sub-section has therefore provided the main attributes that differentiate between households with and those without off-farm employment. The differences noted in this categorization may though hide specific attributes resulting from heterogeneity within off-farm employment. The next section thus discusses how income earned from each of the functional categories of off-farm employment (farm wage, non-farm wage and non-farm self employment) contribute to poverty statuses.

5.5.2 Poverty profile of households based on their income sources

This section provides a comparative analysis of poverty rates and total income of households which is based on households' sub-populations disaggregated by off-farm and farm income sources. For the households' employment/income profile, the sampled households are classified into four occupational categories (income groups), based on their off-farm income status namely: a) households with farm income only, b) households with farm income and farm wage income c) households with farm income and non-farm self-employment income, and d) households with farm income and farm wage income. The results are as shown in Table 5.3.

Table 5.3: Poverty indices by subgroups of households' off-farm and farm income (n=309)

Households' income category	Head count (P$_0$)	Poverty depth (P$_1$)	Poverty severity (P$_2$)
Farm income only (a)	0.707	0.153	0.092
Farm income+nonfarm self-employment income (b)	0.245	0.085	0.089
Farm income+farm wage income (c)	0.299	0.137	0.149
Farm income+non-farm wage income (d)	0.550	0.133	0.067
Magnitude of index change			
Percentage change (%) b-a/a*100	-65.4	-44.4	-54.4
Percentage change (%) c-a/a*100	-57.1	-10.4	-32.3
Percentage change (%) d-a/a*100	-22.5	-13.00	-27.02

Note: 1. The last three columns under 'magnitude of index change' show the percentage change (reduction) of each of three poverty indices as a results of addition of self-employment income (b), farm wage income (c) and non-farm wages income (d) to the farm income(a). 2. The computations of these percentage changes are shown in the last three rows of the first column.

Table 5.3 displays the impact of each income source on the three FGT poverty measures. All income sources include farm income as all households are engaged in farming and have this income in their total household income. The results generally show that off-farm income is not only associated with low poverty rates (high poverty measures) but also its inclusion in household (farm) income leads to reduction of income poverty. For example, incidence of poverty is highest, (70.7%) (see the first row under P_0) among households with farm income and lowest (24.5%) among households with non-farm self-employment. Similarly, an addition of non-farm self-employment to a household's farm income reduces the poverty incidence in the study area by about 65% (see the second column, seventh row of Table 5.3). This impact of reduction is much higher than the impact of an additional of farm wage income and non-farm wage income to farm income which results into 57.1% and 22.5% changes in P_0 respectively. The study's findings are comparable to those reported by Ibrahim and Srinivasan (2014) in a study covering rural Nigeria where it was found that self-employment reduced incidence of poverty by 5.1%. However, this reduction is relatively lower compared to the current study's findings, plausibly because of the small proportion of households with off-farm (non-farm self-employment) in Ibrahim and Srinivasan's (2014) study. Nevertheless, it suggests a positive role of off-farm income in reducing the proportion of poor households.

It is important to note that, the incidence of poverty simply represents the head count or proportion of households below a relative poverty line. However, understanding the proportion of households (poverty head count) below income poverty is less informative in terms of poverty analysis and policy measures. The measure (poverty incidence or head count) does not show how far households are deeper away from

the poverty line. It is of much policy interest to understand the depth of poverty or how far the poor fall short of the income poverty line. This depth (P_1), as described in section 5.4.5, has an implication for poverty targeting strategies as households close to the poverty line may need different interventions from those deep into poverty.

Column 3 of Table 5.3 shows absolute values of poverty measure per income group (first five rows) and proportion change of poverty depth (the last three rows). The poverty depth reflects how worse off households designated as poor, are based on the poverty line used in the analysis. In other words, the measure, P_1, shows the income gap of the poor households relative to the poverty lines. This measure is thus far more rich in poverty analysis as it takes into account the distribution of income shortfall of poor households. The results in Table 5.3 further show that P_1 is much lower when non-farm self-employment is included in farm income compared to the other two off-farm income sources. In other words, one can say that engaging in non-farm self-employment leads to a lower poverty depth.

The change in poverty depth when non-farm-self-employment is added to household farm income is 44.4%, which is the highest compared to the observed change for the other two off-farm income categories. The above suggests that, inclusion of non-farm self employment reduces the income shortfall of the poor by 44.4%. Similarly, the reduction of P_1 with addition of non-farm wage and farm wages to households farm income are 10.5% and 13% respectively. The higher the absolute value for poverty depth the higher the income needed to prevent income shortfall of the poor. As

expected, this value (P_1) is highest for households with farm income only in their total income as shown in Table 5.3. The study's findings in regard to poverty depth is comparable to findings of a study by Ibrahim and Srinivasan (2014) that also used the income poverty line. The positive poverty effect of off-farm employment was also noted in a study by Adetayo (2014) that used the expenditure based poverty line.

Generally, poverty severity (P_2) compared with P_1 gives more weight for households much further away from a poverty line than those less poor which are much closer to the poverty line. Table 5.3 shows a more or less similar trend for severity as it is for poverty depth. The results in Table 5.3 show that non self employment income and farm wage would reduce poverty severity by 54.4 and 27% respectively for households that have off-farm income types. The results further show that poverty is most severe for households with farm wage income than those with other types of off-farm income sources.

Two important observations can be noted based on results of the poverty measures presented above. First, the overall farm wage has less effect on poverty depth and severity compared to other off-farm employment categories. This can be explained by having relatively fewer individuals in the sample (about 23%) with this employment type. Thus, because the index involves aggregate population measure, the effect of farm wage is likely going to diminish. The other possible explanation of the decreasing role of farm wage in lowering poverty measure is based on off-farm diversification survival-accumulation needs argument posited by Ellis (1998) and Dimova and Sen (2010), which also reflect the prevailing situation in Kilombero

Valley. This argument suggests that households in rural areas are simply pulled to off-farm employment (e.g. farm wage in this case) with a sole motive of reducing shock exposure and smoothing their consumption in an environment of risky agriculture income. This means that accumulation of income which would raise their total household income, and hence aggregate community measure cannot be realized. Second, it means that non-farm self employment has more impact on lowering poverty measures (reducing poverty). This can simply be explained by having the majority (58.6%) of households in the sample engaging in this kind of employment. In relation to policy purposes, measures that increase opportunity for non-farm self-employment activities and non-agricultural wages are more significant. These measures will not only reduce relative poverty (poverty head count) but also improve poverty depth and severity hence reduction of social exclusion.

5.5.3 Household location and poverty status

A houseold location across the study villages may determine its poverty status. This is because villages covered in this analysis had some attributes that determine income poverty as explained in sub-section 5.4.3. Thus, it is of great relevancy to explain poverty by village groupings, as the poverty policy also needs to recognize location differences even for an area that may be regarded as homogenous in terms of livelihood strategies such as the study area. Table 5.4 presents the results of the FGT decomposable poverty measures by villages.

The results generally show that there is a difference in incidence, depth and severity of poverty across the study villages. It should be noted that Lumemo together with

Mwaya represent accessible villages with good road infrastructure on one hand and Lupilo which is grouped with Malinyi and Mngeta as more remote villages on the other hand. These three villages (Lupilo, Malinyi and Mngeta) are also more resourceful in terms of farmland availability. Generally, Lumemo village has the lowest poverty level (high poverty measure). For example, the value of poverty depth of 0.10 as shown in Table 5.4 for Lumemo is the lowest across all the villages. A simple interpretation of this value is that, 10% of the poverty line will be needed to get the poorest households in Lumemo up to the poverty line. On the contrary, 21% of the poverty line is needed to lift the poorest households in Lupilo which has the highest (0.21) poverty depth level. One plausible explanation for this observation is that, Lumemo; compared to lupilo, Malinyi and Mngeta; is located in close proximity to an urban area with good accessible roads, which ensures interaction with other urban areas. In this case, farming households in Lumemo are likely to get profit from low transaction costs as a result of good connectivity of the village. The lower poverty status measure reflecting income well-off in Lumemo can also be attributed to being located in an area with vibrant off-farm activities particularly those related to trading. The road accessibility attribute has been positively associated with participation in off-farm employment in Tanzania (Mduma, 2014) as it increases opportunities for various off-farm income generating activities. Those off-farm opportunities have desirable effects on household's total income.

The characteristics of Lupilo are also shared by Mngeta and Malinyi although the latter are comparably less poor than Lupilo as they have lower values for poverty incidence, depth and severity. For example, Table 5.4 shows that the poverty incidence was 0.32 and 0.34 for Mngeta and Malinyi respectively which were lower

compared to the absolute value of 0.46 in Lupilo. Field observations revealed that Lupilo is less productive in terms of paddy production which is the main marketable crop compared to the other two villages with a similar status. Accordingly, households' total income may be lower in Lupilo leading to a higher incidence of poverty because of its implied lower farm (paddy income). This may be explained by a theoretical view point of production linkage between farm and off-farm activities as described by Reardon and Taylor (1996), and Haggbalade *et al.* (2007). This view point suggests that, farm income may be used as input (capital) for off-farm business start up. Hence, these off-farm activities have a direct effect on income poverty.

Table 5.4: Relative distribution of poverty indices across the study villages (n=309)

Poverty index	Mwaya (n=54)	Lumemo (n=69)	Mngeta (n=56)	Lupilo (n=67)	Malinyi (n=63)
Poverty incidence (P_0)	0.40	0.23	0.32	0.46	0.34
Poverty depth (P_1)	0.17	0.10	0.12	0.21	0.13
Poverty severity (P_2)	0.10	0.02	0.06	0.15	0.02

In sum, the discussion in this sub-section has revealed that there is a wide disparity in terms of poverty even for an area that may seem to be homogenous in terms of their livelihood activities. These differences across the villages have largely been shaped by availability of road infrastructure and agricultural resources in terms of farmland. Generally, these attributes are key ingredients for growth of off-farm employment (De Janvry and Soudulet, 2001; Mathenge *et al*., 2015) and reduction of income poverty.

5.5.4 The Effect of off-farm employment on poverty status among farming households

A 2SLS estimation with instrumental variables (IV) are presented in the last three columns of Table 5.5 with the results for the OLS presented alongside. The dependent variable was log transformed in order to maintain normality and yield better estimation results. The post estimation test for multicollinearity was run for the OLS model. The mean variance inflation factor (VIF) of the test was 4.3, which was well below the level at which the variables would be considered suffering from multicollinearity. The Durbin-Wu Hausman test statistics to check whether NFSE is truly endogenous was carried out. This test confirmed the appropriateness of the IV estimation approach. To check for validity of both instruments, the Sagan overidentification test was performed. The null hypothesis for the test state; the instruments are jointly valid. The result of the test was insignificant (as shown in Table 5.5), thus confirming validity of the instruments used. Results of first stage least square regression which reported coefficients of the instruments are presented in Appendix 8. This analysis thus focuses on the second stage regression with the identified instruments as decribed in section 5.4.6.

2SLS results (Table 5.5) showed all three main explanatory variables i.e non-farm self employment (NFSE), farm wage (FW) and non-farm wage (NFW) were positive and significant. This suggests that households that engage in any of the off-farm employment gain more total income. For example, the coefficient for NFSE was significant at 0.05 level. The implication is that, engagement in NFSE increases total household income by 46% keeping other variables constant. This increased income contribution is much lower than the one caused by engagement in NFW in which

total household income is raised by 61.7%. On the other hand, FW was significant and positive at 0.05 level. The coefficient for FW in the 2SLS model (Table 5.5) was 0.061, implying that engaging in this employment category leads to 6% increase in total household income. It can thus be said that, of the three categories of off-farm employment, NFSE and NFW are stronger predictors of household income and thus income poverty. This finding is generally consistent with Sanusi's (2012) study in rural Nigeria, which used the income poverty measure and findings by Obisesan (2012) which employed expenditure data as a proxy for household monetary poverty. Both of these studies reported a strong positive association between NFSE and household well-being.

Results for other control variables were largely as expected. The variables that were significant are crop shock, lowland field, land cultivated and land owned. The coefficient of lowland field was negative implying that a farm being located in the lowland resulted in decline in total household income by 32% compared to upland fields. Lowland fields are usually flooded leading to considerable crop failure. The crop loss was largely caused by floods which were reported and affected households with paddy fields in lowaland water logged areas in the survey year.

As a control for household assets endowment both land cultivated and land owned were positive and significant at (p = 0.05). The interpretation is that an additional hectare of cultivated land raised total household income by 15%, where as for an extra hectare of land owned the total income increased by 10%. For households in the Kilolmbero valley, cultivated area is dominated by paddy which is not only an important crop for food, but also a valuable cash crop. Thus, since farming is

associated with less intensification, large area under cultivation can be assumed to lead to more farm income and thus a household's total income. This income earned has an implication on determining a household's poverty status. As a household asset, land is crucial for the rural poor and determines their income poverty status. This finding corroborates the evidence by De Janvry and Sadoulet (2001) in rural Mexico arguing that farm land owned (both irrigated and rainfed) is positively associated with increased household income.

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Table 5.5: **OLS and 2SLS results for effect of off-farm employment on total household income**

Independent Variables	Dependent variable : log transformed total household income per adult equivalent					
	OLS			2SLS		
	Coefficient	Standard error	t values	Coefficient	Standard error	Z values
Non-farm self employment	0.395***	0.156	2.53	0.461**	0.152	3.03
Education of the head	0.034**	0.026	1.31	0.042	0.020	2.09
Female head	-0.315**	0.190	-1.65	-0.361*	0.148	-2.44
Number of dependent	0.006	0.052	0.12	0.053	0.039	1.36
Access to credit	-0.011	0.170	-0.07	0.177	0.122	1.45
Crop shock	-0.393***	0.176	-2.23	-0.227	0.130	-1.74
Lowland field	-0.286**	0.178	-1.60	-0.323*	0.139	-2.33
Other crops	-0.029	0.166	-0.18	-0.148	0.125	-1.18
Group membership	0.086	0.153	0.56	0.057	0.119	0.48
land cultivated	0.190**	0.081	2.34	0.150**	0.062	2.40
land owned	0.172***	0.068	2.52	0.105**	0.050	2.08
Non-farm wage	0.611***	0.216	2.82	0.617***	0.122	4.50
Farm wage	0.092**	0.051	1.8	0.061**	0.024	2.54
Mwaya/lumemo	-0.256	0.157	-1.63	-0.239	0.122	-1.95
Constant	13.4	0.48	27.8	12.4	0.69	17.92
R^2		0.36				
Durbin –Wu-Hausman test					14.72***	
Sagan overidentification test					0.8	

Notes: ***, **, * represent significance levels at 0.01, 0.05 and 0.1 respectively. Number of observations in both models is n= 309.

In summary, the results in this sub-section have shown that off-farm employment is a relevant predictor of a household's total income and consequently a household's welfare status. The estimation method applied has enabled analysis in this study to describe causality between off-farm employment and income poverty at a fairly high degree of certainty. However, the problem of endogeneity cannot completely be ruled out. Other variables in the model, for example land owned as an asset, may be endogenous. But as long as this is not the main explanatory variable in the model, its effect in terms of interpretation of the results is not significant.

5.6   Conclusions and Recommendations

The present study aimed at examining the the poverty effect of off-farm employment/income among rural households in Kilombero valley. Three households' off-farm income groups which are non-farm self-employment, nonfarm wages and farm wages were identified and their poverty effect analysed.

Results based on decomposable poverty measure, (FGT) suggest that off-farm income generally helps to reduce income poverty among farming households. This was ascertained from lower poverty levels for FGT measures namely incidence, depth and severity of poverty for households with any of the three sources of off-farm income. This shows welfare improvement occurs not only in the proportion of households' poverty level but also in the extent to which households fall below the poverty line. However, the reduction is not uniform across all the three off-farm categories. Non-farm self-employment income has much higher desirable effect compared to farm wage and non-farm wage income.

Evidence based on the estimated effect of engagement in any of the three off-farm employments has generally revealed a direct positive effect of engagement in non-farm self-employment or non-farm wage and farm wage employment on total household income. Other individual and household attributes that significantly predict total household income are education, sex, and farmland owned and location. Thus, it can be concluded that income generated from off-farm employment has leads to significant reduction of income poverty.

From the policy perspective, this study recommends that, the role of off-farm employment as a key to rural livelihood diversification should be reinforced in the Tanzania's long term development strategies and policies. For example strategy with immediate relevance in this context is Tanzania's Development Vision 2025. It is further recommended that, the review process of the vision, which aims to achieve a middle income country by 2025, should consider and integrate the off-farm sector in agricultural development programmes. In the same reasoning, specific strategies that will promote infrastructure development in the study area whether carried out by national level government or local government authorities will not only enhance off-farm opportunities but also enhance households' income earning potential and thus reduction of income poverty. This will also have far reaching effect on reducing income inequality and social exclusion.

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CHAPTER SIX

6.0   Summary, Conclusions and Recommendations

6.1   Summary of the Major Findings and Conclusions

Households' diversification into off-farm employment is a norm. However, empirical question that abounds is the extent and pattern to which off-farm employment can indirectly or directly contribute to improved livelihoods and poverty reduction. For smallholder crop farmers, this contribution can be either through increased farm production or reduction of exposure to crop income shocks. The present study was carried out generally to investigate off-farm employment potential for poverty reduction by focusing on farm input expenditure, income shocks and income poverty. The research was motivated by the low use of inputs and regular shocks that face households in Kilombero valley. Five related objectives were set and four broad sets of hypotheses were formulated to empirically address the main research problem.

The first objective was on examination of individual, household and community level variables that determine engagement in off-farm employment. This was set as the main theme in the second chapter of the thesis. It was particularly imperative to carry out an assessment of the various barriers and factors affecting off-farm employment before examining its contribution to aspects of livelihoods i.e. input expenditure, shocks and income poverty in the preceding chapters. This makes sense since discussion of off-farm employment contribution is only relevant if individuals or institutional attributes that pose impediments to successful off-farm engagement are recognised and overcome. The particular focus on examining these attributes was on the role of social capital. It was revealed that social capital was equally important

in explaining engagement in off-farm employment as other more tangible households' capital assets such as physical, financial and natural capital. Households seem to exploit social capital in terms of social trust and social cohesion in accessing credit and reduction of transaction costs, features that may increase their probability of off-farm engagement. Strong association was observed between for example level of social trust and the likelihood for one being involved in farm wage employment. On the other hand households engagement in non-farm self employment was more associated with social cohesion and membership to associations. Hence, the different dimensions of social capital have a varied effect on off-farm employment engagement. Thus, enhancing household level social capital through formation of social groups may imply an important step that will ensure more engagement and growth of off-farm employment in the study area. The study further found association between, farm size under cultivation, proximity to urban locations and probability of engaging in off-farm employment. Though no strong claim of causality is made, the findings generally support the hypothesis set ealier (sub-section 1.11.1) on association between off-farm employment and social capital.

The second objective examined the farm input effect of off-farm employment by broadly examining farm-off-farm linkages (Chapter 3). The findings have revealed important complementarities and competing needs in terms of input and labour supply between farm and off-farm activities. One aspect of these complementarities is expenditure effects in which off-farm income, particularly that obtained from non-farm self-employment (NFSE) was used to finance the farm enterprise (paddy farming) through more expenses on input. Econometric evidence generally suggests

strong association between off-farm income and spending on farm inputs (herbidices, machinery and labour) for paddy cultivation as hypothesised earlier in sub-section 1.11.2. Nonetheless, there was little evidence whatsoever to suggest households with farm wage income also spend their earnings on purchase of these essential inputs. Qualitative evidence provides a strong evidence of negative effect of off-farm employment engagement on a household's labour. In this case labour was perceived as a variable input in paddy farming in the study area.

The findings in chapter three suggest that, growth of the off-farm employment sector should not be taken for granted as it can always be directly linked to increased farm expenditure (in terms of input and labour) through linkages in the consumption and production spheres. However, there are potential trade-offs between farm and off-farm sector in the environment of rural labour shortage. This is because the assumption of surplus rural labour, often held in literature, was not particularly valid in the Kilombero Valley which was dominated by labour intensive paddy production. The findings of this study thus challenge the notion set forth in literature that, participation in off-farm activities always leads to complementariness and positive effects that lead to increased investment and growth in farm activities. The study's findings rather suggest that, due to competition for family labour between farm and off-farm activities, there are indeed elements of labour competition between the farm and off-farm sectors of rural economy. The observed competition between farm and off-farm may apparently lead to a damaging effect that may reduce farm investment and create a cycle of farm income risk, shocks and vulnerability. Hence, the related concept of risk and resultant shocks for crop farming households in

Kilombero is an important dimension of poverty that households have to contend within their quest for off-farm employment diversification.

From the livelihood perspective, more farm investment in terms of labour (as an asset) can be translated into less exposure shocks, particularly those related to crop income. The study emphasised on crop income shock because this was found to be the most pronounced threat to households (according to 84.3% of all sampled households) that affect productivity in the study area. With the above understanding, the third specific objective was examined parallel with the third study's hypothesis (chapter 4) both of which focus on the shock insurance role of off-farm employment activities. The findings in this thesis show that off-farm activities carried out during the off-farm season have more risk reducing effects and they generally enable households to cushion themselves from crop income shocks.

In addition to the above-mentioned, it is off-farm activities during the farming season that have an *ex post* shock absorption role. Generally, econometric evidence from the study shows that there is an inverse relationship between engagement in non-farm self-employment and the probability of being affected by crop income shocks. Linking findings from chapters three and four, one assumption can be made; that, off-farm engaging households with more leverage on paddy producing inputs (chapter 3) are more likely to insure against income shocks. All these attributes have a positive total income effect since households will earn more income from their paddy production. It should, however, be noted that despite the input effects, engagement may lead to more shock exposure if less labour is available for farm

productivity. Hence, realisation of the income effect may not always be actual. Thus, it is important to examine if the income effect also depends on the nature and type of off-farm employment/income.

The thesis addressed income poverty in chapter five with the purpose of examining the income poverty levels for households with different off-farm engagement. The findings have generally revealed that poverty effect (FGT measures) differs according to type of off-farm employment. In particular, it was noted that income from non-farm self-employment has more income poverty reduction effect compared to other sources of households' income, by reducing incidence, depth and severity of poverty to different extents. In a similar understanding, the findings of the thesis have proved that income poverty was associated with a households village location. Houseolds located in villages with vibrant off-farm activities had relatively low poverty rates based on all the three poverty parameters. Evidence from the regression results further showed that engagement in off-farm employment leads to increased household total income. In terms of establishing causality, the findings establish a direct relationship between engagement in off-farm employment and households' income. This was achieved through the use of instruments to take care of endogeneity of non-farm self-employment in the 2SLS regression model.

Based on the main research problem, two main conclusions can be drawn. First, engagement in off-farm employment enhances households' ability to overcome liquidity associated with both lack of proper functioning of input and insurance marktets. Second, the manner in which such liquidity provides enough leverage and

how it is used, depends on seasonal availability and type of off-farm-employment or income. Whereas econometric evidence indicates non-farm self- employment income to be used in input expenditure for paddy cultivation, farm wage employment/income does not. Farm wage which is obtained during the farming season has a negative effect as it reduces labour available to households' own farm activities. Moreover, income earned from farm wage is not used to compensate for the lost labour. Qualitative evidence, however, showed that income from farm wage employment provides an *ex post* risk management role as it is used in consumption smoothing. Hence, off-farm employment should be considered as a heterogeneous group with disaggregated role in liquidity provision and insurability. Broadly, given the importance of the rural off-farm sector in buffering against liquidity constraints, it does play a crucial role as not only a mechanism to enhance more investment in agriculture, but also as an effective strategy to address shocks brought by output price fluctuations. In countries such as Tanzania where agriculture in terms of crop farming remains central to livelihoods of rural households, availability of inputs and reduction of risks and shocks are of critical cimportance.

6.2   Theoretical Implications

The study's findings have wider theoretical implications which are particularly relevant in explaining the processes of off-farm employment in areas with the same socio-cultural and agro-climatic conditions as the study area. At a broader analytical perspective, this study illuminates an analytical gap in development economics between the farm household model (FHM) built on assumption of perfect labour market on one hand and rural off-farm employment as a risk reducing strategy on the

other. The conceptual framework that incorporates risk aspects as employed closed this gap. The market imperfection in terms of households' inability to access input credit and insuarance against crop income shocks is a critical aspect in rural livelihoods at least in the Kilombero Valley. Evidence has shown that households overcome input credit/insurance constraints by engaging in off-farm employment, albeit their abiliy to overcome these constraints through consumption depends on their earnings from off-farm employment (production). Hence, households' production (i.e. off-farm engagement and use of inputs or labour) and consumption decisions are detetrmined by labour endowment and production assets and thus decisions are non-separable.

Based on the analysis in this study, any model built on the assumption of imperfect markets that tries to explain off-farm employment should not only focus on income effect but also on lost-labour effect. Indeed, the lost-labour effect is likely to be relevant in areas where there is generally growth of farm wage related to off-farm activities, and where these activities covary with households farm activities. This is indeed a prevailing situation in the study area. In such a case, competition for labour between farm and off-farm activities that prevail offsets the income effect of off-farm activities.

From the risk management theoretical view, off-farm employment has been found to have both *ex ante* and *ex post* roles. But these roles are shaped by seasonality of not only off-farm employment but also seasonal nature of farm activities. In the study area, income shocks seem to be determined by the element of seasonality. Thus, the

risk management roles of off-farm employment are shaped and construed within the processes of seasonality. It has been shown, for example, that the *ex ante* roles of reducing exposure to income shocks are more relevant and have more impact if these off-farm activities are carried out during farming off-seasons. On the other hand, off-farm activities that are practised parallel to farming season (paddy farming) essentially play the *ex post* roles of consumption smoothing. In such a situation the nature of off-farm employment also determines its risk/shock management effect.

6.3 Policy Implication of the study's findings

Rural livelihood strategies involve both individual household's processes and state based interventions. Individual household's processes are those related to household's assets endowment and strategies adopted to achieve a desirable outcome of sustaining flow of income and avoiding deprivation. The state intervention involves policies and other measures implemented by governments at different administrative levels and non-governmental organisations. These interventions assist households and individuals to pursue sustained livelihoods hence attaining economic development. Therefore, three sets of specific policy implications are discussed focussing on the state interventions based on what transpired from a household strategy which is off-farm employment.

The first policy implication is in the area of promoting social capital which was found to reduce barrier to engagement in off-farm employment. This may be enhanced by promoting and supporting growth of self-help associations or community groups at the village level. These groups can facilitate access to capital/credit and reduce transaction costs for rural trading and enterprises. The role

of promoting growth of these groups largely falls under the district administrative councils (local government authorities (LGA) which have a direct supervisory role in village administration in Tanzania. Distict administrative officers, for example, in both districts to which Kilombero Valley spreads (Ulanga and Kilombero) may visit and provide education on the best way to sustain these community groups. The role of NGOs is also important at this point.

The second implication is that rural off-farm employment is asscociated with increased spending on inputs among rural households. Therefore, the off-farm sector should be promoted in policies that intend to increase farm investments. The role of farm wage employment is crucial at this point, as a significant number of households in the Kilombero Valley engage in this employment. For example, the ministry for labour at the policy making level can formalise some of the activities to ensure acceptable remuneration. This may reduce the impact of lost family labour on household farm production with positive farm investment effect. More importantly, these activities have been found to be an important buffer against income shocks in situations of missing insurance markets.

The last specific policy intervention relates to the finding that engaging in off-farm employment does increase total household income. This again emphasises on the promotion of different forms of off-farm employment. But the fact that well-off households earn significantly more off-farm income than the poor in the Kilombero Valley calls for more scrutiny on the distributive nature of off-farm employment opportunities. Policies should ensure equal participation of the poor households so as to reap the benefit of the off-farm sector.

At a broader perspective, a cross-sectoral approach to rural development is recommended. Policy makers at the ministerial level should not pursue off-farm led strategies at the expense of farm led growth strategies. It is critical to address sectoral constraints to rural development: infrastructure e.g. roads and electricity, human capital (skills and literacy), social capital (trust, groups and networks) and activation of key markets (financial, information, input and output). Rural development policies that focus on these attributes would increase households and individual human, physical and financial capacity to seize opportunities, both on-farm and off-farm. This recommendation is based on the findings that point to production and investment linkages between farm and off-farm activities as presented in the thesis. With the same understanding, a more specific recommendation is towards a broader perspective in reviewing the Tanzania development vision (TDV) 2025, particularly the second (2015/16-2020/21) and the third (2020/21-2025/26) medium term plans. Generally, there is a need to recognise the increasing role off-farm employment in rural economic diversity which may lead to inclusive economic growth that helps to realise the TDV target of having a semi-industrialised country by 2025.

6.4   Areas for Further Research

A few potential areas for further investigation emerged from the current study. These areas emanate from the coverage and methodological standpoint as far as the study is concerned. On coverage, one of the information gaps that remains unaddressed hence warranting further investigation is related to level of generalisation. The thesis is based on findings from data collected from five villages considered to be

representative of Kilombero Valley, a favourable agriculture zone in south eastern Tanzania. Hence, the findings are largely based on the study area and other areas with similar socio-economic and agro-ecological characteristics as Kilombero Valley. It would be more informing and empirically valid to use the same methodology to conduct a similar study in other regions considered as having low agricultural potential in Tanzania. This will give a comprehensive understanding on how endowment of agriculture resourses determines income and off-farm diversification in the different agro-ecological zones. This will, moreover, provide a basis for a comparative analysis of farm investment and income shock effects that off-farm employment have on rural households livelihoods.

On basis of the current study's coverage, there is a need for a further in-depth analysis of one aspect of off-farm employment, i.e. farm wages, which is becoming increasingly dominant. Having an investigation that focuses on this employment alone as a rural livelihood strategy will unveil some attributes related to its effects on households and villages economies that have not been covered in detail by the current study.

Finally, there is also a knowledge gap that calls for investigation on how rural-urban linkages can contribute to growth of off-farm employment and income. This linkage can specifically focus on migration as an off-farm strategy.

APPENDICES

Appendix 1: Household questionnaire used in the research

INTRODUCTION
I am John Msinde, a student from Sokoine University of Agriculture (SUA). I would like to obtain information on your household and your income generating activities. This interview will approximately take 45 minutes. So I kindly request you to respond to this questionnaire which is set for the study purpose only. Participation is voluntary, and confidentiality of your identify and information therein is guaranteed. You may ask any question before we start. Thank you in advance for your cooperation and support!

SECTION A: IDENTIFICATION DATA

No.	Questions	Responses
A.1	Ward name	
A.2	Village name	
A.3	Date of interview	

SECTION B: HOUSEHOLD SOCIOECONOMIC AND DEMOGRAPHIC INFORMATION

No.	Questions	Responses												
B.1	Total household members													
B.2	Members below 15(<15) and above 64(>64)													
B.3	Ethnicity of head and spouse	B3.1 head						B3.2 spouse						
		Household member											**coding**	
B.4	Sex of respondent (Write codes below the column for each member; No 1represents the household head)	1	2	3	4	5	6	7	8	9	10	11	1.Male	
													2.Female	
B.5	Marital Status												1.Married	
													2.separated	
													3.Divorsed	
													4.Widower	
													5.Never married	
B.6	What is your highest level of education?												1.No formal education	
													2.Adult education	
													3.Completed 1º education	
													4. Completed 2º education	
													5. University /college	
													6. Other (specify)…….	
B.7	Years of schooling													
B.8	Age of household members													

No.	Questions	Coding Categories		Go To
B.9	Where was the household head born?	This village	1	
		Another village in the same district	2	
		A different region	3	
B.10	Where was the spouse born?	This village	1	
		Another village in the same district	2	
		A different region	3	
B.11	If born (head) elsewhere when did you settled in this village?	Mention the year……………………..		
B.12	What is the ownership status of the house you are living in?	Rented	1	
		Family house	2	
		Government free house	3	
		Inherited house	4	
		Other (specify):	5	
B.13	Has any household member migrated over the last three years? (being absent for more than 4 months)	Yes	1	
		No	0	B.15
B.14	What was the purpose of migration?	………………………………………………………… ……..		
B.15	Are you (or your spaouse) a member of any social organization? e.g. SACCOS, credit and saving, farm society, VICOBA	Yes	1	
		No	0	B.17
B.16	Which type of these organization are you a member?	Credit and thrift Cooperative (VICOBA)		
		Farmers group cooperative(mention)		
		SACCOS		
		Other (Specify)…………………………		
B.17	Has the household head received any loan in the last 12 months?	Yes	1	
		No	0	B.19
B.18	Where was the loan obtained from?	Close relative and friends 1		
		Rotating fund groups 2		
		Bank or SACCOS i.e FINCA 3		
		Other (specify)………………………		
B.19	What was the loan for?	Expain……………………………………………………..		
B.20	Has you or any household member received any formal training after schooling?	Yes 1		
		No 0		
B.21	What type of training has you (any other household member) attended?	Entrepreneurship 1		
		Agricultural skills 2		
		Vocational training (e.g carpentry e.t.c 3		
		Other (specify):……………… 4		
B.22	Has the household suffered any major shock that resulted in decline labour supply or income loss, i.e long term of sickness, floods, death of a member, fall in paddy sale?	Yes 1		
		No 0		C.1
B.23	What kind of shock was it?	……………………………………………………		

SECTION C. FARMING ACTIVITIES, FARM INPUTS AND CROP SHOCKS

No.	Questions		Coding Categories		Go To
C.1	Do you have land for farming?		Yes	1	
			No	0	
C.2	How do you characterize your farm ownership?		Own farm	1	
			rented	2	
			Both rent and own farm	3	
			Other (specify)	4	
C.3	What is the main food crop and cash crop cultivated in last season?		Cash crop………………, Food crop…………		
C.4	If you cultivated maize how did you allocate area for it?		Share crop with paddy farm	1	
			Allocate a separate farm (size…..)	0	
C.5	How far is the paddy farm from your dwelling		Distance (km)……………………………………..		
C.6	What is the location of your main crop farming plot?		Low land watershed areas	1	
			High land dry area	0	
C.7	In your opinion what can you say about paddy cultivation in the past four years?		Decreased	1	
			Increased	2	
			Constant	3	
C.8	Have you changed the size of farm (owned or rented) under paddy cultivation over the past four years?		Yes	1	
			No	0	C.12
C.9	What changes have you made?		Expanding area under paddy	1	
			Decrease area under paddy cultivation	0	
C.10	Why have you made the change in C.9 above?		Explain...		
C.11	Did you cultivated any other crop apart from paddy last season?		Yes	1	
			No	0	
C.12	Have you borrowed cash/food using unharvested crops as collateral in last season?		Yes	1	
			No	0	
C.13	Did the households run out of stock of previous food crop harvest before the following (2012/13) harvesting season?		Yes	1	
			No	0	
C14.	Had you sold 75% or more of the paddy before the next planting season (Dec 2013-January 2014)		Yes	1	
			No	0	
C.15	What is your household farm size?		Farm size (ha) ………………………………………		
C.16	What amount of land did your household cultivated (both owned and rented) during last season?		Farm size (ha) ………………………………………		
C.17	Indicate the size of farm land the household rent out (in) last season (if any)		Farm size (ha) ………………………………………		
C.18	How much did the household pay for renting out or got payed for renting in		Mention the amount………………………..		
C.19	What is the size of the paddy farm this season		Farm size (ha)……………		

			Please give the estimates of income in terms of market value of crops harvested in 2013					
	Type of crop	C20Response 1.Yes 2.No	C.21Land allocated for a crop	C.22Total Production (bags)/tins	C.23 Costs	C.24.Amou nt sold	C.25Unit price	C.26Total value (computed)
1	Paddy							
2	maize							
3	sesame (*ufuta*)							
4	Pea (*kunde*)							

5	Sweet potato						
6	Others(spe cify)						
7							
8							
		Please indicate the cost of the following inputs and other expenses incurred in last farming season					
C.27Did you purchase one of the following farm inputs 1.Yes 0. No	C.28 Amount purchased	C.29 Cost in Tshs for each		C.30 Cost for machinery used (if any)		C.31 Cost for Hired labour (if any)	C.32 Other costs
Seeds							
Organic fertilizer							
Inorganic fertilizer							
Herbicides							

Please indicate the cost of the following paddy inputs and other expenses incurred in the (2013/14) farming season					
C.30Did you purchase one of the following farm input 1.Yes 0. No	C.31 Amount purchased	C.32 Cost in Tshs for each	C.33. Cost for machinery used (if any)	C.34 Cost for Hired labour (if any)	C.35 Other costs
Herbicides					

Section D. Off-farm employment activities

No.	Questions	Coding Categories		Go To
D.1	Has the household engaged in any off- farm employment (i.e casual labour, any form of petty businesses) in the last year?	Yes	1	
		No	0	D.8-D.12
D.2	What type of off- farm employment did youself or (spouse) engaged in? (i.e. the one with significant income contribution)	Non farm self employment .eg carpentry or petty business,(mention).............	1	
		Non-farm wage employment e.g casual labour-mention…….	2	
		Farm wage employment	3	
D.3	What was the main source of capital?	Own saving from agricultural income	1	
		Credit	2	
		Relatives	3	
		Remitances	4	
		Other (specify)………………………………..	5	
D.4	Was self employment conducted all year around?	Yes	1	
		No	0	
D.5	Is wage employment carried out all the year around?	Yes	1	
		No	0	
D.6	What is the main factor for involvement in non-farm employment?	Inadequacy of farming land	1	
		Low income of agricultural activities	2	
		Good marketing opportunities /availability of employment	3	
		Other (specify)………………………….	4	
D.7	What is the role of off-farm employment?	As the main source of income	1	
		As the extra source of income	0	

Rate the following reason for not participating in non farm employment						
	Reason	1=Not true at all	2=Not true	3=Not sure	4=true	5=Very true
D.8	We don't have enough money					
D.9	We don't have enough time					
D.10	We don't have enough Education and training					
D.11	The income from farming is enough to meet our needs					
D.12	There are no opportunity for beneficial non farm employment					

	D.13 Indicate with x	D.14 Type of labour 1. hired 2. family	D.15 Year activity started	D.16 Months/days activity undertaken in past year	D.17 What was the gross income	D.18 Operating cost	D. 19 profit per day/ months
Please indicate the type of non farm activity and its estimated earnings							
Artifact							
Carpentry							
Mansory							
Food processing							
Local brew selling							
Kiosk							
Fishing							
Livestock keeping							
Other (specify)							

For the following non-farm and farm wage employment give estimated average annual income (for past twelve months)

Employment type	No of days of engagement	Payment per day/month	Total amount received (annual)
D.20. Casual labour (in other farms)			
D.21. Wage employment in private owned venture			
D.22. Employment from other employer			
D.23. Remittances from relatives	Give the estimated amount received as remittance from migrated household member…..		
D.24. Pension payment	Give the amount received……………………………..		

	Reason	1=Not true at all	2=Not true	3=Not sure	4=true	5. completely true
D.25	Use of economic capacity					
D.26	Mostly to generate cash income for household basics i.e food					
D.27	Unstable return from agriculture					
D.28	Increased social status (prestige)					
D.29	Income for investment on children's education.					
D.30	lack of land for farming					
D.31	To respond to business/employment potential opportunities					
D.32	High wage in non farm sector					
D.33	The credit market is efficient					
D.34	I considered the tax of doing business low					
D.35	Low farm productivity					
D.36	Lack of capital for farms i.e inputs					
D.37	Lack of farming land/small farm size					
D.38	The market is favourable					

For Items below tick the appropriate box regarding reason for engaging in off- farm employment

D.39. In your view what is the main constraint of starting non-farm business............

D.40. Where do you plan to invest **more** in the next 5 years if given choice between 1.farm and 2. off-farm activities?

D.41. what is the main use of off-farm income……………………………………

SECTION E. DWELLING CONDITION AND ASSETS OWNERSHIP

Dwelling related indicator			
	E.1 Roof material 1. corrugted iron 0. thatched roof	E.2Wall material 1. mud wall 2. mud brick 3. burnt brick	E.3 Floor quality 1. mud floor 0. cement floor
E.4 Does the house have electricity?	Yes	1	
	No	0	
E.5 What is the main energy source for cooking?	Firewood	1	
	Charcoal	2	
	Kerosene	3	
	Other (specify)………	4	
E.6. Is there any crop storage facility?	Yes	1	
	No	0	
E.7 What is the observed structural condition of main dwelling?	Seriously dilapidated	1	
	Needs major repair	2	
	Sound structure	3	
E.8 Toilet type	Pit latrine	1	
	Flush toilet	0	
E.9Toilet wall	Burnt brick	1	
	Grasses, cloth,or other	0	
E.10 Does the toilet has a roof?	Yes	1	
	No	0	
E.11How many sleeping rooms does the dwelling have?	(including rooms that are separate from the main house)……………………..		

Food related indicators				
E.12	During last 12 the months how many months did H/H had at least one day without enough to eat?	…………………………		
E.13	During the last 30 days, did everyone in your household have enough to eat everday?	Yes		1
		No		0
E.14	During the last 12 months, did all of your households members have enough to eat?	Yes		1
		No		0
E.15	How many meals were served to household members in the last two days?	…………………………		
E.16	In the last 7 days how many times was meat/chicken served to household members?	…………………………..		
E.17	In the last 7 days how many times was vegetable served to household members?	…………………………		

Assets related indicators		Please indicate ownership and value of assets		
S/N	Assets	1=yes for ownership, 0, otherwise	quantity	Total resale value at current market price
Consumer durable				
E.18	Car			
E.19	Motorbike			
E.20	Bicycle			
E.21	Refrigerator			
E.22	Kerosene stove			
E.23	Radio			
E.24	Music system			
E.25	Television			
E.26	Mobile phone			
E.27	Other (specify)			
Production assets				
E.28	Hoe			
E.29	Machette			
E.30	Wheel barrow			
E.31	Plough for animal traction			
E.32	Tractor			
E.33	Sprayer			
E.34	Water pumping set			
E.35	Milling machine			
E.36	Irrigation pump			
E.36	Power tiller			
E.37	Furniture set			

Section F. Social capital endowments

I would like to start by asking you about the groups or organizations, networks, association to which you or any member of your household belong. These could be formally organized groups or just groups of people who get together *regularly* to do an activity or talk about things			
F.1	How many such groups are you or your spouse have a membership?	1.Farmers group	
		2.Vegetable production group	
		3.Fishing group	
		4.Thrift and saving group	
		5.Traditional dance group	
		6.VICOBA	
		7.SACCOS	
		8. Church group	
		9. Praying community	
		Other (mention)…………..	
F.2	Of all these groups to which you or members of your household belong, which one is the most important to your household?	Mention the groups………………………………..	
F.3	Does this group work with or interact with groups outside the village/neighborhood?	1.No	
		2. Yes, occasionally	
		3. Yes, frequently	
F.4	Does the household has any close friend or relative living in city/urban?	1.Yes	
		0. No	
F.5	About how many close friends do you have these days? These are people you feel at ease with, can talk to about private matters in this village, or call on for help.	…………………………	
	Do group members mostly have the same…	H.6 Gender	1 yes
			0 No
		H.7 Religion	1 yes
			0 No
		H.8 Occupation	1 yes
			0 No
		H.9 Education	1 yes
			0 No
		H.10 All have other non-farm employment	1 yes
			0 No
F.11	If a community project does not directly benefit you but has benefits for many others in the village/neighborhood, would you contribute time or money to the project?	Yes	1
		No	0

In general, do you agree or disagree with the following statements on social cohesion?		1Agree strongly	2 Agree somewhat	3Neither agree nor disagree	4Disagree somewhat	5 Disagree strongly
F.12	Most people in this village/neighborhood are willing to help if you need it.					
F.13	In this village/neighborhood, one has to be alert or someone is likely to take advantage of him/her					
F.14	I always feel safe from crime and violence in this village					
Indicate the extent to which you trust the following						
		1. To a very small extent	2. To small extent	3.Neither great nor small extent	4. To a great extent	5. To a very great extent
F.15 Local government officials						
F.16 Central government officials						
F.17. Fellow villagers						

F.18	In the past 12 months did you or any one in your household participate in any communal activities, in which people came together to do some work for the benefit of the community?	Yes	1
		No	0
F.19	About how many *close friends* do you have these days? These are people you feel at easewith, can talk to about private matters, or call on for help.	……………………………	
F.20	In general, how much do you feel that you participate in the decision making of your organization?		
		1.to a very great extent	
		2.to a great extent	
		3.to a less extent	
		4.not at all	

THANK YOU FOR YOUR PARTICIPATION IN THIS SURVEY!

Appendix 2: Checklist of question used in focus group discussions

1. Do people in this village engage in off-farm emplyments?

2. What types of these off-farm employment do people engage in?

3. What are the main motives of engaging in these off-farm employment?

4. Can you list factors that enable someone to engage in each of the following;? a) non-farm self-employment b) farm wage c) non-farm wage employment

5. List the main constraints for operating non-farm enterprises in this village.

6. Why should people focus only on paddy and other crop cultivation, instead of diverting their resources to off-farm employment activities?

7. How is the income earned off-farm spent?

8. What can we say about the future of employment in this village? b) do you thing more people will quit farming and focus more on off-farm employment?

Types of shocks event

1. What were the major shocks to crop income in 2012/13 season in this village?

2. What was the impact of these shock events?

3. Have all households in the village been affected by these shock events?

Types and role of Social capital (groups)

1. Do people in this village participate in self help groups, e.g VICOBA?

2. List other associations that are found in this village to which households/ individual have membership.

3. What is the value of being associated with these groups/ association?

Appendix 3: Instrument for illustrating seasonal calendar

The table below describe seasonal calendar, for selected event as described in the

first row. Describe and rank events carried out during different months of the year

based on the set of activities listed.

Month	Paddy price	Cash needs	Farm activities	Availability of off-farm employment
December-January				
February-April				
May-June				
July-September				
October-November				

Appendix 4: Checklist of question used for the in-depth interviews with selected household's heads.

1. Who in the household engages in off-farm employment identified in the earlier survey?

2. Which duration of the year do the household members engage in off-farm employmemt?

3. Does off-farm employment cause any threat to labour available for the households?

4. Describe how involvement in off-farm leads to labour shortage for the household farm activities?

5. If you think there is problem to household labour then why do you/household members still engage in these off-farm activities?

6. What were your main shock events in the last farming season?

7. Can you give details of the mechanism you employed to counteract the effect the above-mentioned shocks?

Appendix 5: Checklist of question for key informants

1. What is your view on households' participation in off-farm employment?

2. How does the village/district government support the growth of off-farm employment?

3. How do people in this village/district perceive off-farm employment activities?

4. What are your thoughts on making sure that there is increased opportunities for off-farm employment?

5. What is the role of the village/districts in supporting the community level groups/associations?

Appendix 6: Participatory Wealth Ranking Results

Wealth Ranks, Characteristics and Sampled Households

Village (No of ranked households)	Wealth category	No. of households in a category	No. of Households sampled	Socio economic characteristics
Mwaya (215)	Poor	96	25	Thatched roofed, muddy house; own less than 2 hectares (ha) of land, have paddy farm size less than 1 hectare, drop out from school children; work as farm labourers on other farms
	Middle	96	25	Have corrugated iron roofed, burnt brick houses, own 2-4 hectares, cultivate 2-3 hectares of paddy, children attend school regularly, annual paddy harvest more than 10 bags, may own power tillers cultivate other crops e.g maize
	Non poor	23	6	Corrugated iron roofed houses, cement floor, own more than 10 hectares, paddy farm size of more than 7 hectares, higher labour to farm activities, children attend private schools, tractors, have electricity connection, may own television set majority have salaried jobs
Lumemo (301)	Poor	54	14	Thatched roofed, muddy house; own less than 1 hectare of land, have paddy farm size less than 1 hectare, drop out from school children; work as farm labourers on other farms
	Middle	197	48	Have corrugated iron roofed, burnt brick houses, own 2-5 ha, cultivate 2-4 ha of paddy, children attend school regularly, annual paddy harvest more than 10 bags, may own power tillers (land titling machinery) cultivate other crops e.g maize, may own small business or waged non-farm jobs
	Non Poor	50	12	Corrugated iron roofed houses, cement floor, own more than 5 ha, paddy farm size of more than 7 ha, children attend private schools, tractors, have electricity from solar power or from fuel generators, majority have salaried jobs, or other income generating activity have electricity
Lupilo (96)	Poor	41	29	Thatched roofed, muddy house; own less than 2 hectares of land, have paddy farm size less than 1 hectares, drop out from school children; work as farm labour on other farms, paddy farming use mainly family labour and less inputs
	Middle	32	23	Have corrugated iron roofed, burnt brick houses, own 3-6 ha, cultivate 2-4ha of paddy, children attend school regularly, annual paddy harvest more than 10 bags, may own power tillers cultivate other crops e.g maize, own at least one bicycle, may hire labour

	Non poor	23	17	Corrugated iron roofed houses, cement floor, own more than 7ha, paddy farm size of more than 6ha, children attend private schools, tractors, have electricity from solar power or from fuel generators, majority have salaried jobs, use of hired labour in for farm works.

Village (Total households ranked)	Wealth group	No. of households in a group	No. of households sampled	Socio-economic characteristics
Mngeta (216)	Poor	67	19	Thatched roofed, muddy house; own less than 1 ha of land, have paddy farm size less than 1 ha, they sell their product (rice) immediately after harvest drop out from school children; work as farm labour on other farms,
	Middle	112	31	Have corrugated iron roofed, burnt brick houses, own 2-5 ha, cultivate 2-4ha of paddy, children attend school regularly, annual paddy harvest more than 10 bags, may own power tillers cultivate other crops e.g maize, own at least one bicycle
	Non poor	37	10	Corrugated iron roofed houses, cement floor, own more than 6 ha, paddy farm size of more than 5 ha, higher labour to farm activities children attend private schools, tractors, have electricity from solar power or from fuel generators, majority have salaried jobs
Malinyi (196)	Poor	64	21	Thatch roofed, muddy house; own less than 1.5 ha of land, have paddy farm size less than 1ha, mostly use family labour in paddy farming, they sell their product (rice) immediately after harvest; drop out from school children; work as farm labour on other farms
	Middle	89	29	Have corrugated iron roofed, burnt brick houses, own 4-7 ha, cultivate 3-5 ha of paddy, children attend school regularly, annual paddy harvest more than 10 bags, cultivate other crops e.g maize, own at least one bicycle, do not hire farm labour
	Non poor	46	15	Corrugated iron roofed houses, cement floor, own more than 8 ha, paddy farm size of more than 7 ha, may harvest more than 50 bags of rice. use tractors in all stages of paddy farming, Children attend private schools, own power tiller, tractors, have electricity solar powered or fuel generator electricity, own a motorcycle, most paddy farming is done by hired labour

Note: Total households sampled in each wealth group in column 4 was calculated from the weights assigned in each wealth category depending on the pre-determined village total sample. For example, in Mwaya (column two) PWR managed to categorised 215 households. Of these households, 96 were in a poor category. This number (96) was divided by 215 and multiplied by 100 to get the weight for 96 households. This weight 44.6% was then divided by 100 and multiplied by the required (predermined) sample size in Mwaya which was 56 to get proportion of households to be sampled from the first wealth category.

Appendix 7a: Adult-equivalent scale constants for East Africa.

Age (years)	Male	Female
0-2	0.40	0.40
3-4	0.48	0.48
5-6	0.56	0.56
7-8	0.64	0.64
9-10	0.76	0.76
11-12	0.80	0.88
13-14	1.00	1.00
15-18	1.00	1.00
19-59	0.88	0.88
60 and above	0.72	0.72

Source: Adopted from Tanzania National Panel Survey Report wave 3, NBS (2014b)

Appendix 7b: Household economies of scales

Household size	Margin cost	Average costs
1	1.000	1.000
2	0.892	0.946
3	0.789	0.846
4	0.713	0.897
5	0.632	0.851
6	0.632	0.778
7	0.632	0.757
8	0.632	0.741
9	0.632	0.729
Above 10+	0.632	0.719

Source: Deaton (1980), cited by Collier *et al.* (1990)

Appendix 8. First-stage Regression Results (1SLS)
            n= 309.

Variables	Dependent Variable: Dummy for engagement in non- farm self-employment			
	Coefficient	Standard error	t values	Probability (P > t)
Education of the head	0.005	0.006	0.87	0.387
Female head	0.010	0.013	0.77	0.439
Number of dependent	0.061	0.040	1.51	0.133
Access to credit	0.058	0.043	1.35	0.179
Crop shock	-0.008	0.046	-0.19	0.849
Lowland field	-0.069	0.043	-1.59	0.112
Other crops	-0.006	0.040	-0.16	0.871
Group membership	-0.017	0.049	-0.36	0.722
Female head	-0.015	0.021	-0.75	0.455
Land cultivated	-0.027	0.016	-1.63	0.105
Non-farm wage	-0.253***	0.060	-4.17	0.001
Farm wage	-0.341***	0.041	-8.17	0.002
Mwaya/lumemo dummy	-0.072	0.052	-1.36	0.174
Instruments				
Electricity	-0.279***	0.064	-4.34	0.001
Distance	-0.051***	0.017	-2.99	0.003
R^2	2.8			
Total observations	309			

*** Coefficients are significant at the 0.01 level

Appendix 9: Definition and measurement of variables used in the 2SLS model

Variable	Definitions	Level of measurement
Non farm self employment	Households heads/spouse engaging in Non-farm self employment	Nominal Yes=1, No=0
Education of the head	Number of schooling years of the head	Ratio (Years)
Female head	The head is female	Nominal Yes=1, No=0
Number of dependent	Number of household memebrs below above 15 and below 64	Ratio (person)
Access to credit	Household had access to credit in the	Nominal Yes=1, No=0
Crop shock	Households had crop shock due to pests of drought in 2012/2013 season	Nominal Yes=1, No=0
Lowland field	The households paddy field located in lowland	Nominal Yes=1, No=0
Other crops	Whether other crops apart from paddy was cultivated	Nominal Yes=1, No=0
Group membership	whether a household head or spouse or both is/are members in any village association.	Nominal Yes=1, No=0
land cultivated	Total farm land cultivated	Ratio (hectares)
land owned	Total farm land under ownership	Ratio (hectares)
Non-farm wage	Households heads/spouse engaging in non-farm wage employment	Nominal Yes=1, No=0
Farm wage	Households heads/spouse engaging farm wage employment	Nominal Yes=1, No=0
Mwaya/lumemo	Households is located in Mwaya or Lumemo	Nominal Yes=1, No=0