Farm and Off-Farm Linkages: The Effect of Off-Farm Employment on Farm Inputs and Labour Allocation in Kilombero Valley, Tanzania

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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 implications on the household's ability to enhance farm investment and reduce poverty. This study first examines the role of off-farm employment on financing farm inputs, and secondly, it assesses the effects of labour devoted to off-farm employment on a household's farm labour supply. The survey data from 309 randomly selected farming households in five villages of the Kilombero Valley were used. Tobit model that considers cornered solution has been used. Results from the econometric estimation show that holding other factors constant, the increase of non-farm self-employment income is associated with more expenditure on inputs. Qualitative evidence, however, 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 repercussions on-farm productivity. It is 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.*

1.0 Introduction

In Africa, smallholder farmers engage in several 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) reported an increasing contribution of off-farm income to the total household income among rural households in Africa. The authors reported that off-farm income accounts for about 35% of rural income 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 (Ellis, 2000; Oseni and Winters, 2009) but also can potentially increase investment in agriculture including purchasing of essential farm inputs.

Farm input spending and use are hindered by input credit market failure as farmers cannot access credit to purchase the required inputs since agricultural credit for smallholder farmers are severely lacking in Sub-Saharan Africa including Tanzania (Mathenge *et al*., 2015). This challenge underscores the crucial role of off-farm earnings as an important source of capital to finance inputs (Ruben and Van den Berg, 2001; Oseni and Winters, 2009). Despite this significant off-farm income benefit, households' engagement in off-farm activities may have potential labour withdraw

effect. That is, household labour is diverted away from household farm production. This withdrawal has a serious consequence in labour intensive cropping such as paddy farming. 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. 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 labour demanding effect.

In Tanzania, the structural adjustment programmes (SAPs) imposed by the IMF in the early 1990s resulted in the liberalisation of both the agricultural input and output markets. This was followed by the removal of subsidies that were previously provided to farmers by the government. Consequently, this led to limited access to essential farm inputs. As a result, the use of inputs is generally low with farm input intensity of 8kg/ha of fertilizer, which is below the average for Sub Saharan Africa (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).

20

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Furthermore, 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 Tanzania government introduced a state provisioning initiative termed The National Agricultural Input Voucher Scheme (NAIVS)[1] 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, only middle-income farmers benefited from the subsidised scheme (Todd *et al.,* 2013).

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 examined the role of off-farm employment on farm input by Katega and Lifuliro (2014) was based on descriptive analysis and was conducted in the less agriculturally favourable semi-arid areas of central Tanzania. However, according to literature (e.g. FAO, 1998; Loening *et al.,* 2010; 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 focusing on one of the favourable agro-climatic regions of Tanzania dominated by subsistence paddy farming.

Given the above background, this study was set to examine the effect of off-farm employment and resulting wages and earnings on farm input expenses and households' labour supply. It is hypothesized that off-farm income has a positive contribution to a household's expenditure on inputs used for paddy farming.

2.0 The Effect of Off-Farm Employment on Farm Input Expenses and Household Labour Allocation: Theoretical Debate

Off-farm employment is conceptualised as an income-generating activity that farming households engage in outside their farms.

Following Reuben 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 these different types of off-farm employment may have different implications in households' spending on farm inputs and labour supply.

Generally, the literature on the relationship between farm and 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; Ellis and Freeman, 2004; De Janvry, *et al.,* 2005; Feng *et al.*, 2010) whereas the second is related to the lost-labour effect (Ayieko, 1995; Hennessy *et al.*, 2008; Pfeiffer *et al.*, 2009). Income effect refers to complementarities between the two sectors in which case income generated from off-farm is invested in farming activities. For example, Reardon *et al.* (1996) 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 (Reardon *et al.* 1996) implying that in less agriculture potential areas returns from off-farm have a declining effect on-farm investment. This indicates that off-farm earnings are reinvested in some other off-farm activities or used for households' consumption. But since Kilombero Valley is considered as being a favourable agricultural area positive off-farm effect may prevail. Off-farm income has also been found to support the purchase of inputs in Kenya (Evans and Ngau, 1991), in Honduras (Ruben and Van Den-berg, 2001), in China (De Janvry, Sadoulet and Zhu, 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 blends the theoretical trajectory of the lost-labour effect. The lost-labour effect is manifested when engaging in off-farm employment leads to labour constraint on on-farm production (Hennessy *et al.*, 2008; Feng *et al.,* 2010). Ironically, this means if labour is generally scarce the two sectors may compete with each other. In case of such 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 (Goodwin and Mistra, 2004). The effect, however, depends on labour market perfection and the nature of off-farm activities. The 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) household has been modelled to behave under imperfect farm household model (FHM) with labour market imperfection. In a situation where there is surplus labour, 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 good agro-climatic conditions,

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[1] This was a public provisioning system 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 selected input (Word Bank, 2014),

21

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household earnings from off-farm activities could complement and support farm activities. There is a high likelihood for returns from off-farm employment being spent on paddy which is the main cultivated crop 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 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.

3.0 Methodology

3.1 Description of the Study Area
The study area, Kilombero Valley, is located in Ulanga and Kilombero districts, Morogoro Region, Tanzania. The area has annual precipitation between 1 200 mm and 2 600 mm between November-April (URT, 2010) and is usually flooded during the heavy rain season of March-April. The total coverage of the area is 11 600 km ^{2} and it is dominated by subsistence paddy producing households who makes 95% of total households (Kato, 2007). The valley is a major paddy producing area (ACT, 2007), supplying 9% of all rice produced in Tanzania (Kangalawe and Liwenga, 2005). There has, however, been an increasing trend of agro-pastoralist migration over recent years leading to increased pressure on cultivation land (Nindi, 2014). This has led to frequent conflicts between crop producers and agro-pastoralists (Kato, 2007). Other adversities confronting farming households in the area include frequent flooding by the Kilombero River and the expansion of plantations agriculture. This increases the need for more intensification which can be achieved through increased use of farm inputs.

3.2 Data Collection Methods and Sampling
Data collection involved a household survey, 20 in-depth interviews, and one focus group discussion (FGD). The household survey was carried out using a structured questionnaire. The questionnaire collected information on socio-demographic characteristics, farm input expenditure, and off-farm related characteristics whereas in-depth interviews and FGD gathered community-level data on labour allocations.

Sampling involved the purposive selection of 5 villages which represent two attributes: accessibility and/or remoteness; and endowment with farmland resources. These two attributes are associated with the growth of the off-farm sector. 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 about access to land for cultivation. As theories predict, village socio-economic differences have different implications as far as off-farm patterns and spending of farm inputs are concerned. A total of 309 were randomly selected to participate in a household survey.

3.3 Empirical Model and Description of Variables
Adhering to standard procedures as used in other studies that modelled the relationship between off-farm income and farm input supply or farm production (e.g. Ruben and van de Berg, 2001; Goodwin and Mishra, 2004), expenditure on inputs was fitted using a Tobit regression model. This model was more appropriate because of the censoring of the dependent variable (expenditure on input) which is missing for households that have not spent on inputs in the total sample**.** The dependent variable (expenditure per hectare) was zero in case of non-spending in any of the three types of farm inputs to be described. There were 70 households among the 309 sampled households which reported to spend nothing on inputs. The use of ordinary least square (OLS) in the 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 1). The βn are parameter underestimation and ε is the error term which is assumed to be normally distributed, with a zero mean and constant variance. For different values of independent variables, the equation becomes,

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

The dependent variable is farm input expenditure. There are three different commonly used types of input 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 farm preparation to weeding. For paddy production in Kilombero valley, weeds have a great effect on yield, making herbicides and labour to feature as crucial inputs.

Further description and measurement of input are provided in Table 1. The input expenses were expressed per unit farm area in the 2014/15 farming season to correct differences in plot size.

22

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4.0 Findings and Discussion

Table 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 2014/15)
Household size	Number of household members
Shock	Whether households faced crop loss/damage (Yes=1, Otherwise =0)
Other crops	Whether households cultivated other crops apart from paddy (Yes=1, Otherwise =0)
Education	Years of schooling of the household's head
Number of adults	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
Non-farm income	Annual wage earnings from farm labour employment in TShs
Farm labour 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)

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. Although households may have multiple activities that 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 products.

For non-farm self-employment 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 the 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 types of employment activities. Farm income involves the computation of the market value of produced crops in 2013/14 farming season less the production costs. All income data were computed per adult equivalent (AEU) to control for inter-households' income differences.

4.1 Off-Farm Employment and Socio-Economic Characteristics of Respondents

Concerning 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%) engage in farm activities only. This group of farming households depends almost solely on paddy farming for their livelihood. This level of engagement is slightly similar to one reported by Katega and Lifuliro (2014) in a study conducted in the semi-arid areas of central Tanzania in which 69.5 percent of households were engaged in non-farm activities.

Apart from off-farm employment engagement disparity among households, socio-economic differentials among households can provide an important insight into their capacity in terms of labour and incomes to invest in on-farm inputs. These differentials may imply differences in input expenditure and labour allocation. Table 2. depicts these differentials and statistical differences. On average, households with off-farm income were shown to have more total household income, younger household heads, and more group memberships compared to those with farm income only.

More specifically, Table 2 shows that the variable, total household income is statistically significant at different levels between households without and those with some forms of off-farm employment. This may imply that these households are more endowed with cash flow that may potentially be spent on inputs. Similarly, households with off-farm employment (Table 2 columns, a, b and c) have more association membership with various social groups, and this is shown by the observed significance mean difference at the different levels between households with no off-farm employment and those with at least one. This finding is consistent with that 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 in 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 2. The mean for household's head age as a human capital variable is significant at 1% between households with off-farm and those without any of the three types of off-farm employment.

Notably, some variables are significantly different only for one category of off-farm employment and those without off-farm employment. For example, a farm area owned significantly differs (p ≤ 0.032) between households with farm wage employment and households without off-farm employment. This further suggests that heterogeneity in off-farm employment may imply a difference in other socio-economic attributes including the use of inputs.

23

The East African Journal of Social Sciences and Humanities
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4.1. Socioeconomic and Demographic Characteristics of the Respondents

The average household size was 5.9 with the minimum and maximum sizes of 2 and 14. In terms of age, the minimum and maximum ages of the household heads were 19 and 91 years, respectively, while the average age was 46.1 years. Many (73%) of household heads had primary education. Eighty percent of household heads were male and married (78%). The average land cultivated in hectares was 2.55 with the maximum and minimum of 0.00 and 28 hectares, respectively. The main occupation of the household heads (98.5%) was crop production.

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 NFS income and not an agricultural wage that is associated with increased spending on agricultural inputs. Without disaggregating off-farm into its functional categories, Pfeiffer *et al*. (2009) also obtained a similar result of a positive effect of off-farm income on farm input using an instrumental variable approach.

Table 2: Socioeconomic and demographic characteristics of the respondents (n = 400)

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 (16.30)	52.36 (43.30)	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)	1.08 (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)	1.50 (1.28)	2.160** (0.032)	-1.023 (0.3070)	0.767 (0.777)
Total income(in Tshs)	517 748 (688 511)	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 (610 206)	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	1.05 (1.43)	1.65 (1.73)	1.89 (1.58)	1.57 (1.33)	-2.200** (0.028)	3.860*** (0.000)	1.940* (0.054)
Male head of households	73.0	38%	69.5%	72.5%	–	–	–
Credit access(mf)	23.6	38.5%	42.1%	50.0%	–	–	–
Other crop cultivation	56.2	55.8%	50.8%	47.5%	–	–	–
Cultivate maize	46.1	48.2%	41.4%	45.0%	–	–	–

Table 3: Off-farm income and other factors influencing farm input expenses (Tobit regression)

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
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Male head of households	73.0	38%	69.5%	72.5%	–	–	–
Credit access(mf)	23.6	38.5%	42.1%	50.0%	–	–	–
Other crop cultivation	56.2	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, 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.

4.2 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. Non-farm self-employment (NFS) income was positive and significant at 5%. The interpretation is that 1 TZS increase in non-farm self-employment income increases expenditure on inputs by 0.025 TShs for the households who have spent money on inputs. The implication here is that NFS income has an increased effect on input spending holding other factors constant. This, of course, could work the other direction as well: such NFS

One of the most interesting results in the model (Table 3) is the negative and significant effect of farm wage (FW) on spending on inputs. This is a particularly surprising finding because it shows that for households that have spent on inputs, a rise in FW leads to a decline in the expenditure on input. This finding hence points to an important competing needs between farm and off-farm investments and warrant more attention.

It also indicates that income gained from FW may probably be used to cope with consumption shocks (*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 at the 5% level. Credit constraints in rural areas are one of the critical limiting factors that affect spending and the 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

24

The East African Journal of Social Sciences and Humanities
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other requirements that involve spending such as paying for health needs and children's schooling and not directly in support of their farm expenses.

Similarly, consistent with social capital theory (Coleman, 1988) group membership was found to have a direct relationship with expenditure on inputs. This variable is significant at the 5% level with a coefficient of 29 854.38 TZS implying relatively strong association. 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. Table 3 also shows that as a proxy for physical capital the variable cultivated paddy farm area was positively associated with expenditure on inputs in the following farming season (2014/15). This reinforces the importance of paddy farming among households in Kilombero Valley as large farms generate relatively more outputs that can be sold to fund farm activities.

Lastly, the household location was associated with input expenditure since the dummy variable Mwaya/Lumemo was positive and significant at the 1% level. This means, keeping other factors constant residing in Mwaya/Lumemo is associated with increasing input spending. This can be explained by the fact that households in Mwaya and Lumemo are located in more land constrained areas. Thus, they need more intensification which is translated into more input expenditure. But also being located in a more urban area, for Mwaya/Lumemo implies more opportunities for off-farm employment whose income may be spent on inputs.

4.3 Understanding Households Labour Allocation on Investment in Paddy Farming from in-depth interviews and Focus Group Discussions

In this study, the effect of the different categories of off-farm income on input in addressing the main question of farm input investment was examined. 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 FGDs that represent typical cases in the study area to examine household-specific situations relating to off-farm labour supply that affect household farm activities. In the same vein, the section further aims to complement the findings on the off-farm effect in Table 3 as far as FW income is concerned. This is because our econometric model could not only give strong evidence of causality but also fell short of describing specific household's farm-related factors that lead to the reported input expenditure – off-farm relationship.

Generally, engagement in off-farm employment implies 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 engage 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' farm activities, especially those related to paddy farming. Thus, there are serious own farm investment threats for some households engaging in farm wages 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 for all needs. During the farming season, I have to work in KPL plantation as a casual labourer weeding paddy. But at the same time, I need to weed my paddy farm located far from this village (about 7km) during the same season. However, since I spend many days on the plantation I only go to my farm irregularly thus risking poor harvest from my farms….."* (an in-depth interview with female respondents aged 36 conducted in Mngeta, March 2015)

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 a limited household labour supply, a trade-off between farm and off-farm arises. This tradeoff is caused by the desperation that pulls households to low earning farm wage employment. To emphasise this desperation, one female answering the question on how farm wage is spent put forward the following response;

> *"…the wage I earn from plantation work is largely used to support household food needs. This is because the food stock I kept from my last season's harvest has all been sold out... this is masika[2] and the price of food is rising much higher…. "* (an in-depth interview with female respondents aged 44 conducted in Mngeta in March 2015).

It was further revealed during FGDs that the daily minimum wage paid to a farm casual labourer of 3,800TShs (2.3US$) per day may not be sufficient to pay for replacement labour in one's farm which cost 2,000TShs(1.2US$) per day. The wage is barely enough to sustain a household's basic needs. This desperate 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 to attain food security. Despite an observed shortage of labour households are still forced to sell their labour to meet household seasonal income needs.

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[2] *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.

25

The East African Journal of Social Sciences and Humanities
Volume 1, Issue 2, June 2019
Published by the College of Social Sciences and Humanities, Sokoine University of Agriculture (SUA), Morogoro-Tanzania

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 a different impact as far as labour effect is concerned as one respondent said in the quotation below:

> *"I work as a masonry 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 to spend time on my farm which provides my family food needs throughout the year……" (an in-depth interview with a male respondent aged 32 conducted in Malinyi on March 2015).*

This is an exceptional case whereby despite the household labour shortage still some households manage 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 behavior 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 4 presents the results. The Table indicates that case 1 household has low productivity due to its low labour investment on its farm. The productivity is used in this table to give a reflection of farm investment on labour as an input. In household case 1 in Table 4, there are competing needs between farm and off-farm because households deploy labour to off-farm work during the peak of the farming season. Consequently, this creates labour shortage in households which affects its productivity.

Table 4: 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 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

N.B. Farmers usually give their production figures in husked rice packed in 110-120 kg polythene 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 the 2013/14 cropping season. This finding supports the contention put forward by Yang 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 4) households seem to be well cushioned from lost labour effect, since its off-farm activities are largely concentrated during the off-farm, post-harvest season. As a result, it has a good harvest of 12 bags which is larger than the average. The results in this sub-section suggest that FW has an undesirable effect as it imposes labour constraints on households. For the intensive cultivation of paddy, this is an expected scenario.

4.4 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 farm wage employment (FWE) that provides a more interesting case for discussion. Income from non-farm self-employment (NFSE) is spent on inputs, whereas there is little evidence whatsoever to suggest the same trend for FWE income. The case of NFSE income being spent on inputs blends with the argument that considers off-farm income as having a positive input expenditure in 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 wage earned to hire labour to work on their farms as a substitute for off-farm labour loss. But, econometric results show that different from NSFE income, FWE income has a regressive effect because labour loss from a household seems to lack substitution by similarly investing 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; Yang *et al.,* 2014).

This finding is important because it indicates that FW employment is practised out of desperation, with rather a survival needs, i.e. to support for food purchase and not input needs. Households thus have to forgo the opportunity cost of not working on their farms to go for FWE. This finding conforms to arguments posed earlier by Pfeiffer et al. (1999) that there is indeed competing needs for labour. In a similar context, Kochar (1995), consider this as a labour shock, as it increases households' vulnerability to poverty. Vulnerability in Kilombero Valley may result from the manifestation of the antagonistic needs between farming and off-farm activities that threaten paddy production (Table 4). Paddy is not the only main cash and food crop but is also an essential component of livelihoods in the Kilombero Valley. Hence, while NFSE supports income effect as set forth by Reardon et al. (1996), FWE seems to rather lead to a lost-labour effect.

26

The East African Journal of Social Sciences and Humanities
Volume 1, Issue 2, June 2019
Published by the College of Social Sciences and Humanities, Sokoine University of Agriculture (SUA), Morogoro-Tanzania

This being the case, 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 the future trend; 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. Hence, the study's findings espouse the theoretical notion that off-farm activities put a heavy labour demand and have competing and indeed lost-labour effect with farm activities in Kilombero Valley. The implicit premise of surplus labour in rural households reported literature including Reardon *et al.* (1996) and Singh (1999), which do not hold in Kilombero Valley giving rise to competition between on-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 standpoint 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 the effect that off-farm may have particularly on labour supply to farm and off-farm activities. Also, since lost labour and income effects have different implications on the different types of off-farm employment there is relevant methodological consideration. Analysis in this study suggests that it is important to disaggregate off-farm into different categories based on labour requirements to rigorously examine trends that cannot be unveiled by homogenous grouping all households into one broad category of off-farm employment.

5. Conclusions and Recommendations

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 in Kilombero Valley, Tanzania. The findings revealed 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.

On the other hand, however, farm wage employment (FWE) which is another off-farm functional category has undesirable labour withdrawal effects. This effect creates a negative impact on household labour supply. Due to labour market imperfection, households are unable to hire labour replacing those withdrawn from on-farm activities. Hence the effect of off-farm employment differs according to the 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 in lost labour effect. 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 the 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.

Findings from this study have a broader implication on the agricultural policies that focus on subsistence farmers' input support which are prevalent not only in Tanzania but also in other sub-Saharan African countries. The policy on inputs support through the provision of subsidies for example 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 income to augment farm input provisioning. Therefore, the government both at the central and district council level must first, ensure increased access and opportunities for off-farm employment particularly those related to non-farm self-employment activities. Household labour relocated to off-farm employment should be modestly remunerated to counteract the effect of labour loss off-farm.

Competing Interest
There is no competing interest in this study.

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27

The East African Journal of Social Sciences and Humanities
Volume 1, Issue 2, June 2019
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28

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29

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Volume 1, Issue 2, June 2019
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