RUFORUM Working Document Series (ISSN 1607-9345), 2021, No. 19 (1):758-767.
Available from http://repository.ruforum.org

Research Application Summary

Status of rice post-harvest value addition by smallholder farmers in the Southern Region of Sierra Leone

Kamanda, P. J. [1, 2,] Mensah, A. O., [2] Motaung, M. V. [2, 3,] & Akaba, S. [2]

[1]Department of Agricultural Extension and Rural Sociology, School of Agriculture and Food Science, Njala University, Njala Campus, Private Mail Bag 47235, Sierra Leone
[2]Department of Agricultural Economics and Extension, School of Agriculture, College of Agriculture and Natural Sciences, University of Cape Coast, Ghana
[3]Department of Agricultural Extension and Rural Development, Faculty of Agribusiness, Education and Extension, Botswana University of Agriculture and Natural Resources, Gabarone, Botswana
Corresponding author: pjkamanda@njala.edu.sl; kama.pj06@gmail.com

Abstract

Smallholder farmers in Sierra Leone are characterized by their socio-demographic characteristics which affect their ability to add value to rice at post-harvest stages. The rice value addition technologies start from harvesting to storage. Smallholder farmers mainly use manual technologies to harvest, thresh, dry, mill, package, and store their rice at their disposal. The objective of this study was to characterize the context of smallholder rice post-harvest value addition in the Southern Region of Sierra Leone, in terms of harvesting, threshing, drying, destoning, parboiling, milling, sorting and grading, packaging, and storage. The agricultural extension system in Sierra Leone, which builds the capacity of farmers in the rice value chain, like many other developing countries, is confronted with many challenges. Therefore, data for this study were collected from four hundred smallholder rice farmers with a structured interview schedule. Data were processed by the Statistical Package for Social Sciences (IBM SPSS Statistics) version 25.0 software, analyzed using simple descriptive statistics (frequencies, percentages, mean, and standard deviations). The survey results revealed that the majority of the farmers were males and their mean age was 43 years. Additionally, the majority of the farmers practise only two of the total post-harvest value addition technologies. About 10% of the farmers profited less than Le1 equivalent to USD 0.000096 between 2017 to 2020 from the sales of their rice. These results, therefore, suggest that rice processing equipment, training, and credit facilities are required for smallholder farmers for effective rice value addition at post-harvest stages.

Keywords: Drying, harvesting, milling, packaging, threshing, rice, Sierra Leone

Résumé

Les petits exploitants agricoles de la Sierra Leone se caractérisent par leurs caractéristiques sociodémographiques qui affectent leur capacité à ajouter de la valeur au riz aux stades post-récolte. Les technologies de valeur ajoutée du riz commencent de la récolte au stockage. Les petits exploitants agricoles utilisent principalement des technologies manuelles pour récolter, battre, sécher, moudre, emballer et stocker leur riz à leur disposition. L'objectif de l'étude était de caractériser le contexte de la valeur ajoutée post-récolte du riz des petits exploitants dans la région sud de la Sierra Leone, en termes de récolte, battage, séchage, épierrage, étuvage, broyage, tri

et classement, emballage et stockage. Le système de vulgarisation agricole en Sierra Leone, qui renforce les capacités des agriculteurs dans la chaîne de valeur du riz, comme dans de nombreux autres pays en développement, est confronté à de nombreux défis. Par conséquent, les données de cette étude ont été recueillies auprès de quatre cents petits producteurs de riz avec un programme d'entretien structuré. Les données ont été traitées par le logiciel Statistical Package for Social Sciences (IBM SPSS Statistics) version 25.0, analysées à l'aide de statistiques descriptives simples (fréquences, pourcentages, moyennes et écarts-types). Les résultats de l'enquête ont révélé que la majorité des agriculteurs étaient des hommes et que leur âge moyen était de 43 ans. De plus, la majorité des agriculteurs ne pratiquent dans une large mesure que deux des technologies totales de valeur ajoutée post-récolte. Environ 10 % des agriculteurs ont tiré moins de Le1 équivalent à 0,000096 USD entre 2017 et 2020 de la vente de leur riz. Ces résultats suggèrent donc que des équipements de transformation du riz, une formation et des facilités de crédit sont nécessaires pour les petits exploitants agricoles pour une valeur ajoutée efficace du riz aux étapes post-récolte.

Mots clés : Séchage, agents de vulgarisation, récolte, mouture, conditionnement, battage

Introduction

Smallholder rice farmers in Sierra Leone are currently faced with several challenges to boost productivity and to increase their income level through rice value addition. Such challenges among others include lack of quality inputs (seeds, sufficient fertilizers, and processing equipment), limited access to extension services, low level of investments and limited working capital, and this is made ...by weak market linkages, and climate change which exerts pressure on production (West and Central Africa Division, 2018).

In Sierra Leone, there is high food loss along the value chain, which is attributed to ineffective or inefficient harvesting, poor storage facilities, poor processing and handling materials (Njoro *et al*., 2013). Knowing the needs for training of rice farmers helps to create effective policies and extension services that could further strengthen the skills and abilities of rice farmers to increase production (Kshash, 2016). In addition to this understanding, their socio-economic characteristics is vital in determining the needed rice post-harvest value addition. Comparative analysis study of both upland and lowland ecologies in Sierra Leone by Chenoune *et al*. (2016) suggested that average rice yields are 0.29t/ha and 0.34t/ha for upland and lowland ecologies, respectively. For labour use and the average size of farmland, farmers averagely spend 121 days/ha and 90 days/ha; and cultivate an average of 0.99ha and 0.66ha from upland and lowland, respectively.

In addition, extension systems in most developing countries including Sierra Leone are still characterized by weak linkages with research institutions; inadequate extension staff; lack of technical and managerial competence to successfully deliver products to value chains; and lack of good training opportunities for the extension agents. In this way, training as means for farmers and extension agents to acquire specific skills to better perform their jobs is therefore needed (Saleh *et al*., 2016). The Government of Sierra Leone has therefore made increased rice production one of its key development strategies, with the hope to achieve food self-sufficiency and food security in the country (Kumar and Kalita, 2017). Land coverage of Sierra Leone is 72,300sq.km out of which 5.4 million hectares are potentially cultivable; upland ecology constitutes 80% of arable land best for the production of varying cash crops (Ighobor, 2014). This is on the backdrop that the country has a huge potential for self-sufficiency in rice, but less than 10% of the land is unfortunately

under cultivation. Henceforth, the Government is making efforts to improve rice production from its current 1.23 tons/ha to 2 tons/ha through several strategies (Sannoh, 2011). Key among these strategies is the AfDB $11 million investment in the Agribusiness and Rice Value Chain Support Project, which primarily is to stimulate agribusiness development through rice production. The aim is to produce an additional 900,000 MT of rice by 2023 (WFP and AU, 2020).

The efforts supporting the rice value chain development project will require major agricultural transformation to improve the production of rice by smallholder farmers and also increasing market access. The main challenge, therefore, is that smallholder farmers lack the ability to add value to their rice during and after harvest (processing stages). This reduces the quality of their yield which consequently adversely affect their income level. For instance, a study by Kamara and Cooke (2015) found out that value-added prospects for rice by smallholder farmers in Sierra Leone are few, especially for locally produced rice to attract high market value. There is an over-reliance on the use of the locally available rice post-harvest technologies by smallholder rice farmers in Sierra Leone ranging from harvesting, threshing, drying, milling, packaging, marketing or storage operations available to them. The study, therefore, sought to assess the status of smallholder rice production and the extent to which farmers add value to rice at post-harvest stages. The study focussed on the Southern Region of Sierra Leone.

Materials and Methods

A descriptive research design that calls for a survey was adopted to select 400 farming households, following the Miller and Brewer (2003) sampling technique formula and covered four districts in the region. The formula was used to proportionally determine a sample size of 400 smallholder farmer households from the total sample frame of 157,114 (Statistics Sierra Leone, 2015) wherein one rice smallholder farmer was selected from each household as a unit of analysis, or respondent for this study. The method used thus produced precise results and posed no observer subjectivity. A Closed-ended/structured interview schedule was used to collect primary data from smallholder farmers. Descriptive statistics which involved the use of frequencies, percentages, means and standard deviations were calculated to describe the smallholder rice farmers' socio-demographic characteristics, and the findings are presented in tables.

Results and Discussion

Among the 400 smallholder rice farmers in the study area, a relative majority (74.0%) were males while 26.0 percent were females (Table 1). The mean age of the farmers was 43.09 years with less than half (44.2%) aged between 40-49 years while 4.5 percent were aged 60 or more years old. These findings are broadly consistent with the one of Mwololo *et al*. (2019) who reported that a significant proportion of the sampled farmers were aged 41 to 50 years and that the majority were of middle age. This is the economically active category that can withstand stress which translates into the high productivity level of the farmers. Furthermore, Mwololo *et al*. (2019) in their study of 816 households in Kisii and Nyamira counties in Kenya noted that 48 years was the average age of farmers in the study area.

The study further revealed that most of the respondents (83.5%) were married while only 3.8% were co-habiting. Similarly, Ayanwale and Amusan (2014) in their gender analysis of rice production efficiency study in Nigeria reported that majority of the farmers (73.3%) were married. Provided

that members of the family are available for farm activities, this finding has ramifications for the provision of family labour for rice production. In addition, marriage improves the technical efficiency of farmer households, as families are a significant source of labour in rural community settings (Rasheed *et al*., 2020). The use of family labour is therefore commonly practiced because no wages are paid.

Regarding their level of education, 26.5% had no formal education while Junior Secondary School (JSS) and tertiary education were attained by 16.3 percent and 3.5 percent, respectively. On the contrary, a study by Conteh *et al.* (2015) in Sierra Leone reported that 79% of the respondent farmers had some levels of education. On the other hand, a study by Tarway-Twalla, (2013) in Liberia reported that 37% of smallholder farmers had no form of education, whereas 5% had a degree or college education. On the whole, rice growing smallholder farmers who were better educated and attended more association meetings and field demonstrations were more inclined to use part or all of the technology options available to them in rice production (Tsinigo and Behrman, 2017). The average household size was ten with most farmers (45.8%) having a household size of 6-10 members and 20 or more members were found among 3.2 percent of them. This result is in sharp contrast with a study by Sammeth *et al*. (2010) which reported that an average household in Sierra Leone had approximately seven members. However, findings of Ahmed *et al.* (2017) too reported that a household had on average seven individuals in rural Pakistan, including two wage earners.

Table 1 further shows that farming was the main source of income for the majority of the farmers (86.5%) and only 8.2 percent had commerce as their main source of income. A comparative majority of the farmers (41%) had 10-19 years of farming experience whereas 19.3% and 5% had 20-29 years and 30-39 years of farming experience, respectively. Sources of farm labour included family (49%), hired (38.5%), and rotatory (12.3%). Less than half (37.5%) of the farmers had developed farmlands while only 29.8 percent had stumped farmlands. Also, sources of information on rice post-harvest value addition were extension agents (60.3%), other farmers (33%), and local mass media (6.3%). The majority of the farmers (80.5%) did not have access to credits,while a few receive cash (6.5%), in-kind gestures (7.2%), and both cash and in-kind gestures (5.8%).

Table 1. Socio-demographic characteristics of farmers

Socio-demographic variable	Frequency	Percentage
Sex		
Male	296	74.0
Female	104	26.0
Age (completed years)	Mean=43.09±8.33	
20-29	18	4.5
30-39	128	32.0
40-49	177	44.2
50-59	59	14.8
60+	18	4.5
Marital status		

Single	14	3.5
Married	334	83.5
Co-habiting	15	3.8
Divorced	12	3.0
Widowed	25	6.2
Highest educational level (n=191)		
No education	106	26.5
Non-formal	103	25.8
Primary	22	5.5
JSS (Junior Secondary School)	65	16.3
SSS (Senior Secondary School)	43	10.8
Technical/Vocational	47	11.8
Tertiary	14	3.5
Household size Mean=10.10±4.46		
1-5	44	11.0
6-10	183	45.8
11-15	128	32.0
16-20	32	8.0
20+	13	3.2
The main source of income		
Farming	346	86.5
Employment	15	3.8
Commerce	33	8.2
Family remittance	6	1.5
Farming years		
<10	132	33.0
10-19	164	41.0
20-29	77	19.3
30-39	20	5.0
40+	7	1.8
Source of labour		
Family	196	49.0
Hired	154	38.5
Rotatory	49	12.3
Others	1	0.2
Source of information on rice post-harvest value addition and marketing		
Extension agents	241	60.3
Local mass media	25	6.3
Colleague farmers	132	33.0
Traders/marketers	2	0.4
Type of credit received		
None	322	80.5
Cash	26	6.5
In-kind	29	7.2
Both	23	5.8

Source: 2021, Field Survey

Table 2 shows the extent to which smallholder farmers in the study area practiced rice post-harvest value addition. Almost all the farmers (99.5%) practise timely harvesting of paddy, harvesting paddy by panicle selection with a knife (92.3%), sun-drying of paddy on tarpaulin (90.8%), sun drying of paddy on the cemented floor (69.0%), parboiling paddy (78.3%), and milling/processing paddy (88.0%). Very few farmers (2.3%) practiced harvesting paddy with a combine harvester, threshing paddy with a mechanical thresher (6.0%), use of a moisture meter (14.3%), de-stoning paddy (13.3%), sorting and grading processed rice (12.8%), weighing processed rice for packaging (3.3%), and using ventilated and insect free storage facility (6.0%).

The findings further revealed that farmers use a knife to select panicles in harvesting paddy and, sun dry paddy on tarpaulin/plastic sheets. The extent to which farmers carry out value addition practices like; timely harvesting of paddy and milling/processing paddy was done to a moderate extent. All of the other post-harvest value addition technologies were done to a small extent by the smallholder farmers.

Rice harvesting is mostly done with a knife rather than a handheld sickle, demonstrating that traditional tools constitute the bulk of the production activities of smallholder farmers (Tarway-Twalla, 2013). The fundamental challenge in rice harvesting for smallholder farmers is the manual harvesting process with a sickle or other types of rice cutting knife, followed by placing the cut paddy on the wet soil until they are picked up and transported to threshing sites by human labour force (Tinsley, 2012).

Table 3 presents the profit margins accrued by farmers in rice production over the given period of years that affect their income levels. Profit (P) was calculated by subtracting the total revenue accrued from the harvested yield (R), from the total production costs (PC). Therefore, P = PC-R. The total production costs included all estimated costs of production factors (land, labour, and capital), and revenue was the cost of the harvested yields. Considering the effects of the estimated production costs (land, seed rice, tools, and farm labour) by farmers, the study revealed that 10.0% of the farmers in 2017, 8.2% in 2018, 7.2% in 2019, and 9.7% in 2020 practically accrued serious economic loss in their rice processing activities with a profit margin of less than Le1 equivalent to USD0.000096 per year. Overall, the highest profit margin (6195913) was realized by farmers in 2020, followed by 2019 (4257952) and the least was in 2018 (3593075). Nearly one-third of the farmers (32.7%) had Le1 - 1000000 as profit realized from their processing activities. In 2018 and 2019, 29.9% and 37.7% profited between Le1000001 - 2000000. The year 2020 accounted for a comparatively higher profit margin of Le 2000001 - 3000000 as compared to the other years. The mean profit accrued by most of the farmers was highest in 2017 (2097920.7592) followed by 2019 (1446988.9677) and least in 2018 (1403843.5739).

These findings ceteris paribus are consistent with those of Hussaini *et al*. (2021) who reported that in Nigeria approximately 70% of rice farmers highly ranked lack of improved rice processing methods as one of the factors that impeded investment in rice value addition activities. This shows that farmers still rely on their traditional rice processing methods in the study area. However, contrary to this, Kulyakwave *et al*. (2020) concluded that rice farming was a profitable venture in Tanzania as farmers obtained revenue of TZS 1484175.3 equivalent to USD162.54/ha.

Table 2. Extent of rice post-harvest value addition practised among smallholder farmers (n=400)

Value Addition activity	Practising farmers		Mean practise	S.D practise	Extent of practise
	Frequency	Percentage			
Timely harvesting of paddy	398	99.5	3.34	1.12	3.3
Harvesting paddy by panicle selection with knife	369	92.3	3.82	1.31	3.8
Harvesting paddy with a combine harvester	9	2.3	0.10	0.63	0.1
Threshing paddy with mechanical thresher	24	6.0	0.24	0.95	0.2
Use of moisture meter to determine moisture content in paddy	57	14.3	0.40	1.09	0.4
Sun drying of paddy on tarpaulin/plastic sheet	363	90.8	3.63	1.39	3.6
Sun drying of paddy on the cemented floor	276	69.0	2.83	2.09	2.8
Sun drying of paddy on a raised platform	85	21.3	0.75	1.50	0.7
De-stoning paddy	53	13.3	0.36	1.01	0.4
Parboiling paddy	313	78.3	2.55	1.71	0.6
Milling/processing paddy	352	88.0	3.17	1.43	3.2
Sorting and grading processed rice	51	12.8	0.27	0.86	0.3
Weighing processed rice for packaging	5	1.3	0.05	0.44	0.1
Packaging and labelling processed rice	13	3.3	0.07	0.45	0.1
Use of ventilated and insect free storage facility	24	6.0	0.14	0.62	0.1

Source: 2021, Field Survey

Scale: (1=To a small extent, 2=To some extent, 3=To a moderate extent, 4=To a great extent, 5=To a very great extent

Where: 1 1.45; 2=1.46-2.45; 3=2.46-3.45; 4=3.46-4.45; and 5 4.46

Conclusions and recommendations

The mean age of the rice farmers of 43.09 years indicates that the majority of the farmers are elderly. Regardless of their age, almost all of the farmers practised timely harvesting of paddy to a moderate extent, followed by the use of a knife to harvest paddy by panicle selection and sun-drying of paddy on a tarpaulin. On the other hand, more than 40% of the respondents had large household size (>ten persons) with more than half of them with no formal education. Furthermore, very few farmers (2.3%) used combine harvester to harvest paddy and threshing machine to thresh paddy (6.0%), moisture meter (14.3%), destoning paddy (13.3%), sorting and grading processed rice (12.8%), weighing processed rice for packaging (3.3%), and used ventilated and insect free storage facility (6.0%). Harvesting paddy by panicle selection and sun drying of paddy on tarpaulin were done to a very great extent. Farmers majorly derive little or no profits in their value addition efforts to rice. From the above conclusions, it is recommended that farming be made more attractive and lucrative to attract the youthful population into rice farming. Additionally, adult functional literacy drive, value addition equipment and credit facilities should be provided to smallholder farmers by the Government and other development partners so as to realize the better rice production and income.

Acknowledgements

The first author thanks Njala University (Sierra Leone), University of Cape Coast (Ghana) and RUFORUM Secretariat for endorsing my Graduate Teaching Assistantship status under which this study was done. Thanks also to Carnegie Cooperation of New York through RUFORUM for supporting this research through a capacity-building competitive grant provided by the "Training the Next Generation of Scientists". This paper is a contribution to the Seventh Africa Higher education Week and RUFORUM Triennial Conference held 6-10 December 2021 in Cotonou, Benin.

References

Ahmed, U. I., Ying, L., Bashir, M. K., Abid, M. and Zulfiqar, F. 2017. Empowering smallholder rice farmers in Tanzania to increase productivity for promoting food security in Eastern and Southern Africa. *PLoS* 12 (10): 1–15. https://www.niddk.nih.gov/health-information/diabetes/overview/diet-eating-physical-activity

Ayanwale, A. B. and Amusan, C. A. 2014. Gender analysis of rice production efficiency in Osun State: Implication for the transformation agenda. *Nigerian Journal of Agricultural Economics* 4 (2066-2018-918): 12-24.

Chenoune, R., Belhouchette, H., Paloma, S. G. Y. and Capillon, A. 2016. Assessing the diversity of smallholder rice farms production strategies in Sierra Leone. *NJAS - Wageningen Journal of Life Sciences* 76 (1): 7–19. https://doi.org/10.1016/j.njas.2015.10.001

Conteh, A. M. H., Yan, X. and Moiwo, J. P. 2015. The determinants of grain storage technology adoption in Sierra Leone. *Cahiers Agricultures* 24 (1): 47–55. https://doi.org/10.1684/agr.2015.0733

Kulyakwave, P., Xu, S., Yu, W., Sary, S. and Muyobozi, S. 2020. Profitability analysis of rice production, constraints and consumption shares by small-scale producers in Tanzania. *Asian Journal of Agricultural Extension, Economics and Sociology* 1–12. https://doi.org/10.9734/ajaees/2019/v37i430280

Table 3. Total rice production profit attained by smallholder farmers for the given period of years

Amount (Le)	2017		2018		2019		2020	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
< 1	28	10.0	24	8.2	21	7.2	29	9.7
1 – 1000000	57	20.3	41	14.1	28	9.6	27	9.0
1000001 – 2000000	39	13.9	31	10.7	38	13.0	26	8.7
2000001 – 3000000	39	13.9	43	14.8	14	4.8	18	6.0
3000001 – 4000000	22	7.8	20	6.9	28	9.6	15	5.0
4000001 – 5000000	18	6.4	32	11.0	31	10.6	22	7.3
5000001 – 6000000	27	9.6	20	6.9	46	15.8	21	7.0
6000001 – 7000000	16	5.7	31	10.7	25	8.6	23	7.7
7000001 – 8000000	7	2.5	8	2.7	22	7.5	18	6.0
8000001 – 9000000	9	3.2	13	4.5	-	-	10	3.3
9000001 - 10000000	3	1.1	-	-	3	1.0	23	7.7
10000001 - 11000000	1	.4	11	3.8	11	3.8	24	8.0
11000001 - 12000000	-	-	2	.7	8	2.7	10	3.3
>12000000	15	5.3	15	5.2	17	5.8	34	11.3
Total	281	100.0	291	100.0	292	100.0	300	100.0
Minimum	42000000.00		-33080000.00		-31880000.00		-15520000.00	
Maximum	17000000.00		16200000.00		17600000.00		23200000.00	
Mean	2562935.59		3593075.3952		4257952.0548		6195913.3333	
Standard deviation	7142227.18		6214033.13297		6163611.73889		6499632.53689	

Source: 2021, Field Survey

Where: 1 Sierra Leone Leone (Le) = USD 0.000096 = Ghana Cedes (GHC) 0.00058

Hussaini, A. S., Oladimeji, Y. U., Sanni, S. A. and Abdulrahman, S. 2021. Determinants of rice farmers' investment in value addition and its effect on poverty status in Kebbi State, Nigeria. *Nigerian Journal of Basic and Applied Science*s 28 (1): 75–84. https://doi.org/10.4314/njbas.v28i1.10

Ighobor, K. 2014. Trade between two unequal partners. *Africa Renewal* 28 (2): 3-4.

Kamara, J. S. and Cooke, R. A. 2015. A national survey of rice (*Oryza sativa* L.) grain quality in Sierra Leone. II: Evaluation of physical grain quality. *African Journal of Food, Agriculture, Nutrition and Development* 15 (5): 10559-10577–10577.

Kshash, B. 2016. Training needs of rice farmers in Mahanawiyah district, AL-Qadisiya Province, Iraq. *Turkish Journal of Agriculture - Food Science and Technology* 4 (12): 1072-1076. https://doi.org/10.24925/turjaf.v4i12.1072-1076.714

Kumar, D. and Kalita, P. 2017. Reducing postharvest losses during storage of grain crops to strengthen food security in developing countries. *Foods* 6 (1): 1-22. https://doi.org/10.3390/foods6010008

Mwololo, H., Nzuma, J. and Ritho, C. 2019. Do farmers' socio-economic characteristics influence their preference for agricultural extension methods? *Development in Practice* 29 (7): 844–853. https://doi.org/10.1080/09614524.2019.1638344

Njoro, J., Anthony, N., de Hoogh, I., Fanzo, J., Chahid, N., Fornah, D., Gboku, M.L., Kamara, M., Kargbo, A., Koroma, A. and Ljungqvist, B. 2013. An analysis of the food system landscape and agricultural value chains for nutrition: A case study from Sierra Leone. ICN2 Second International Conference on Nutrition, Rome.

Rasheed, A., Mwalupaso, G. E., Abbas, Q., Tian, X. and Waseem, R. 2020. Women participation: A productivity strategy in rice production. *Sustainability* 12 (7): 1-15. https://doi.org/10.3390/su12072870

Saleh, J.M., Man, N., Salih, M.H., Hassan, S., Nawi, N.M. and Mohammed, S.J., 2016. Training needs of agriculture extension officers in Iraq. *International Journal of Scientific and Research Publications* 6 (2): 147-152.

Sammeth, F., Michel, B., Hites, G. and Gomez y Paloma, S. 2010. Impact of rural poverty reduction strategies: The case of smallholders in Sierra Leone. In: African Association of Agricultural Economists (AAAE) 2010 AAAE Third Conference/ AEASA 48th September 19-23, Cape Town, South Africa.

Sannoh, I. J. 2011. Agricultural and Rural Development Statistics in Sierra Leone - Key aspects of institutional arrangements and performance. 1–20. http://www.fao.org/fileadmin/templates/ess/pages/rural/wye_city_group/2011/documents/session6/Sannoh_-_Paper.pdf

Statistics Sierra Leone. 2016. Statistics Sierra Leone 2015 Population and Housing Census Summary of Final Results. 1–190. http://www.statistics.sl

Tarway-Twalla, A. K. 2013. Agricultural productivity, climate change and smallholder farmer' s entrepreneurship : A case study of the Central and Western Regions of Liberia. Monrovia, Liberia.

Tinsley, R. 2012. Rice Value Chain Analysis – Sokoto State Nigeria (NIG 244).

Tsinigo, E. and Behrman, J. R. 2017. Technological priorities in rice production among smallholder farmers in Ghana. *NJAS - Wageningen Journal of Life Sciences* 83: 47–56. https://doi.org/10.1016/j.njas.2017.07.004

West and Central Africa Division, 2018. Sierra Leone Agriculture Value Development Project Design Completion Report Main Report And Appendices.1544pp.

World Food Programme (WFP) and African Union (AU). 2020. Cost of hunger in Malawi: Implications on national development and vision 2020. Available at https://www.wfp.org/publications/cost-hunger-malawi.