Contribution of agricultural intensification on household income and food security: The case of Njombe and Mvomero districts

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Abstract

Agricultural intensification is now a reality around the world. The phenomenon has been attributed to various drivers including an increased demand for feeding the growing human population, increased multiple competing land uses and therefore creating the pressure of need for enhanced production. Other factors entail the advancement of market and road infrastructures and thus creating enabling environment for agricultural transactions, and improved access to agricultural inputs and technologies. It is undoubtedly true that intensification brings diverse consequences in terms of income and food security among others. This study manifests the effects of agricultural intensification on income and food security amongst small scale farmers based on the data collected through household survey, and uses maize and paddy production in Njombe and Mvomero districts respectively as the case study. Our operational definition of intensification entails the frequent use of agro-chemical inputs such as mineral fertilizers, pesticides and herbicides; and use of improved seeds for the aim of enhancing crop productivity. We also narrow the food-security-definition by focusing on sufficient production for household consumption and having surplus for sale.

Key words: *agricultural intensification, income, food security, smallholder farmers*

1. Introduction

Agricultural intensification is a reality globally. Various factors are attributed to the drive towards intensification. Among them include competing land uses, growing human population (Josephson et al., 2012), advancement of market and road infrastructures, and improved access to agricultural inputs and technologies (Wu and Li, 2013). It is undoubtedly true that agricultural intensification contributes to income and food security among others. Various definitions of agricultural intensification exist in the literature (Carswell 1997; Stéphenne and Lambin, 2001). However, our operational definition of agric Intensification entails the frequent use of inputs such as mineral fertilizers, pesticides herbicides, and improved seeds to enhance crop productivity (Wu and Li, 2013; Dixon et al. 2001; Solano et al. 2001; Abdoulaye and Sanders 2005; Dar and Twomlow 2007).). In the same token, food security is an ambiguous term. Nonetheless, in this study we narrow down the concept 'food security' by defining it as sufficient crop production for household consumption and having surplus for sale.

This study looks at the contribution of Agricultural intensification on income and food security with focus on maize and paddy crops in Njombe and Mvomero districts respectively.

2. Research questions

General question

- How does agricultural intensification (AI) for maize and paddy production for Njombe and Mvomero respectively contribute to income and food security?

Specific questions

- What maize and paddy harvests are realized under AI?
- What maize and paddy produce are sold out of total harvests?
- What maize and paddy produce is consumed out of total harvest?

3. Methodology

A two-method approach was used wherein household surveys and focus group discussions (FGDs) were used to collect the data from smallholder farmers in Mvomero and Njombe districts. The two methods were used for complementary and validation purposes. Household survey employed the use of a semi-structured questionnaire which was administered to 40 smallholder farmers in Ibumila, Kichiwa, Maduma and Tagamenda villages of Njombe district, and to 20 smallholder farmers from Dihombo and Hembeti villages of Mvomero district. Two focus group discussions were held with other smallholder farmers (these did not participate during household survey) from the above mentioned villages. The FGD was guided by a checklist of questions for guiding the discussion. While the focus group discussion in Njombe involved 28 smallholder farmers, in Mvomero the FGD involved 19 smallholder farmers. Therefore, both quantitative data and qualitative data were collected.

Both purposive and random sampling techniques were used to get the respondents for participation in the household survey. Purposively, households that were involved in the production of maize and paddy for the two study districts were the target of this study. However, to get the 40 and 21 smallholder famers for the survey exercise, probability sampling techniques were employed. Regarding focus group discussion, purposively both sexes of men and women were considered because of capturing the culture-based variation in the division of roles and responsibilities in agricultural extension activities in the two study districts.

Two analytical tools were used to analyse the collected data. The quantitative data collected using the semi-structured questionnaire were analysed using the statistical package for social science (SPSS). Using this tool, statistics of demographic characteristics and produced, sold and consumed harvest variables including minimum, maximum and mean values were estimated. The frequencies in percentages were also calculated using the SPSS. For the qualitative information gathered using FGDs and open-ended questions in the semi-structured questionnaire, content analysis tool was used. In keeping with the specific objectives of the study, qualitative information was categorized into textual themes, units and subunits.

4. Results

4.1 Demographic characteristics of respondents

Demographic characteristics provide a picture in terms of skills, knowledge, experience, social capital, and resources -among other attributes -possessed by household heads and/or members of the household as well as culture-based roles and responsibilities and division of the same. Demographic characteristics covered in the present study are household type, gender of the respondents interviewed, marital status, respondent's education, age, and household size. Table 1 presents the first four of the characteristics: *Household type, marital status, and respondents' gender and education*

Majority of the surveyed households were male-headed for both Njombe (85%) and Mvomero (71.4%) whereas the remaining percentages represent female-headed households. It is a custom in the study area that men are recognized as heads of their

families among the married couples except for cases wherein women are unmarried and/or divorced. The marital status of the respondents in the study area manifested most of the respondents as married for both Njombe (87.5%) and Mvomero (76.2%) with few widowed (10% for Njombe and 9.5% for Mvomero) and unmarried (9.5% for Mvomero) whereas fewer were unmarried (2.5% for Njombe) and divorced (4.8% for Mvomero).

The study involved both male and female respondents at generally or almost equal percentages. Male and female respondents were estimated at 47% each for Njombe district whereas for Mvomero district while women covered 52.4 % men covered 47.6%. Both men and women in the study areas are involved in agricultural intensification in terms of maize and paddy production activities. Regarding the education level of the respondents, while majority of the interviewed smallholder farmers (95%) had attained primary school education in Njombe district, all respondents in Mvomero district (100%) had attained primary school education (Table 1)

Table 1: demographic characteristics of the respondents for study area in Njombe and Mvomero district

Characteristic	Category /level	% of respondents in Njombe (n=40)	% of respondents in Mvomero (n=21)
Household type	Male-headed Female-headed	85 15	71.4 28.6
Respondents interviewed	Male Female Both M&F	47.5 47.5 5	47.6 52.4
Marital status	Married Unmarried Widow Divorced	87.5 2.5 10	76.2 9.5 9.5 4.8
Education of respondent	Primary Adult No formal education	95 2.5 2.5	100

Ages of respondents

Distributions of ages of respondents for both Njombe and Mvomero districts are presented in Figure 1 and 2. Most of the respondents are skewed to the adult age of between 30 and 50 years for Mvomero district and 40 and 50 years for Njombe district. Fewer of the respondents have ages below 30 years and above 50 years.

This age distribution implies that the age group largely involved in agricultural intensification activities in the two districts is that between 30 and 50 years as an active working group. As such, Table 2 indicates that the mean ages for the respondents from the two study districts are 44 years for Mvomero district and 46 years for Njombe district.

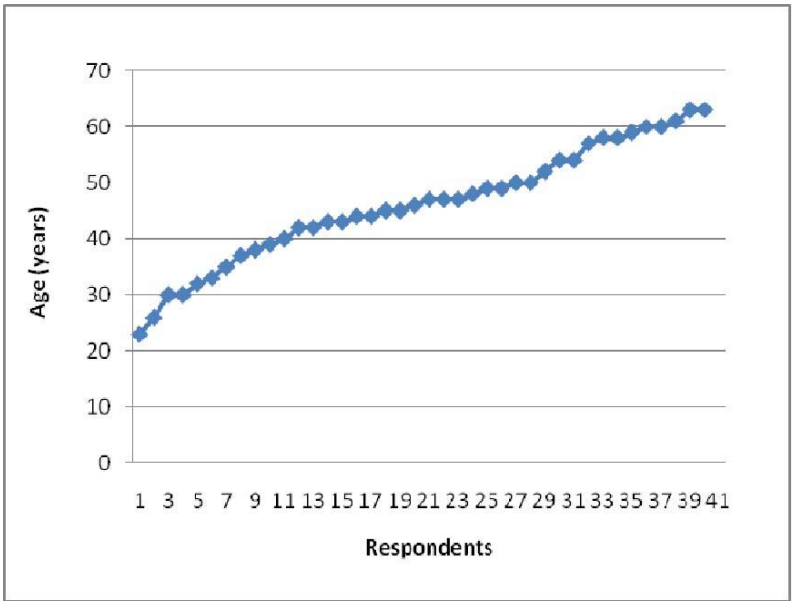

Figure 1: Distribution of age of respondents in Njombe district

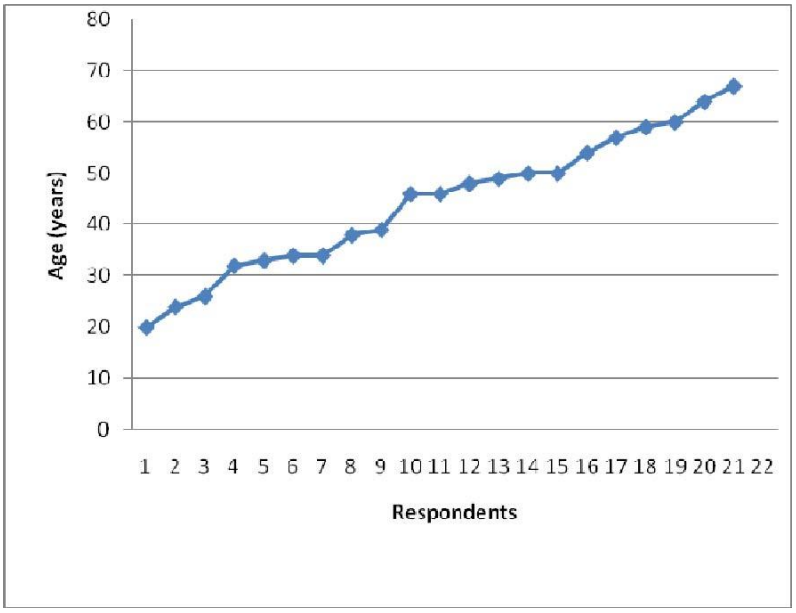

Figure 2: Distribution of ages of respondents in Mvomero district

Table 2: Age statistics for the studied districts of Njombe and Mvomero

District	Minimum	Maximum	Mean	Standard deviation
Mvomero (n=21)	20	67	44.29	13.46
Njombe (n=40)	23	63	46.08	10.39

Household size

Household size portrays number of individuals living within one household. It comprises of members that contribute to the active labour vis-à-vis the dependant ones, and is therefore a good indicator of responsibility facing, and human labour available in, a particular household. The ratio of active labour and dependants provides a clue as to the nature and

magnitude of agricultural intensification activities the household may register to, and cost and effort strategies required for intended degree of intensification. The household sizes for the two studied districts of Njombe and Mvomero were about 6 persons for Njombe district and about 5 people for Mvomero district (Table 3).

4.2 Amounts (tones) of maize harvested, sold and consumed for Njombe district

Table 4 indicates the area of land used by smallholder farmers in production of maize in Njombe district. On average, the area of 1.3 hectare is used for this purpose. The average production of maize is also presented in the same table as 2.5 tons and out of which 1.4 tons are sold whereas 0.9 tons are used for household consumption. Maize production therefore contributes to smallholder farmers' income and food security at Njombe district. Minimum and maximum values for area and production variables including their dispersion (standard deviation) are presented in Table 4.

Table 3: Household sizes for study areas in Njombe and Mvomero districts.

Variable	N	Minimum	Maximum	Mean	Std. dev
Households in Njombe district	40	1	14	5.9	1.99
Household in Mvomero district	21	1	8	5.1	2.55

Table 4: maize yield, and the sold and consumed amounts for Njombe district

Attribute	N	Min.	Max.	Mean	Std Dev
Area (ha) planted	39	0.61	2.84	1.32	0.63
Amount harvested	39	0.26	11	2.56	2.59
Amount sold	39	0.81	8	1.42	1.97
amount consumed	39	0.09	3.56	0.92	0.98

4.3 Amount of paddy (tones) harvested, sold and consumed for Mvomero district

Paddy production in Mvomero district is practiced in two seasons namely dry season and rainy season. Dry season production employs the use of the irrigation opportunity. The following section presents area converted into paddy production for both dry and rain seasons and the amounts produced, sold and consumed among smallholder paddy producers in the district

4.3.1 Dry season production

During the dry season an average area of 0.8 hectares is used for paddy production. On average, paddy yield of 1.2 tons was realized from irrigation paddy production in the year 2012. Out of the produced paddy, a significant amount (0.75 ha) is sold whereas the remaining amount (0.57) is consumed by the household. However, out of the studied 21 households, 7 households did not have opportunity to access irrigation infrastructures and therefore did not practice paddy cultivation during the dry season (Table 5).

Table 5: Paddy produced, sold and harvested in the study area of Mvomero district

	N	Min.	Max.	Mean	Std Dev
Area (ha) planted	14	0.20	3.24	0.82	0.87
Amount harvested	14	0.08	4.50	1.23	1.22
Amount sold	14	0.08	2.30	0.75	0.68
amount consumed	14	0.18	3.60	0.57	1.01

4.3.2 Rainy season paddy production

Out of the 21 households involved in the survey, 13 practiced rain-fed paddy production. An average area used for paddy production by smallholder farmers during rainy season is estimated at 0.9 hectares. On average, paddy yield realized through rain-fed production is estimated at
1.93 tons out of which 0.99 tons were sold whereas the remaining 0.5 tons were used for household consumption. The results indicate that the rainy season paddy yields are relatively higher than the dry season ones although the areas used for paddy production for the two seasons are more or less equal (Table 5).

4.4 Average maize and paddy productivity

Table 6 presents average productivity of maize and paddy crops in terms of tons per hectare for the studied areas of Njombe and Mvomero districts. Maize productivity was estimated at 1.94 tons per hectare whereas paddy productivity was estimated at 1.5 tons per hectare for irrigation paddy production and 2.19 tons per hectare for rainy season paddy production. Tables 7 and 8 compare maize and paddy productivity for the present study with productivity reported by other researchers for the same crops. For maize, the results indicate that average yields realized in the study areas were higher than the yield values reported by AATF and COSTECH (2010) and MOAFSC (2012) which range from 1.2 to 1.6 tons per hectare. On the other hand, the yields reported in the present study for maize in Njombe are slightly lower than that reported by FAOSTAT (2012) which was 2 tons per hectare.

Table 5: Paddy produced, sold and harvested in the study area of Mvomero district

Attribute	N	Min.	Max.	Mean	Std Dev
Area (ha) planted	13	0.20	3.24	0.88	0.92
Amount harvested	13	0.27	7.20	1.93	2.22
Amount sold	13	0.27	4.32	0.99	1.20
Amount consumed	13	0.09	4.14	0.50	1.10

Table 6: Average maize and paddy productivity for Njombe and Mvomero districts

Crop type		Njombe	Mvomero		
			Dry season		Rainy season
Rice			1.5		2.19
Maize		1.94			

Table 7: Comparison of average maize yields (Tons/Ha) from this study with other studies

THIS STUDY	**AATF & COSTECH 2010**	**MOAFSC (2012)**	**FAOSTAT (2012)**	**POTENTIAL (AATF&COSTECH 2010)**
1.94	1.2 – 1.6	1.2	2.0	4-5

Table 8: Comparison of average paddy yields (Tons/Ha) from this study with other studies

THIS STUDY		**URT (2012)**	**MAFS (2009)**	**FAOSTAT (2012)**	**POTENTIAL (MAFS 2009)**
Dry season Rainy season Rainy season					
1.5	2.2	1.8	1.6-1.8	1.8	4-5

Similarly, through comparing productivity of paddy observed in the present study to those reported by other researchers, two way observations are made. On the one hand, for dry season paddy, yield reported in this study was relatively lower than 1.8 tons per hectare reported by URT (2012) and FAOSTAT (2012), and 1.6 to 1.8 tons per hectare reported by MAFS (2009). On the other hand, paddy yield observed in this study for rainy season was higher than those reported by the above mentioned references. Generally, results from this study indicate that maize and paddy represent an important contribution in terms of income and food security among smallholder farmers in Njombe and Mvomero districts. However, the productivities realized from the present study for both paddy and maize crops were lower than the potential productivity which is estimated at 4 to 5 tons per hectare (MAFS, 2009; AATF and COSTECH, 2010).

Less production than the existing potential is attributed to various factors. During focus group discussion, smallholder farmers uncovered barriers towards achieving that potential. Among the factors include inadequate/limited awareness on use of inputs such as improved seeds and fertilizers (e.g. Minjingu), inputs not being available or when available being expensive or fake, inadequate access to information and extension services, climate change in terms of unreliable rainfall and drought, increased incidence of insect pests challenge such as chaffers grab, and conflicts between/among multiple land uses for example entailing crops farmers and pastoralists.

5. Conclusion and recommendation

This study concludes that agricultural intensification indicates an important contribution in terms of food security and income generation at household level in the studied districts. Farmers have been able to produce for their household consumption and for the market to enable them acquire income that can be used for obtaining other off-farm products and services. However, more productivity potential exists than what is currently produced. It is therefore recommended that efforts need to be made to ensure reliable and dependable sources of inputs are in place, and to enhance farmers knowledge on appropriate use of inputs through extension-based intervention. It is further recommended that timely availability and accessibility of inputs should be worked on, and regarding conflicts among multiple land users, a move should be made not only by designing a land use plan but moving beyond by ensuring that such the tool is effectively enforced.

References

Abdoulaye T, Sanders JH (2005) Stages and determinants of fertilizer use in semiarid African agriculture: the Niger experience. Agr Econ 32:167-179

Afircan Agricultural Technology Foundation (AATF) and Commission for Science and Technology (COSTECH) (2010). Mitigating the impact of drought in Tanzania: the WEMA intervention. 4 pp

Carswell G (1997) Agricultural intensification and rural sustainable livelihoods: a 'think piece'. http://wwwidsacuk/ids/bookshop/wp/wp64pdf. Cited 2 Jul 2008

Dar WD, Twomlow SJ (2007) Managing agricultural intensification: the role of international research. Crop Prot 26(3):399-407

DixonJ, Gulliver A, Gibbon D (2001) Farming systems and poverty: improving farmer's livelihoods in a changing world. Food and Agriculture Organization, Rome, and World Bank, Washington DC

FAOStat (2012). Agriculture and Trade Opportunities for Tanzania, working paper

Josephson, A.L., Gilbert, J. R., Chamberlain, J., and Florax, R. (2012). How does population density affect agricultural productivity? Evidence from Ethiopia. A selected paper prepared for presentation at the Agricultural & Applied Economics Association's 2012 AAEA Annual Meeting, Seattle, Washington, August 12-14, 2012. Pp. 29

Stéphenne N, Lambin EF (2001) A dynamic simulation model of land-use changes in Sudano-Sahelian countries of Africa (SALU). Agr Ecosyst Environ 85:145-161

Solano C, León H, Pérez E, Herrero M (2001) Characterizing objective profiles of Costa Rican dairy farmers. Agr Syst 67:153-179

United Republic of Tanzania (URT) 2012. Poverty and Human Development Report Dar es Salaam: REPOA. Retrieved. May 21, 2013 from: http://www.repoa.or.tz/documents_storage/Poverty_and_Human_Development_Report_2011.pdf

Wu, J. and Li, M. (2013). Land use change and agricultural intensification: key Research Questions and Innovative Modeling Approaches. A background paper submitted to the International Food Policy Research Institute. Final Report, November 2013. 48 pp.

MOAFSC (2012). Household Budget Survey