International Journal of Agricultural Management and Development (IJAMAD)
Available online on: www.ijamad.iaurasht.ac.ir
ISSN: 2159-5852 (Print)
ISSN:2159-5860 (Online)

Analyses of Labour Productivity among Small-Holder Cassava Farmers for Food Security and Empowerment in Central Madagascar

Okoye, B. C.[1], Abass, A.[2], Bachwenkizi, B.[2], Asumugha, G.[1], Alenkhe, B.[2], Ranaivoson, R.[3], Randrianarivelo, R.[3], Rabemanantsoa, N [3] and Ralimanana, I [3]*

Received: 18 August 2015,
Accepted: 26 October 2015

Abstract

Labour productivity affects food security, but quantifying this relationship has been scarce with respect to empirical literature. The Central Madagascar dataset explores the influence of labour productivity and related variables on the food security status of cassava farmers. Drawing on both theory and empirical evidence, this paper argues that fundamental effects of links between labour productivity and food security are most times often overlooked currently in policy analyses. The study used a probit regression analytical procedure to explain the effect of labour productivity on food security of 180 Malagasy small-holder cassava farmers selected through a multi-stage random sampling technique. Results showed that 25% of the cassava farmers were food in-secure. Labour productivity had a direct relationship with food security status of farmers at 1% level of probability as well as membership of cooperatives and farm size. Aged farmers were more food insecure at 10% level of probability than their younger counterparts. Households with high dependency ratio and family labour tend to be food insecure at 1% and 10% level of probability respectively among the farmers sampled. The results therefore call for land re-distribution and re-form policies aimed at encouraging younger farmers who seem to be more labour productive by allocating more land to these group (as cooperatives) to increase cassava cultivation thereby giving a boost to food security.

Keywords:
Farm size, Family labour, Membership of cooperatives

[1] National Root Crops Research Institute, Umudike, PMB 7006 Umuahia, Abia State, Nigeria
[2] International Institute of Tropical Agriculture (IITA) Regional Hub for Eastern Africa 25, Light Industrial Area, Mikocheni B, PMB 34441, Dar es Salaam, Tanzania
[3] Centre National d Recherche Appliquee au Developpement Rural (FOFIFA) Ambatobe, B.P. 1690 101 Antananarivo, Madagascar
** Corresponding author's email: okoyebenjamen@yahoo.com*

INTRODUCTION

Agriculture provides a livelihood for most of the three quarters of the world's poor that live in rural arrears, particularly in Asia and Africa (Ravallion *et al*., 2007). One of the most common characteristics of developing countries is the large share of agriculture in their economies. This feature produces the widely observed inverse size-yield relationship (Gul Unal, 2008). Majority of the population in Madagascar are rural households for which a large part of their incomes originates from agricultural production. Agricultural performance and growth is then crucial (Randrianarisoa and Minten, 2001).

Cassava is Africa's second most important food staple after maize in terms of calories consumed (Nweke, 2004). It is the most widely cultivated crop and plays a vital role in the food security of the rural economy because of its capacity to yield under marginal soil conditions and its tolerance to draught (Ezedinma *et al.*, 2006). The requirements of consistent supply of large volume of fresh roots by cassava – based industries cannot be supported by the current subsistence production systems. The critical constraint under such production systems is agricultural labour costs which have been estimated to be between 70 -90% of the total labour cost (Ezedinma, 2000) in smallholder farming agriculture.

Cassava, the second most important source of calories in Madagascar, contributes 15% of national calories. Among the most vulnerable households, this share increases sharply. Likewise, in the drought-affected south of Madagascar, cassava provides the principal source of calories. Elsewhere, across all other zones, poor households depend more heavily on cassava than do the rich. Across all geographic zones, cassava accounts for a 50% greater share of total food intake among poor households than among the non-poor (Dostie *et al.,* 2000).

With increase in rural – urban migration, the ageing of the rural population and the feminization of agriculture, rural farm labour is likely to remain inelastic and expensive for agro-industrial purpose (Ezedinma *et al.*, 2006). Labour production or output per worker derives its importance from the relationship to economic wellbeing of a nation. For economic growth to result in an increased standard of living, it is necessary for output to grow faster than the labour force in the population, which implies that labour productivity must grow (Ukoha, 2000). Therefore, policies aimed at improving the productivity of cassava farmers and increase the output of the crop are deemed necessary.

There are 450 million women and men working as agricultural labourers worldwide who neither own nor rent the land on which they work including the tools and equipment they use. These workers comprise over 40% of the world's agricultural labour force often living below the poverty line and forming part of the majority of the rural poor in many parts of the world (FAO-ILO-IUF, 2005). Many of these economically active agricultural workers are not employed full-time in agriculture. While labour migration remains a critically important strategy, rural dwellers are increasingly diversifying their sources of livelihood (Reardon, 1997). Diversified livelihoods may involve combining farming with wage labour, trading, selling services and producing commodities for sale. They also involve all the help, transfers, exchanges and information that people get access to through social networks. Most African rural households have long depended on more than one source of livelihood (Francis, 2002).

Agricultural production in Madagascar is very labour intensive, with the exception of cases where animal traction or tractors are used (in general, still rather rare) and of regions where labour extensive techniques such as slash-and-burn agriculture ("tavy") and direct seeding are still dominant. The importance of labour use for agricultural production has been shown by various studies on labour allocation and agricultural productivity (Bockel and Dabat, 2001; IFPRI/FOFIFA, 1998; Randrianarisoa and Minten, 2001; Randrianarisoa, 2001). Due to the small sizes of farms and low income, the agricultural sector depends largely on manual labour which is invariably obtained from household members or hired from local community. The farms are therefore vulnerable to household labour disruptions (Asenso-Okyere *et al*., 2010).

Prevalence of redundant labour, low income growth, lack of training, low level of technology, low level of capacity utilization, low investment expenditures, and poor performing infrastructure are critical factors, amongst others that are responsible for low productivity of the labour force in Africa (Mordi and Mmieh, 2008).

Staple food prices and agricultural labour force productivity are critical for people's welfare and long term economic growth and structural change. However increasing yields per unit land and increasing productivity of energy and material inputs used in agriculture are also important given the global food security challenges with increasing world population, consumption of animal products, and needs to reduce agriculture's 'environmental footprint' (Dorward, 2012). Gurkan (1995) pointed out that food production, general economic and social development variables as determinants of food security. He further explained that, consistent improvement in yield and labour productivity, upgrading the quality of human resource, instituting virile agricultural research and extension system and providing price and non-price incentives for the adoption of new technology as the panacea to food insecurity. According to Aidoo *et al*. (2013), food security is a term used to describe whether or not households have access to sufficient quality and quantity of food. Measures aimed at raising agricultural productivity of food-insecure farmers are considered as priorities for reducing hunger in the United Nations Millennium Development Project in 2005 (UN-MDP, 2005).

Food security among households has been an important issue among policy makers across the world, being that food is essential for any living being. It is a commodity and a source of wealth of which the control over some elements of the food chain impacts on food prices, availability and access (Page, 2013). According to Smith and Subandro (2007), food insecurity continues to be a major development problem across the globe, undermining people's health, productivity and often their survival. Efforts to overcome the development challenges posed by food insecurity necessarily begin with accurate measurement of key indicators at the household level.Household food and nutrition security relies heavily on rural food production and this contributes substantially to poverty alleviation. Consequently, the first pillar of food security is sustainable production of food (Odurukwe *et al*., 2006). Individuals have sufficient access to food when they have adequate incomes or other resources to purchase or barter to obtain levels of appropriate foods needed to maintain consumption of an adequate diet/nutrition level (USAID, 1992). Haddad *et al*. (1994) identified indicators that can be used as predictors for food insecurity at the household level to include; asset ownership, household size and dependency ratio.

Minten and Barret (2008) studied the link between productivity and extreme poverty in Madagascar by reliance on two readily available indicators for poverty: the perceived percentage of food insecure households and the average length of households' lean period in the communes by the use of ordinary least square regression analyses. Our study differ in this case by the use of the probit analyses procedure operationalizing food secure (1) and insecure households (0) as a function of labour productivity and related variables.

Research and policy for high rural labour productivity in sustainable and resilient agricultural and food systems therefore need much greater attention in international policy and should be a core part of any successor to the Millennium Development Goals after 2015. This needs, however, coordinates around policy goals and targets and targets need indicators (Dorward, 2012). There is therefore a need for indicators that provide better measures of different types of agricultural productivity and impacts on poor people. Indicators proposed in the final sections of the paper go some way to meeting this need and could help to focus coordinated international and national efforts to promote improved food security if implemented.

MATERIALS AND METHODS

The Study Area

Madagascar is the largest island in Africa and the fourth largest in the world. With a size of 587,040 sq km, it is approximately twice the size of Arizona and limited fresh water resources

covering only about one percent of land area surface (FEWSNET, 2012). Agriculture in Madagascaris heavily influenced by rainfall, which is generally abundant on the whole East coast, decreases sharply on the highlands falling to less than 500 mm per year in the South and South-West. The season starts with the first rains in October – November. The cropping calendar greatly varies from region to region according to different climatic conditions, soils and altitude. Food crop production is the most important agriculture sub-sector accounting for around 75 percent of the cultivated area. Rice is the staple food, covering 1.34 million hectares throughout the country – with the exception of some semi-arid areas in the South and in the South-West - under both rain-fed and irrigated systems. Other food crops include maize (mainly grown in the South and Central-East regions), cassava, sorghum (in the South), beans, groundnut, sweet potatoes and a wide variety of vegetables. Nonetheless, the risk-coping strategies of the farmers, including the use to cassava as energy-giving food, are insufficient to make the farmers food secured (Harvey *et al*., 2014; Ramaroson *et al*., 2014); and cassava farmers, similar to other farmers, suffer significant losses from recurrent incidences of cyclones.

Sampling procedure

The multistage randomized sampling technique involved 180 farmers in twelve rural communes randomly selected from six districts (Moramanga, Betafo, Ambalavao, Soavinandriana, Analamanga and Vakinankara). The districts are in the western coast near Mozambique Channel and along transverse section of the country through the central region to the eastern coastal side (Figure 1). Primary data were collected with the aid of a well-structured questionnaire.

Analytical procedures

The food security index was analysed following (Arene and Anyaeji (2010); Bashir *et al*. (2012a); Omonona and Agoi (2007) and Otunaiya (2014). This was used to classify the respondents into food secure and food insecure households to establish the food security status of the individual households in Central Madagascar.

The model for the determination of the food security status of the respondents is thus stated as food security index using the expenditure survey approach. The food security index is hence given as:

Zi= Per capita monthly food expenditure for the ith household/ ⅔ means per capita monthly food expenditure of all households (1)

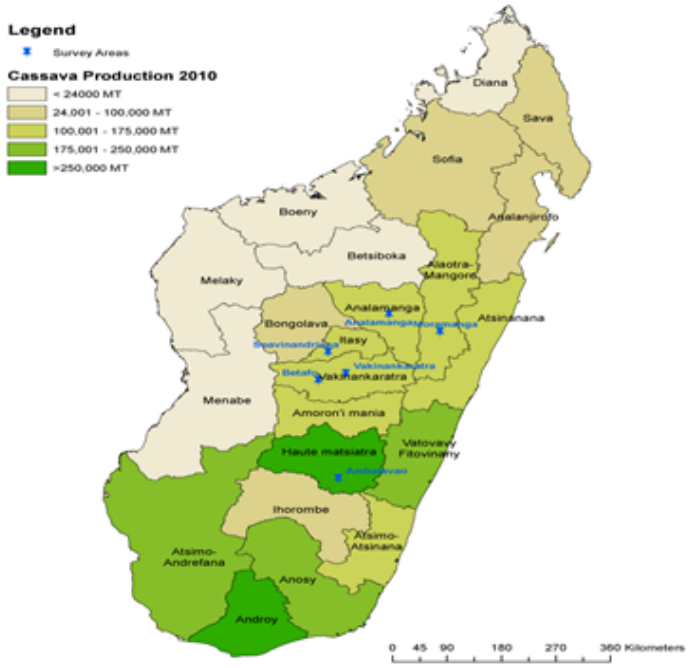

Figure 1: Map of Madagascar showing the survey locations

where;

Zi = Food security index

When Zi≥1, it implies that the ith household is food secure

When Zi< 1, it implies that ith household is food insecure

Effect of labour productivity on the food security status of rural households was estimatedby the use of probit regression analysis. This approach was consistent with Arene and Anyaeji (2010) and Aido *et al*. (2013). The model specification of the factors influencingthe food security status of rural household in Central Madagascar is implicitly given as:

$$P_i = F(Z_i) = 1 / 1 + e\text{-}(\mu 0 + \sum \mu n \beta n) \quad (2)$$

The model is explicitly given as:

$$Zi = \mu_0 + \mu_i X_i + \mu_2 X_2 + \mu_3 X_3 + \mu_4 X_4 + \mu_5 X_5 + \mu_6 X_6 + \mu_7 X_7 + \mu_8 X_8 + \mu_9 X_9 + \mu_{10} X_{10} + e_i \quad (3)$$

where:

Z_i = Food Security status of ith rural household (dummy variable; 1=food secure and 0=

Food insecure

X_1 = Labour productivity (output of cassava in t-ha/labour in mandays)

X_2 = Age (years)

X_3 = Gender (dummy variable; 1=male, 0=female)

X_4 = Educational level (years)

X_5 = Membership of cooperatives (dummy variable; 1=yes, 0=no)

X_9= Family labour (mandays)

X_7 = Off-Farm employment (dummy variable; 1=yes, 0=no)

X_8 = Hired labour (mandays)

X_9 = Dependency ratio

X_{10}= Farm size (ha)

μ_0 = Constant term

$\mu_1 - \mu_{10}$ = beta coefficient of explanatory variables

RESULTS AND DISCUSSION

Descriptive statistics of Cassava farmers

The results in Table 1 showed the average statistics of the sampled cassava farmers in the study area. An average farmer in the study area is about 46.05 years old, with 6years of education, 12 years of farming experience and an average household size of 6 persons. Cassava production in the region is a female (56.05%) dominated occupation, majority (73.88%) of whom are full time farmers. Only 16.32% were members of farmer organizations. A typical cassava farmer in Central Madagascar produced about 2.70t/ha of cassava with family and hired labour input of about 122.89 and 33.20 mandays per hectare. Their labour productivity was also 0.017t/manday.

The results showed that family labour dominates the cassava farming landscape in the study area. Minten and Barret (2008) in their study on agricultural technology, productivity, and poverty in Madagascar, noted that the poor in developing countries remain disproportion ally rural, with most employed or self-employed in agriculture. The labour productivity of 0.017t/man-day also indicates that the farmers were not labouring productive. Unskilled labour is the dominant source of non-farm income for the poorest

Table 1: Average statistics of cassava farmers in central Madagascar

Variable	Mean	SD	Min	Max
Age(yrs)	46.05	13.54	19.00	87.00
Education (yrs)	6.26	3.25	0.00	19.00
Household Size	5.67	3.44	1.00	50.00
Farming experience(yrs)	12.71	8.23	2.00	62.15
Family Labour	122.89	177.70	17.38	154.84
Hired labour	33.20	47.23	4.62	41.16
Labour Productivity	0.017	8.02	2.76	62.75
Output(t/ha)	2.7	1.8	0.06	12.30
Gender (% males)	43.95			
Membership of farmer organizations	16.32			
Occupational Status	73.88			

Table 2: Distribution of cassava farming households according to food security status

Status	Frequency	Percentage
Food Secure	135	25.00
Food Insecure	45	75.00
Total	**180**	**100.00**

African farmers, who commonly earn a significant share of their total income from off-farm labour, commonly in the fields of larger farmers (Barrett *et al*., 200; Reardon, 1997). Randrianarison (2003) noted that the poorest people in Madagascar, often unskilled and landless, rely disproportionately on agricultural wage labour income to survive. Minten and Zeller (2000) also estimated that 27% of the total income of the poorest quartile of the rural population in Madagascar originates from wage labour. This compares to only 10% for the richest quartile.

Adam Smith was of the opinion that division of labour was the basis of efficiency and productiveness while Sangha (1964) the French Physiocrats believed that surplus resulted only from agriculture when labour is utilised. He stated that the same amount of labour if utilised in manufacturing could not yield surplus.

Food security status of households in Central Madagascar

The food security status of the households in Central Madagascar was estimated by the use of the expenditure method. The result is shown in Table 2.

The result showed that majority (25.00%) of the cassava farmers were food insecure while 75.00% were food secure. Madagascar is defined as a low-income country, ranking 155th out of 187 countries in the 2014 Human Development Report (UNDP). Poverty in Madagascar has increased and currently, 72% of the country's estimated 22 million people live below the National poverty line. The 2014 Crop and Food Security assessment Mission found that 35.8% of the rural population in eight surveyed arrears were food insecure (WFP, 2014). The results also showed that farmers in the southern and central regions were more food secure. The Island is prone to natural disasters, particularly cyclones, floods and droughts. This has impacted on agricultural production and threatened the food security status of many (WFP, 2014).

Effect of labour productivity on the food security status of cassava producing households in Central Madagascar

The results in Table 3 showed the probit regression estimates of the effect of labour productivity and related variables on the food security status of the cassava farmers in Central Madagascar. The results showed that the Chi-suare value of 52.79 was highly significant at 1% level of probability indicating that the probit regression line was a good fit and variables used were adequate.

The coefficient for labour productivity was positive and highly significant at 1% level of probability. This implies that any increase in labour productivity will lead to increase in probability of food secure households.

The coefficient for age was negative and significant at 10% level, indicating that any increase in age will lead to increase in probability of food insecure households. The younger people are stronger than the aged and can perform strenuous jobs in field (Bashir *et al*., 2012a). Moreover, households with aged heads are the multi-generational households withmore retired and/ or older persons to feed. This may explain the negative effect of this variable on household food security. In a related study, Bashir *et al.* (2012b) notedthat an increase of one year in the age of household head decreased the probability of households to be food secure by 3%. Similar relationship was observed by Titus and Adetokunbo (2007) for Nigeria using a different statistical technique. On the contrary, for United States of America (USA), it was found that a year increase in the age of household head decreased the probability of households to be food insecure by 2% (Onianwa and Wheelock, 2006).

The coefficient for membership of cooperatives

Table 3: Probit estimates of the effect of labour productivity and related variables on the food security status of cassava farmers in Central Madagascar

Variable	Parameter	Coefficients	Std. Error	t-value
Constant	μ_0	-0.0161	0.7755	-0.020
Labour Productivity	μ_1	0.0484	0.0121	3.98***
Age	μ_2	-0.0137	0.0063	-2.19*
Gender	μ_3	-0.0392	0.0257	-1.590
Education	μ_4	0.0392	0.0257	1.520
Membership of Cooperatives	μ_5	0.7951	0.2624	3.03***
Family Labour	μ_6	-0.1488	0.0652	-2.28*
Off-Farm Employment	μ_7	-0.0302	0.0969	-0.310
Hired Labour	μ_8	0.0615	0.0829	0.740
Dependency Ratio	μ_9	-0.1427	0.0393	-3.63***
Farm Size	μ_{10}	0.2328	0.0706	3.30***
Obs		180		
LR chi^2 (10)		52.79***		
Log Likelihood		-173.7822		
Pseudo R^2		0.5319		

*p<0.1, ** p<0.05 and *** p<0.01

was positive and significant at 1% level of probability. This implies that farmers who belong to cooperatives had increased probability of being food secure compared to their counterparts whom are not members. Farmers in Central Madagascar belong to cooperatives which serve as a major source of labour in their various farms. In some of the communes visited, farmers who belong to cooperatives go to work in each of their individual farms as a group. There is strong evidence that the family farm and cooperatives can provide a decentralized system of food security and employment (Coleman, 2009). There is also close correlation between food security and cooperative organizations. This correlation is possible on account that a smallholder farmer had disposable cash income earned from cooperative activity (Chambo, 2009) to increase the production of cassava. Amaza *et al.* (2009) noted that this can be closely linked to the beneficial effects of their memberships in terms of production and other welfare enhancing services.

The coefficient for family labour was negative and significant at 10.00% level of probability, implying that any increase in family labour will lead to increase in probability of food insecure households. Labour supply from the family level has been dwindling considerably over the past years due to a number of factors, some of which are related. The achievement of the International Labour Organization (ILO) in child labour prevention coupled with the increasing awareness of the importance of education even in the rural areas has increased the proportion of children in schools hence reducing time available to work on the farm (Diallo *et al.,* 2013). Hunger and poor nutrition with their resultant ill-health and sometimes deaths, have also taken its toll on available labour from farming families. Rural-urban migration and the more attractive off-farm labour requirement have left mainly the aged and less mobile farmers to work on the farms (Oluyole *et al.*, 2013). Amsalu *et al*. (2013) noted that shortage of farm labour at peak seasons may be a reason for households to hire farm labour. In addition, vulnerable households such as women headed or orphaned households are usually unduly disadvantaged on family labour availability and productivity (Babatunde *et al*., 2008). Although most desired by peasants because of its lower transaction cost (Beckmann, 2000), family labour is gradually becoming recognized as unsustainable, hence the need for alternative source of human power to meet the food security requirement of the country.

The coefficient for dependency ratio was also negative and highly significant at 1% level of probability. This implies that any increase in

dependency ratio will lead to increase in probability of food insecure households in the study area. The classification of households by child dependency ratio in the study of food security is important because as child dependency ratio increases, food security among households decreases and vice versa. This is plausible as high child dependency ratio results in increased households' food requirements, probable reduction in quantity and quality of food, heavy dependence on available households' income and hence high probability of food insecurity.

The coefficient for farm size was positive and highly significantly at 1% level of probability. This implies that any increase in farm size will lead to increase in the probability of food secure households in the study area. Farmers who cultivate larger farms sizes are able to produce more cassava roots and stems thereby leading to higher output as external inputs for increased output are usually outside the reach of farmers. This followed the findings of Doward (1999) in his study on farm size and productivity in Malawian Smallholder Agriculture. The coefficients for gender and off farm employment were negative but not significant and education and hired labour which were positive.

CONCLUSION

The study analysed the effect of labour productivity on the food security status of small-holder cassava farmers in Central Madagascar. The result showed that 25% of the households were food insecure while 75% were food secure. The results show that food security is influenced by labour productivity, age, membership of co-operatives, family labour, and dependency ratio and farm size. The results therefore call for policies aimed at provision and access to simple farm gate machines among small-holder cassava farmers for enhanced labour productivity. Land re-distribution and re-form policies aimed at farmer groups and cooperatives, thereby encouraging younger farmers who seem to be more labour productive. There is also need for family planning measures to curtail population explosion and reduction in child dependency ratio. These will increase labour productivity thereby giving a boost to food security.

ACKNOWLEDGEMENT

The authors acknowledge the financial assistance received from the Common Fund for Commodities (CFC) to carry out the study as part of the Small-Scale Cassava Processing Projects in East and Southern Africa.

REFERENCES

1- Aidoo, R., Mensah, J.O., &Tuffour, T. (2013). *Determinants of household food security in the Sekyere-Afamplains district of Ghana*. Proccedings of the 1st Annual International Interdisciplinary Conference, AIIC 24-26th April (Pp. 514-529), Azores, Portugal.

2- Amaza, P.S., Abdoulaye, T., Kwaghe, P.V., &Tegbaru, A. (2009). *Changes in household food security and poverty status in PROSAB area of Southern Borno State, Nigeria*. International Institute of Tropical Agriculture (IITA) and Promoting Sustainable Agriculture in Borno State (PROSAB).Pp 1- 40.

3- Amsalu, B., Kindie, G., & Belay, K (2013). Determinants of household demand for and supply of farm labour in Rural Ethiopia. *Australian Journal of Labour Economics,* 6(3), 351-367.

4- Arene, C.J.,&Anyaeji, R.C. (2010).Determinants of food security among households in Nsukka Metropolis of Enugu State, Nigeria. *Pakistan Journal of Social Sciences,* 30(1), 9-16.

5- Asenso-Okyere, K., Aragon, C., Thangata, P., Andam, K., & Mekonnen, D.A. (2010). HIV and AIDS and farm labour productivity: A review of recent evidence in Africa. *Journal of Development and Agricultural Economics,* 2(12), 406-415.

6- Babatunde,R.O., Omotesho, O.A., Olorunsanya, E.O., &Owotoki, G.M. (2008). Determinants of vulnerability to food insecurity: A gender-based analysis of farming households in Nigeria. *Indian Journal of Agricultural Economics,* 63(1), 116-125.

7- Barrett, C.B., Reardon, T., & Webb, P. (2001). Nonfarm income diversification and household livelihood strategies in Rural Africa: Concepts, dynamics, and policy implications. *Food Policy*, 26(4), 315–331.

8- Bashir, M.K., Steven, S., & Pandit, R. (2012b). The determinants of rural household food security in the Punjab, Pakistan: An econometric analysis. Working Paper 1203, School of Agricultural and Resource Economics, University of Western Australia, Crawley, Australia.http://ageconsearch.umn.edu/bit-

stream/122526/2/working%20paper%201203.pdf. Pp. 1-30.
9- Bashir, M.K., Schilizzia, S., & Pandita, R. (2012a). *The determinants of rural household food security for landless households of the Punjab, Pakistan*. Working Paper 1208, School of Agricultural and Resource Economics, University of Western Australia, Crawley, Australia. Pp. 13.
10- Beckmann, V. (2000). *Transaction costs and institutional choice in agriculture*. Berlin: Edition Sigma, Germany, Pp 1-14.
11- Bockel, L., & Dabat, M.H. (2001). *Improve labor productivity in rice cultivation in the fight against poverty. Paper presented at the seminar on Poverty in Madagascar: inventory, explanatory factors and policies to reduce*, February 2001, 14pp.
12- Chambo, S.A. (2009). *Agricultural co-operatives: Role in food security and rural development*. Paper Presented to Expert Group Meeting on Co-operatives Held on 28 – 30 April, 2009 New York, 13pp.
13- Coleman, B.E. (2009). The impact of group lending in Northeast Thailand. *Journal of Development Economics,* 60,105-141.
14- Diallo, Y., Etiene, A., & Mehran, F. (2013). Global child labour trends 2008 to 2012. International Labour Organization Retrieved from http://www.ilo.org/ipec/Informationresources/WCMS_IPEC_PUB_23015 /lang--en/index.htm. Pp 1-68.
15- Dorward, A. (1999). Farm size and productivity in Malawian Smallholder Agriculture. *Journal of Development Studies*, 35(5), 141-161.
16- Dorward, A.R. (2012). Agricultural labour productivity and food prices: Fundamental development, impacts and indicators. *Food Policy*, 39, 40-50.
17- Dostie, B., Randriamamonjy, Jet., & Rabenasolo, L. (2000). *The cassava sector: Shock forgotten vulnerable*. Antananarivo National Institute of Statistics, Antananarivo, Madagascar, Pp. 23.
18- Ezedinma, C.I (2000). Farm resource allocation and profitability of arable crop enterprises in the Humid Forest Inland Valley Ecosystem: A case study of OzuAbam in southern Nigeria. *UNISWA Journal of Agriculture*, 9, 48-56.
19- Ezedinma, C.I., Okafor, C., Asumugha, G.N., & Nweke, F. (2006). Trends in farm labour productivity and implications for cassava industrialization in Nigeria. Proceedings of the Annual Conference of the 40th Agricultural Society of Nigeria held, Oct. 16th – 20th (p. 109-115), NRCRI Umudike, Abia State.
20- FAO-ILO-IUF (2005). *Agricultural workers and their contribution to sustainable agriculture and rural development*. FAO-ILO-IUF. Geneva: ILO. 102pp. ISBN: 9789221187097
21- FEWSNET (2012). Famine Early Warning Systems Network.Madagascar Desk review. Retrieved from www.fews.net/sites/default/files/ MG_deskreview_2012_en_0.pdf. 15pp
22- Francis, E. (2002). Gender, Migration and Multiple Livelihoods: Cases from Eastern and Southern Africa. *Journal of Development Studies*, 38(5), 167-191.
23- Gul Unal, F. (2008). *Small is beautiful: Evidence of an inverse relationship between farm size and yield in Turkey.* Working paper No. 551, The Levy Economics Institute P.O. Box 5000 Annandale-on-Hudson, NY 12504-5000. Pp 1-48
24- Gurkan, A.A. (1995). The Mathematics of Hunger. *California Environmental Resources Evaluation System* (CERES), 27(2), 31-33.
25- Haddad, L., Kennedy, E., & Sullivan, J. (1994). Choices of indicators for food security and nutrition monitoring. *Food Policy*, 19(3), 329-343.
26- Harvey, C. A., Rakotobe, Z. L., Rao, N. S., Dave, R., Razafimahatratra, H., Rabarijohn, R. H., & MacKinnon, J. L. (2014). Extreme vulnerability of smallholder farmers to agricultural risks and climate change in Madagascar. Philosophical transactions of the Royal Society B. *Biological Sciences*, 369, 16-39.
27- IFPRI – FOFIFA, (1998). *Structure and Conduct of Major Agricultural Input and Output Markets and Response to Reforms by Rural Households in Madagascar*, Part 1, Final Report, International Food Policy Research Institute - FOFIFA Project, 1997.
28- Minten, B., & Barret, C. (2008). Agricultural technology, productivity and poverty in Madagascar. *World Development,* 36(35), 1335-1347.
29- Minten, B., & Zeller, M. (2000). *Beyond market liberalization: Welfare, income generation and environmental sustainability in Rural Madagascar*. Aldershot, Hants, England: Ashgate. Pp1-272
30- Mordi. C., & Mmieh, F. (2008), divided labour and divided in-firm markets in the Nigerian petroleum sector. Brunel University, UK. Pp. 8
31- Nweke, F. (2004). *New challenges in the cassava transformation in Nigeria and Ghana*. Discussion Paper No. 118, Environment and Production Technology Division International Food Policy Research, Washington, D.C. Pp 1-118.
32- Odurukwe, S.N., Matthews-Njoku, E.C., & Ejioku-Okereke, N. (2006). Impact of the Women-In-Agriculture (WIA) extension programme on women's lives: Implications for subsistence agricultural production of women in Imo State, Nigeria. *Livestock Research for Social Development*, 18(2), 1-10.
33- Oluyole, K.A., Usman, J.M., Oni, O.A., & Odu-

wole, O.O. (2013). Input use efficiency of cocoa farmers in Ondo State, Nigeria. *Journal of Finance and Economics*, 1(1), 8-10.
34- Omonona, B.T., & Agoi, G.A. (2007). An analysis of food security situation among Nigerian Urban Households: Evidence from Lagos, Nigeria. *Journal of Central European Agriculture*, 8(3), 397-406.
35- Onianwa, O.O., & Wheelock, G.C. (2006). An analysis of the determinants of food insecurity with severe hunger in selected Southern States. *Southern Rural Sociology,* 21, 80-96.
36- Otunaiya, O.A. (2014). *The food security profile of farming households in Rural Areas of Ogun State, Nigeria*. climate change, agriculture and food security in Nigeria. Proceeding of the 14th Annual National Conference of the Nigeria Association of Agricultural Economics 24th – 27th Feb (Pp. 762-768), Federal University of Technology, Akure, Nigeria.
37- Page, H. (2013). *Global governance and food security as global public good*. Centre for International Cooperation, New York University. Pp 1-32
38- Ramaroson, R.V., Arvisenet, G.,& Valentin, D. (2014). Studying the nutritional beliefs and food practices of malagasy school children parents. A contribution to the understanding of malnutrition in Madagascar. *Appetite*, 81, 67-75.
39- Randrianarisoa, C. (2001). *Determinants of rice productivity in Madagascar, Michigan State University.* Unpublished thesis, Department of Agricultural Economics, Michigan Sate University, East Lansing, MI.
40- Randrianarisoa, J.C., & Minten, B (2001). *Agricultural production, agricultural land and rural poverty in Madagascar.* Cornell Food and Nutrition Policy Program Working Paper No. 112, Pp. 46.
41- Randrianarison, L. (2003). *Off-farm income of rural households and poverty.* Minten, B., Randrianarisoa, J.C., Randrianarison, L. (Eds). Agriculture, Rural Poverty and Economic Policies in Madagascar, Cornell University/ INSTAT / FOFIFA. Pp 56-59.
42- Ravallion, M., Chen, S.,& Sangraula, P. (2007). *New evidence on the urbanization of global poverty.* Policy Research Working Paper (No. 4199) Washington, World Bank, Pp. 33.
43- Reardon, T. (1997). Using evidence of household income diversification to inform study of the rural nonfarm labor market in Africa. *World Development,* 25 (5), 735-748.
44- Reardon, T., Delgado, C., & Matlon, P. (1992).Determinants and effect of income diversification amongst farm households in Burkina Faso. *Journal of Development Studies,* 28(2), 264-296.
45- Sangha, K. (1964). *Productivity and economic growth*. Asia Publishing House, London
46- Smith, L.C., & Subandro, A. (2007). *Measuring food security using household expenditure survey method*. International Food Policy Research Institute, Washington DC, USA.Pp 1-147
47- Titus, O.B., & Adetokunbo, A.G. (2007). An analysis of food security situation among nigerian urban households: Evidence from Lagos State, Nigeria. *Journal of Central European Agriculture,* 8(3), 397-406.
48- Ukoha, O.O. (2000). Determinants of labour productivity on small-holder sole crop farm: A Case study of waterleaf enterprise (Taliniumtriangulare). *Nigerian Journal ofAgribusiness and Rural Development,* (3), 10-18.
49- UN-MDP (2005).United Nations millennium development project halving hunger: It can be done. Summary version of the report of the Task Force on Hunger.The Earth Institute at Columbia University, New York, USA.Pp 44.
50- USAID (1992). Definition of food security. USAID policy determination Retrieved from http:// www.usaid.gov/pubs/ads/200/ pd19.pdf, 1992. Pp 1-3
51- WFP (2014). *World Food Programme Madagascar Country Brief*. Oct-Dec 2014.Pp. 2. Retrived from https://www.wfp.org/countries/madagascar

How to cite this article:
Okoye, B. C.1, Abass, A., Bachwenkizi, B., Asumugha, G., Alenkhx`e, B., Ranaivoson, R., Randrianarivelo, R., Rabemanantsoa,N & Ralimanana, I. (2016). Analyses of labour productivity among small-holder cassava farmers for food security and empowerment in Central Madagascar. *International Journal of Agricultural Management and Development, 6(3), 309-318.*
URL: http://ijamad.iaurasht.ac.ir/article_524419_d22aa755b5f68e40c5e029d9626446e1.pdf