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The Influence of Demographic Factors on Productivity in Smallholder Cotton Contract Farming

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Abstract **– The paper sought to contribute to the understanding of the influence of demography in contract farming arrangements in Tanzania with the view to assess the demographic characteristics effect based on geographic zones, gender distribution of farmers, age of farmers and education levels on cotton productivity. The study was explanatory and utilized survey to collect data. A stratified sampling procedure was employed to select 383 smallholder farmer respondents from three high production ecological zones. The analysis, results and findings of the study suggest that demographic factors have significant effect on cotton productivity, and that among them, the geographical zone at which farmers locate to cultivate cotton is more important compared to age, farming experience and education levels.**

Keywords **– Smallholder Farmers, Cotton, Contract Farming, Geographic Zone, Age, Gender and Education Level.**

I. INTRODUCTION

Lake Victoria region has been the main producer of quality cotton in Tanzania and normally referred to as "*the white gold*". This paper focused purposely to a study which was conducted in the Lake region due to its history and potentiality in cotton production on how the demographic characteristics namely zones, gender, age and education influence productivity of smallholder farmers in contract farming arrangements.

Meatu zone in the Lake Victoria region which is dominantly semi-arid with rich volcanic soils has short rains during cotton planting season in November compared to Bariadi and Mara Zones (URT, 1996). Being within Lake Victoria basin, Mara has mostly sandy soils upstream with fertile valleys downstream as rivers flows into Lake Victoria (Lembeli et al.: 2001). Lake Victoria region is a male dominated society so we expect most of the households to be headed by male. The study looked at the sex distribution of the farmers, age of farmers is an important aspect in cotton production and education levels as an aspect of production efficiency.

II. METHODOLOGY

The sample size of smallholder farmers involved in contract farming was evenly distributed among three targeted zones of Bariadi, Mara and Meatu. The expected sample size was 383 for each zone. This was achieved in Bariadi only and it was slightly less in Mara (382) and Meatu (379) due to non-responses that were out of the control of the researcher.

The research employed both probability and non-probability sampling techniques. Since the investigation required intercom and face-to face interaction between researcher and respondents and that the smallholder farmer's relevant strata, stratified systematic sampling techniques was used. According to Saunders et al. (2009: 211), a stratified systematic sampling technique is where the sampling frame is divided into a number of subsets (strata) and then random sampling is then undertaken from each of the subsets. We utilized the stratified systematic sampling technique in order to divide the smallholder farmers among the three major cotton growing zones. Considering the large sample frame a sample of 383 farmers for each stratum was randomly selected.

A stratified random sampling based on the three high cotton producing zones was used in order to minimize systematic error. In each stratum has a sample size of 383 based on 95% confidence level and 5% margin of error was selected.

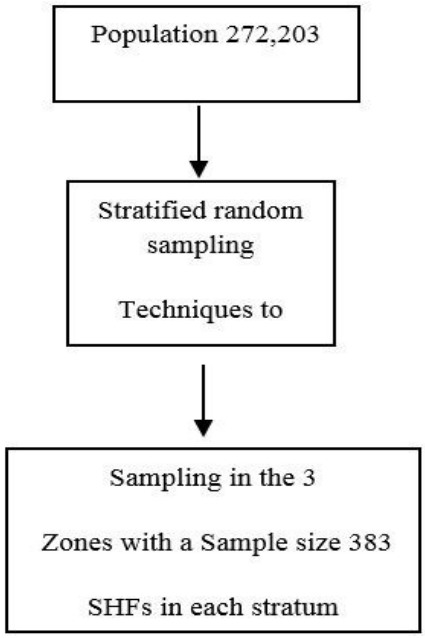

Fig. 1. Sample size-Source: Saunders et al (2009).

Smallholder farmers specified their level of agreement or disagreement on a Likert scale for demographic characteristic attributes questionnaire. The range captured the intensity of the smallholder farmers' opinion and facts for a given attribute.

In this study, the questionnaire was particularly used to generate information on social and demographic variables of smallholder farmers, in particular the information was amassed on; age, gender and education in cotton farming. The questionnaire further gathered information regarding the dependent and independent variables. Dependent variable is the cotton yield per acre of the smallholder farmers.

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In order to ensure that reliability is achieved, the study ensured that enumerators were trained in using the data collection instruments such as the questionnaire. The study developed checklists for semi-structured interviews which were constructed to generate information on social and demographic variables of the smallholder farmers. These variables included geographical zones where farming was being practiced, membership of the smallholder farmers in business groups and cooperative societies, their sex and age groups and their education levels. For ease of communication and understanding, 'Kiswahili; (the Tanzania National language) version of the approved questionnaire was employed.

III. Analysis and Results

Data was analyzed by SPSS tool (version 20). The SPSS tool is used to analyze data in social sciences, or in business world (Darren, 2008). The specific data analysis techniques included: factor analysis, descriptive statistics, correlations, regression analysis, multiple comparison tests, and analysis of variance.

Cotton production income differs in different zones as presented in Table 5.3.1 below. The average cotton production was higher in Bariadi (430.42 kg per acre) followed by Meatu (288.52 kg) and Mara (224.61 kg).

Table 1. Zones Descriptive Analysis.

Variable	Zone	N	Mean	Std. Deviation	Std. Error
Cotton yield per acre	Mara	382	224.61	167.92	8.59
	Bariadi	383	430.42	278.57	14.23
	Meatu	379	288.52	222.64	11.44
	Total	1144	314.69	243.22	7.19

The multiple comparison tests conducted at the significance value of $\alpha = 0.05$ found that there are significant differences in yields between different zones. We therefore conclude at 95% confidence level that cotton yield vary from one zone to another. Thus zone is an important factor in cotton production as different areas have different characteristics in terms of soil fertility and weather conditions as important factors in cotton production.

Table 2. Multiple Comparisons for Zones on Cotton Yield.

Dunnett T3					
Dependent Variable	(I) Zone	(J) Zone	Mean Difference (I-J)	Std. Error	Sig.
Cotton yield per acre	Mara	Bariadi	-205.81042*	16.62615	.000
		Meatu	-63.91510*	14.30422	.000
	Bariadi	Meatu	141.89533*	18.25932	.000
*. The mean difference is significant at the 0.05 level.					

The multiple comparison analysis revealed that a farmer in Bariadi zone produces on average of 205.8kg and 141.9kg more compared to the one in Mara and Meatu respectively. But a farmer in Meatu produces on average 63.9kg more compared to the one in Mara. In this case Bariadi Zone seems to be the highest producer of cotton followed by Meatu and Mara Zones.

The analysis of variance (ANOVA) conducted at 5% and 10% level revealed that the zone where cotton is grown has a significant effect on the cotton yield. The analysis show significant variations (*p-value = 0.000*) among different zones which suggest that the zone where cotton is grown is very important factor in determining cotton productivity and improved livelihood for farmers.

Table 3. Analysis of Variance for Zone for Cotton Yield.

		Sum of Squares	Df	Mean Square	F	Sig.
Cotton yield per acre	Between Groups	8488889.895	2	4244444.948	81.911	0.000*
	Within Groups	59124396.818	1141	51818.052		
	Total	67613286.713	1143			

*Significant at 0.01 level. ** Significant at 0.1 level.

The study looked at the sex distribution of the farmers and revealed that the largest proportion of them were male (92.1 percent) and most of them were aged less than 45 years. This does not necessarily mean that it is only men who farm but it's because the respondent here was the head of the household and most of the households are headed by men. There were no any significant direct relationships between sex and cotton yield or livelihood. So according to this study, sex does not determine the attributes of cotton production which might be due to large differences between male and female samples (see Table 4 below).

Table 4. Sample Distribution by Sex.

Sex	Sample Size	Percent
Male	1054	92.1
Female	90	7.9
Total	1144	100.0

Table 5. Sample Distribution by Age.

Descriptive						
Cotton yield per acre						
Age Group	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Below 36	469	298.4009	221.54904	10.23018	278.2981	318.5036
36 – 45	371	307.6819	224.12356	11.63592	284.8011	330.5628
46 – 55	173	337.2832	286.23481	21.76203	294.3282	380.2383
56 – 65	83	384.9398	303.81065	33.34755	318.6009	451.2787
Above 65	29	418.9655	314.07853	58.32292	299.4964	538.4346
Total	1125	316.9333	244.02088	7.27530	302.6586	331.2080

The age of a farmer is an important aspect in cotton production because it determines the energy and experience one has in cotton production activities. According to the sampled farmers, as presented in Table 5, large proportion (about 73.4 percent) of cotton growers was aged below 45 years. The descriptive analysis (Table 5) revealed that the average cotton production increases as age increases.

The correlation analysis results shows that cotton yield has a significant positive correlation with age ($r = 0.108$, $p\text{-value} = 0.000$, $\alpha = 0.05$). Therefore, we conclude at 95% confidence that the age of the farmer has a positive correlation with cotton yield. This indicates that productivity in cotton farming increases as age increases; this can simply be explained that as someone stays longer in farming his experience and productivity also improves. We saw that most of the farmers were of age below 46 years which suggests that most of them are young but their average productivity was lower than older groups. Young farmers may be more energetic but less productive because they are still learning and have less experience; this is supported by the regression analysis result (Table 6) which indicates that a unit increase in age of a farmer is associated with about 2.189 units increase in cotton production.

Table 6. Regression Analysis for Age on Cotton Production.

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	232.767	24.166		9.632	.000	185.352	280.182
	Age	2.189	.600	.108	3.650	.000	1.012	3.366
a. Dependent Variable: Cotton yield per acre								

The analysis of variance (ANOVA) shows at 95% confidence level that age has significant effect on cotton productivity ($p\text{-value} = 0.003$).

Table 7. Analysis of Variance (ANOVA) for Age on Cotton Yield.

ANOVA					
Cotton yield per acre					
Difference	**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
Between Groups	10.558	4	2.640	4.033	.003
Within Groups	733.107	1120	.655		
Total	743.666	1124			

In Tanzania, most educated individuals reside in urban centers where agricultural farming is not extensively practiced which leads to high number of farmers in rural areas having low levels of education. Apart from most of the farmers being youths, a very large proportion of them (about 95.2 percent) have attained only a primary school education or less as depicted by Fig. 2 below.

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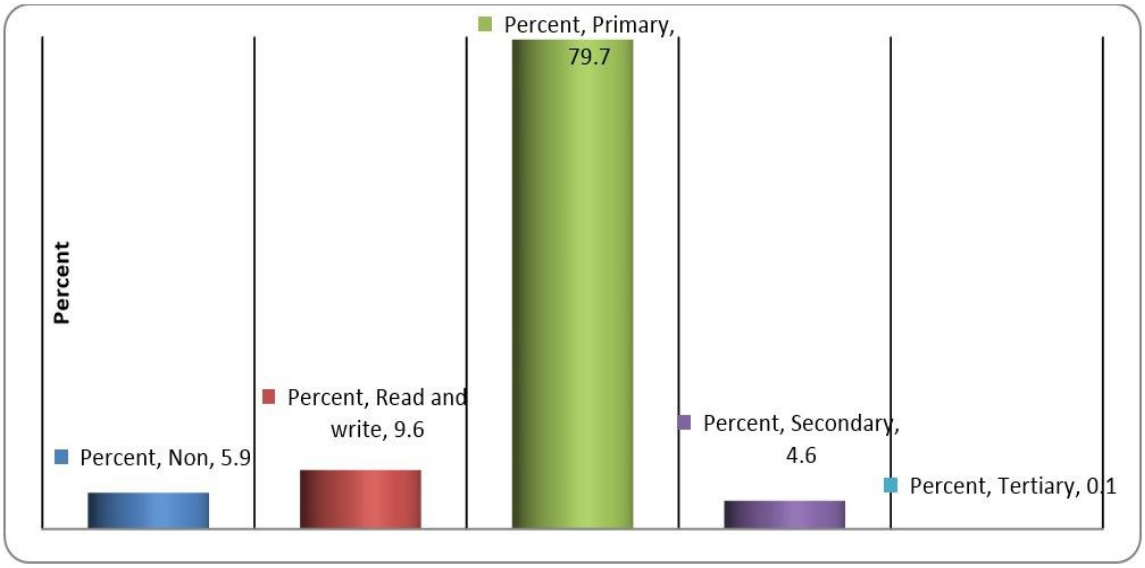

Fig. 2. Sample Distribution by Education Level.
Source: Field Data, 2017.

The analysis depicts that an increase in the farmer's level of education is directly proportional to cotton production level. This supports the argument that in Tanzania, more educated farmers are more efficient in cotton production than less educated farmers.

Table 8. Descriptive Analysis for Education Levels.

Descriptive						
Cotton yield per acre						
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
No	68	255.8824	192.30134	23.31996	209.3355	302.4292
Read and write	110	297.2727	217.87510	20.77358	256.1002	338.4453
Primary	912	323.0263	248.80934	8.23890	306.8569	339.1957
Secondary	53	285.8491	246.58774	33.87143	217.8811	353.8171
Total	1143	314.8294	243.27404	7.19569	300.7111	328.9477

The descriptive analysis above depict that a more educated farmer is more likely to have high cotton production and therefore improved livelihood compared to the one with less education.

Table 9 below gives the differences in cotton production between education levels; a farmer with primary school education is more productive by the average of about 67.14kg per acre compared to the one with no education. Differences in other education levels did not show any significant variations.

Table 9. Multiple Comparisons for Education Level and Cotton Yield.

Dependent Variable: Cotton yield per acre Dunnett T3				
(I) Education	(J) Education	Mean Difference (I-J)	Std. Error	Sig.
No	Read and write	-41.39037	31.23079	.707
	Primary	-67.14396*	24.73257	.047
	Secondary	-29.96670	41.12292	.976
Read and write	Primary	-25.75359	22.34773	.820
	Secondary	11.42367	39.73431	1.000
Primary	Secondary	37.17726	34.85905	.865
*. The mean difference is significant at the 0.05 level.				

The analysis of variance (ANOVA) shows that there are variations between education level of farmers with significant impact on the production level ($\alpha = 0.1$, *p-value* $= 0.095$).

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Table 10. Analysis of Variance for Education Level and Cotton Yield.

ANOVA					
Cotton yield per acre					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	375978.694	3	125326.231	2.124	.095
Within Groups	67210163.038	1139	59008.045		
Total	67586141.732	1142			

Ranking of the demographic characteristics factors influence is indicated by the f-values from the analyses of variance for Cotton yield below:

Table 11. Summary of ranking of demographic characteristics factors' influence on yield.

Importance	**Factor**	***Error Mean Square***	***F***	***p-value***
1st	Zone	4244444.948	81.911	.000
2nd	Age	2.640	4.033	.003
3rd	Education level	125326.231	2.124	.095
	Gender – NOT APPLICABLE			

IV. Discussion

The study revealed that geographical zones are important factor in cotton production as different geographical areas have different characteristics in terms of soil fertility and weather. Zones were purposely selected due to their history and potentiality in cotton production and sample sizes were evenly distributed among the three targeted zones of Bariadi, Mara and Meatu. A strong significant statistical association between the independent variable (Zone) and the dependent variables (cotton yield per acre) was analysed (Tables 1, 2 and 3). Statistical analysis revealed that productivity in Bariadi Zone (430.4 kg per acre) is higher compared to Meatu Zone (288.5 kg per acre) and Mara (224.6 kg per acre). According to Poulton and Maro (2009) soil fertility is a key issue for the Tanzanian cotton sector and that low fertility soil is a constraint, and that cotton requires adequate rains during planting, adequate season sunshine and low humidity (Anderson, 2011). The findings of this study echo in other studies on the same issues (USDA, 2015).

The study revealed that most of smallholder farmers' respondents were male (See Table 4). This can be explained by the fact that since respondents were mostly the head of households and that most of them were men. The study found that there were no any significant correlation between sex and other variables, therefore informing that sex is not an important factor in this case determining the influence of the attributes of contract farming arrangements.

The study revealed that age of a farmer in cotton cultivation is related to increased cotton yield per acre and that the youths were the mostly engaged in cotton farming activities than other age groups. Age of a smallholder farmer is essential as it determines the energy and experience one has in cotton production activities. According to sampled farmers, most cotton growers were aged below 46 years (See Table 5) and that youths are the mostly engaged in cotton farming activities than other age groups. It becomes even more difficult to produce when the smallholder farmer is either very old or very young. This is supported by the study analysis which reveals that a unit increase in age of a farmer is associated with about 2.2 units increase in cotton production (Table 6) and that the analysis of variance show that age has a significant effect on cotton productivity (Table 7).The findings in this study are in line with Coelli and Battese (1996) who reported that youth were more technically efficient than the older one, and that being energetic had to be combined with having considerable experience in cotton farming to witness greater productivity. A related study in China found similar findings (Chuo et al., 2015).

Educational levels of smallholder farmers are also essential in cotton production. Descriptive and the analyses of variation show that there are variations between education levels of smallholder farmers with significant impact on production levels and that a more educated farmer is more likely to have higher cotton production (Tables 8 and 10). Furthermore, the multiple comparisons (Table 9) for educational levels and cotton yield show that a farmer with primary education is more productive by average of 67.1 kg per acre compared to the one with no education. This supports the argument that in Tanzania, more educated farmers are more efficient in cotton production than less educated farmers.

V. Conclusion and Recommendations

The paper reveals that demographic characteristics of smallholder cotton farmers have significant effect on cotton productivity. Ranking the importance of the characteristics factors based on the f-test of the analyses of variance for cotton yield shows that zone is more important (f-value of 81.911), followed by age (f-value of 4.033) and education level (f-value of 2.124). Gender factor did not show any significant relationship in this aspect. According to Poulton and Maro (2009) the fertility of the soil is a crucial issue for the Tanzanian cotton farmer and that smallholder farmers are able to obtain tolerable yields of seed cotton with minimal capital investment because their soils continue to be fertilize. The literature indicated that soil of low fertility is a constraint, and that cotton requires adequate rains during planting, adequate season sunshine

and low humidity (Anderson, 2011). Coelli and Battese (1996) reported that youth were more technically efficient than older ones due their tendency of being active in agricultural activities and willingness to improve in farming knowledge.

The paper recommends that smallholder farmers venture in cotton production upon geographical zone considerations based on fertile soils, adequate rains particularly during planting season, adequate sunshine during plant growth and harvesting for increased cotton production. It also recommends that smallholder farmers strive to engage in cotton production at youth age through mid-age; attain higher education levels for cognitive attribution to handle modern agricultural complexities and achieve farming experience of not less than three years for increased cotton production.

Though the demographic profile of the main cotton growing districts of Western Tanzania cannot but be in alignment with the demographic profile of overall country and that of Africa as a whole, the findings of the study suggest that demographic factors have significant effect on cotton productivity, and that among them, the geographical zone at which farmers locate to cultivate cotton is more important compared to age, farming experience and education levels.

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AUTHOR'S PROFILE

George Francis Nangale graduated in BSc degree in agricultural engineering in 1988 at Sokoine University and later in MSc in energy and MBA both at the University of Reading and MPhil at Maastricht School of Management. He has acquired skills and experiences in engineering, policy issues; volunteerism; cotton procure--ment; investment management and media for over 30 ye--ars and written books on political philosophy and served as a Member of Parliament and President of Tanzania Red Cross. Eng. Nangale is a Doctor of Business Administration candidate at Maastricht School of Management, a social entrepreneur and a non-executive director in a number of public and private corporates in East Africa.