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SOCIO-ECONOMIC FACTORS AFFECTING SMALL-SCALE MAIZEPRODUCING FARMERS IN KAMHLUSHWA, SOUTH AFRICA

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ABSTRACT

Maize is the most significant grain crop produced throughout South Africa. Maize productionlevels in South Africa continue to decline, further deteriorating the situation of increased foodinsecurity, unemployment, and increased poverty levels in the face of increasing population.This article estimates the impact of socioeconomic variables on maize producing smallholder farmers in the Mpumalanga Province. Data was collected using a structured questionnaire that was administered face-to-face to respondents.Random sampling was adopted to select smallholder farmers for the study. Multiple regression model was used to analyse the determinant factors affecting maize production in the area. The results show that annual income, number of employees and farm size are significant determinants of maize production. The paperrecommends theimprovement of yields to make agriculture more efficient, profitable, and sustainable, particularly for smallholders.There is an urgent need to enhance agricultural intensification, increased yields, and alleviate poverty for communitiesin South Africa. Furthermore, South African agriculturalsector must be repositioned to foster local economic development, job creation, and enhance food security.

Keywords: Agriculture,farmers, maize, yield, production, socio-economic, contextual factors, determinants

INTRODUCTION

The agricultural sector plays a vital role in providing businesses with raw materials that build the backbone of any country through job creations, poverty reduction, food insecurity and contributes togross domestic product. South African statistics show the population living in poverty is 50% above in total to the country's population from 2006 to 2015 (Ormatjie, 2017). Furthermore, rural areas are the worst hit by poverty as households have a lower income to support and create opportunities to be independent (Statistics, 2003). This adds to the justification of households relying on agriculture as a means of living (Van den Berg, 2013). Maize is currently grown in many developing countries on almost 100 million hectares and is amongst the three most cultivatedcrop (FAOSTAT, 2010). In South Africa, maize is cultivated mainly in rain-fed farms for consumption, feed, and income covering approximately 90% of the total region.

Nonetheless, the world is experiencing rising demand for grain crops such as maize. It has been estimated that global agricultural production will have to increase by 60% or more by 2050. Some projections suggest a particularly high demand for maize over other cereal crops. To meet this increasing demand will require around 2.4% per year increase in yield. However, based on current performanceestimates,maize production is low by 1.6% which is well below the expected global average that is required. This average also conceals significant variations between regions. Whilst maize yield increases in Asia is generally high, in South America they vary between 1.7 and 4%. Variations in maize yield are most worrisome in Africa where some countries are facing decreases in annual yields amounting to over 7%. Currently yields in sub-Saharan Africa can be as low as 1.5 tons per hectare, a fifth of what is achieved by developed producers. Projections by the International Food Research Policy Institute (IFRI), using its International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT), suggest that grain crop yield in Sub-Saharan Africa may still be less than a third of the highest yields in East Asia by 2020. A recent Foresight Report by the UK government suggests a gap between potential and actual maize yields of over 60% for Sub-Saharan Africa.

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According to (Ortmann and King, 2006), maize is considered to be the field crop that South Africa produces and more especially by the poor, it is regarded as the staple food for most of the population of the country. This further justifies (Oduniyi, 2013) study that maize is not only commercially grown on a large scale, but also on small scale. According to Grain SA (2018) there are three main factors that are vital to maize farming, namely: profit, climate, and food. Maize is one of South Africa's leading field crops, followed by wheat, soybeans, and sunflower. According to (Economic review of South African agriculture 2017/18, 2018), the production volume of maize has decreased in 2016 and 2017 by 3.8 million tons and this is attributed to inadequate rainfall. It is the largest locally produced field crop and the most important source of carbohydrates for human and animal consumption in Southern Africa. South Africa is the main maize producer in Southern Africa, with an average production of approximately 10 to 12 million tons per annum over the past ten years.Deficiencies in productivity and rising input prices in global maize supplies have significant consequences for developing countries. In the past ten years, the maize price has doubled (Index Mundi 2010) along with other commodities. With food price increases, these changes would place difficulties on the vulnerable households.

Furthermore, the latent domestic production of maize would put a massive pressure on rural economies of developing countries. The decrease in local maize production willescalate maize imports from 5% to 24% by 2050, and this will amount to about USD 30 billion in import cost (Rosegrant *et al*. 2008). It is widely accepted that agricultural intensification needs to be achieved by improving yields rather than clearing more land for cultivation. Even in those areas where all suitable land is not already under cultivation, there is increasing competition for land use, water, labour, and other resources. The growing concern about the impact of deforestation on soil quality and fertility pose serious threat to maize production in South Africa. Nonetheless, South African agriculture is highly dualistic and characterised by a small number of commercial agricultural operations that are managed mainly by successful commercial farmers, withmanysmallholders' agricultural enterprises consisting mainly of black struggling farmers Department of Agriculture, Forestry and Fisheries ((DAFF), 2012). Smallholder farmers are confined to rural economic participation within the informal sector with a focus on primary agriculture, whereas commercial farmers are located within the formal economy with footprints along the agriculture and agro-processing value chain (Fan, Brzeska, & Halsema, 2013).Over the previous eighteen years, the South African government has adopted numerous policies and initiatives and extended its spending in favour of developing small scale farmers in agriculture (Forestry, Fishery and Farmers Agency, 2010; Frequin, Anseeuw and Da'Haese 2012; National Treasury, 2008 and Aliber & Hall 2012). To date, however, there is insufficient evidence of the effectiveness of such interventions (Aliber & Hall, 2012). The need to produce high-quality maize is in demand as the South African population is increasingly growing.
Small-scale farmers have big opportunity in assessing market if they can produce enough quality maize to generate more income and create more jobs (Statistics, 2003). Maize produced in South Africa is not only sold locally but also to foreign countries like Japan, Mozambique, Mexico, and Zimbabwe (DAFF, 2014). It is reported that most of the commercial farmers do not sell their yields locally but to foreign countries targeting high profits, which creates opportunities for small-scale farmers to sell their yields locally (Oduniyi, 2013). Although it is very difficult for their yields to meet the quality standard required by the market due to socio-economic problems, but maize production levels in South Africa continue to decline.The promotion of farming and the continued progress in farming, requiresan intervention at macroeconomic policy level throughout Sub-Saharan Africa(IOL, 2020). Many studies have shown efforts by researchers to identify socio-economic determinants influencing small-scale maize farmers around the world; this also includes South Africa as studies have been conducted in different provinces with different dynamics. Researchers pointed out the significant factors which include demographic, economic, and institution as contributors to the main determinants for small-scale maize production.This paper investigatessocio-economic determinants influencing maize yield in Kamhlushwa. The study is important because it will contribute to the body of knowledge in grain crop research with the aim ofincrease production of maize for successful economic development and poverty alleviation.

Contextual factorsinfluencing smallholder maize producers

Farmer education is perceived to have a positive impact on the farmer's probability of implementing a new technology. This is because farmers with good education are more open to information and ideas that are innovative, and thus have improved knowledge to accurately interpret and utilize the information available to them (Yoshikai, Reis and Mak, 1986).Low levels of literacy in the country impact indirectly on agriculture as new technical innovations and knowledge demands a certain degree of formal education and training (Van den Berg, 2013). Sustainable agricultural management methods are expected to be followed by farmers with a higher degree of formal education. Enlightened farmerscanunderstand and respond to new knowledge of improving farming practices far more quickly than their peers without any formal training or education. The capacity of farmers to evaluate the most viable variety of crops was also found to be dependent on their

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educational level. Farmers that are not educated usually lack knowledge on agricultural technology. This is particularly because they are not aware of where to search for information and, at the same time, they are unable to comprehend and interpret accordingly, even though they get the information.

Furthermore, (Njogu, 2019)posited that young farmers seem to be more capable of adopting modern maize processing technologies than older farmers because of the education they have received andtheir approach to transition. In addition, past scholars proposed that higher education would contribute to improved competitiveness in production amongst developed nations, where modern and increasingly complex innovations are present and more likely to pose a challenge to traditional agricultural production. Thus the training to increase the capacity of farmers to distribute choices efficiently and optimally is needed in the present circumstance(Jones *et al.*, 2017).

Farm experiencemay have negative consequences as demonstrated that smallholder growers were more likely to take part in agro-processing due to their number of years in farming. However, as alluded by Issa and Abdulkadir, (2017)farm experience has no effect on the degree of contributions madearoundagro-processing.Older farmers are likely to have a high crop yield with improved farming experience.The experience of farmer raises the chance of increase agricultural production, as more experienced farmers understands the inter-play between production and labour intensive activities at farm level(Aakash, 2019).Household income is also noted as having a major impact on participatingin farming. Results by (Paudel, Shrestha and Matsuoka, 2009) found that farmers with higher income utilises more sophisticated equipment to boost production output.In small-scale agriculture, family labour is significant (Paudel, Shrestha and Matsuoka, 2009b), as most households use members of their family to augment farm labour.Size of the farmland and production of maize have been positive, and contributing to higher yield (Ali-Olubandwa *et al.*, 2011), withgood return on farm investment(Eastwood, Lipton and Newell, 2010).

METHOD

This research was carried out in the central Kamhlushwapositioned in the eastern area of Ehlanzeni district in Mpumalanga, South Africa (figure1). One of the significant reasons behind the choice of the study area is that the Kamhlushwahas been known for growing maize and variety of agricultural products. Additionally, Kamhlushwa as the study area, has sufficient fertile land that suits maize production.

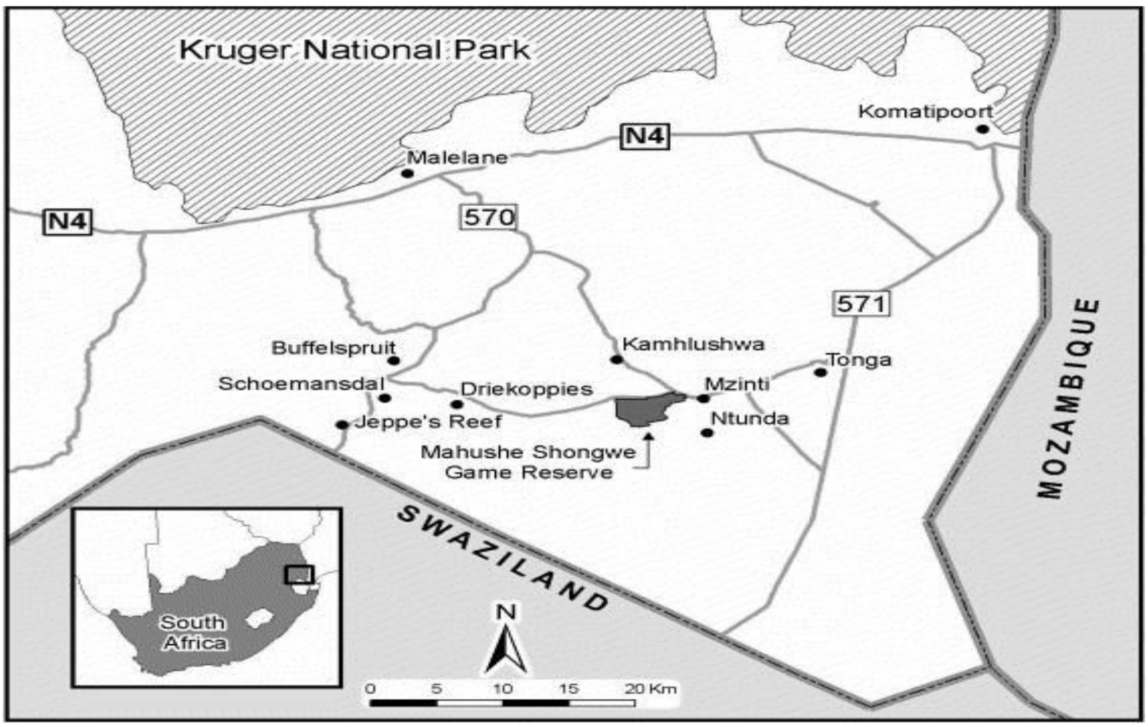

Figure 1: Nkomazi Municipality Map

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Sampling Procedure

According to Fowler (1995), simple random sampling is a technique used to select respondents from a sample size solely based on chance. This study made use of a simple random sampling procedure to select individual farmers; With the help of a list of the population of farmers obtained from an extension agent inthe area.Participants were selected randomly from the sample frame to arrive at a determinate sample size of 100 Smallholder farmers.

Data collection and analysis

The questionnaire covered the socio-economic demographic attributes (age, gender, level of income, educational level, occupation, and farm experience) of the farmers. For respondents that do not understand English language, an enumeratorwas assigned to facilitate communication. Multiple regression technique was applied in the analysis. Multiple regressions are not only a single technique, but also a conglomerate of techniques, whichwas used to explore the relation between one continuous variable and several independent predictor variables in this study.This approach demonstrates how much variation on the dependent variable can be attributed to the independent variables.

The multiple regression equation explained above takes the following form:

$Y = b_1x_1 + b_2x_2 + \ldots + b_nx_n + c.$

RESULTS AND DISCUSSION

Table 1: Demographics of Respondents

Variable (N=100)		%
Gender	Male	57.4
	Female	42.6
Age	≤40Years	10.9
	41-50years	22.8
	51-60years	41.6
	≥ 60Years	24.8
Level of Education	No Formal Education	21.8
	Primary School	17.8
	Secondary School	25.8
	Tertiary Education	34.7
Total		100.0

Table 1 show that out of 100 smallholder farmers from Kamhlushwa, men were in the majority (58%) than the overall participation of females which is 42%. This signals that there were more males involved in maize production within the area than the females.This aligns with a study by (Akerele and Akinleye, 2010) which indicated that 88% of respondents involved in maize production were males. Most of the farmers were below 40 years (11%), while those who are between 40-50 years was 23%, from 50-60 years was 42% and respondents with aged60years and above was 24%. This suggests that younger and middle age group from Kamhlushwa were not much involved in maize production. The age group (50-60years) showed a dominant participation in Maize farming within the area. This also aligns with the study done by (Aakash, 2019), where by the dominant farmers were 40 years above. Therespondent with no formal education is about 22%, while primary education is about 18%. Secondary and tertiary education showed 25% and 35% respectively. Hence, a larger percentage of 60 % combined for farmers had either secondary education.

Table 3: Correlations on the determinants of maize production

		Maize Yield per/ha	Education Index Score	Farm Experience	Annual Income	Number of Employees	Farm Size (ha)
Pearson Correlation	Maize Yield per/ha	1.000	.117	.158	.613	.740	.790
	Education Index Score	.117	1.000	-.325	.431	.125	.160
	Farm Experience	.158	-.325	1.000	.037	.200	.181

	Annual Income	.613	.431	.037	1.000	.544	.577
	Number of Employees	.740	.125	.200	.544	1.000	.738
	Farm Size (ha)	.790	.160	.181	.577	.738	1.000
Sig. (1-tailed)	Maize Yield per/ha	.	.124	.059	.000	.000	.000
	Education Index Score	.124	.	.000	.000	.107	.056
	Farm Experience	.059	.000	.	.356	.023	.035
	Annual Income	.000	.000	.356	.	.000	.000
	Number of Employees	.000	.107	.023	.000	.	.000
	Farm Size (ha)	.000	.056	.035	.000	.000	.

Multiple Regression Assumptions

The correlations between the variables in the model are provided in table 3. In this case, all the independent variables (Education, Farm Experience, Income, Number of Employees and Farm Size) correlate substantially with maize yield. Also, the correlation between each of our independent variables is not too high. Tabachnick and Fidell (2001) suggest that including two variables with a bivariate correlation of, say 0.7 or more in the same analysis' would produce problems with results validity. This is not the case in our analysis; therefore all variables were retained in the equation.

We performed 'collinearity diagnostics' on our variables as part of the multiple regression procedure. This can pick up problems with multicollinearity that may not be evident in the correlation matrix. The results are presented in table 4. Two values are given: Tolerance and VIF. Tolerance is an indicator of how much of the variability of the specified independent is not explained by the other independent variables in the model and is calculated using the formula *1–R2* for each variable. If this value is very small (less than .10), it indicates that the multiple correlation with other variables is high, suggesting the possibility of multicollinearity. The other value given is the VIF (Variance inflation factor), which is just the inverse of the Tolerance value (1 divided by Tolerance). VIF values above 10 would be a concern here, indicating multicollinearity (Extracted and adapted from a table in Tabachnick and Fidell (1996). In this analysis the tolerance value for each independent variable is not less than .10; therefore, we have not violated the multicollinearity assumption. This is also supported by the VIF values, which are well belowthe cut-off of 10. These results are not surprising, given that the Pearson's correlation coefficient between these independent variables were on a satisfactory level.

In the model summary box, the value given under the heading adjusted R^2 gave an indication of the strength of the model. This shows how much of the variance in the dependent variable (maize yield) is explained by the model (which includes the variables of Education, Farm Experience, Income, Number of Employees and Farm Size). The Adjusted R^2 statistic corrects the R value to provide a better estimate of the true population value. In this case, the value is 0 .692, expressed as a percentage, this means that our model explains 69.2 per cent of the variance in maize yield. This is quite a respectable result particularly when it is compared to some other results.

Table 4: Model Summary & ANOVA[a]

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.841[a]	.707	.692	145.768	1.373

ANOVA[a]

Model	Sum of	Df	Mean Square	F	Sig.

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	Squares				
Regression	4826745.795	5	965349.159	45.432	.000[b]
Residual	1997353.205	94	21248.438		
Total	6824099.000	99			

To assess the statistical significance of the result, it is necessary to look in table 4(ANOVA). This tests the null hypothesis that multiple R in the population equals 0. The model in this instance reaches statistical significance (Sig = .000, means p<.0005).

Table 5: Coefficients of the determinants of maize production

	Unstandardized Coefficients		Standardised				
Model	B	Std. Error	Beta	Part	Sig.	Lower Bound	Upper Bound
(Constant)	42.291	73.690			.567	-188.604	104.022
Education Index Score	4.657	3.027	-.103	.086	.127	-10.668	1.354
Farm Experience	2.898	6.693	.027	.024	.666	-16.187	10.392
Annual Income	.002	.001	.233	.168	.003	.001	.003
Number of Employees	32.734	9.638	.290	.190	.001	13.599	51.870
Farm Size (ha)	47.388	8.939	.463	.296	.000	29.639	65.138

Observing the Beta column, we check for the beta value that is the largest (ignoring any negative signs out the front). In this case, the largest beta coefficient is 0.463, which is for Farm Size. This means that this variable makes the strongest unique contribution to explaining the dependent variable, when the variance explained by all other variables in the model is controlled. The Beta value for Number of Employees was slightly lower (0.290), indicating that it made less of a contribution. Annual Income (0.233), Farm Experience (0.027) and Education Score (0.103) made lesser contributions to the outcome of maize yield, respectively.

For each of these variables, we checked Significance Level, to determine, which variable is making a statistically significant *unique* contribution to the equation. This is very dependent on which variables are included in the equation, and how much overlap there is among the independent variables. If the Significance value is less than 0.05 (0.01, 0.0001, etc.), then the variable is making a significant unique contribution to the prediction of the dependent variable. If greater than .05, that variable is not making a significant unique contribution to the prediction of our dependent variable. This may be due to overlap with other independent variables in the model. In this case, Farm Size, Number of Employees and Annual Income showed significance of 0.000; 0.001; and 0.003, respectively. Thus, we conclude that the three variables made a unique, and statistically significant, contribution to the prediction of maize yield.The other potentially useful piece of information in the coefficients table is the *Part* correlation coefficients (Tabachnick and Fidell, 2001). Squaring the value gives us an indication of the contribution of that variable to the total R squared. In other words, it suggests how much of the total variance in the dependent variable is uniquely explained by that variable and how much R squared would drop if it were not included in your model. In our analysis, Farm Size has a part correlation coefficient of 0.296. If we square this (multiply it by itself) we get .08, indicating that Farm Size uniquely explains 8% of the variance in maize yield. For the Number of Employees gives a value of 0.190, which squared gives us 0.036, indicating a unique contribution of 3.7 per cent to the explanation of variance in maize yields.

Note that the total R^2 squared value for the model (in this case 0.707, or 70 %-explained variance) does not equal all the squared *Part* correlation values added up (0.08 + .036 + 0.02 + 0.00057 + 0.0073 = 0.14387). This is because the *Part* correlation values represent only the unique contribution of each variable, with any overlap or shared variance removed. The total R squared value, however, includes the unique variance explained by each variable shared. In this case theindependent variables are reasonably correlated; therefore, there is a lot of shared variances that is statistically removed when they are both included in the model. The beta values obtained in this analysis can also be used for other more practical purposes than the theoretical model testing shown here. Standardised beta values indicate the number of standard deviations that scores in the dependent variable would change if there was a one standard deviation unit change in the predictor.

Table 5show that the farm size made the strongest contribution that is unique in describing the dependent variable. This is similar to the report by (Ali-Olubandwa *et al.*, 2011), who found that farm size is important because it estimates how much yield a farmer can realizein a cropping season. This result on farm size,is supported by the study of Agholor (2021), who found that farm size was significant and positively related to adoption of integrated pest management. The study also noted that the size of farmland was noted by smallholder farmers as surrogate for wealth. However, a report by (Eastwood, Lipton and Newell, 2010), foundthat smallholder farmers with small farm size are likely to obtain decreased yields than those with larger farm size.Number of employees had a slightly lesser contribution compared to the variable farm size, which implies that it resulted to a less strong contribution in describing the dependent variable. A research by(Kaliba, Verkuijl and Mwangi, 2000), is also consistent with the same result. Thus, skill and number of employees might result to higher contribution to maize production, although it might results to higher costs which most smallholder farmers cannot not afford (Oyewo *et al.*, 2009).Annual income, farm experience, and education recorded lesser contributions to maize yield, respectively.

Conclusion

The study examined the socio-economic factors affecting small-scale maize producers in Kamhlushwa, South Africa. The result from the studyshows that the socio-economic determinants -educational levels, the size of the farm,farm experience, annual income, and number of employees are positive and significant variables which influenced maize production. The South African agriculture sector continues to play a significant role in local economic development and provide sustainable livelihoods for most communities.The GDP contribution from agriculture cannot be over-emphasised. Therefore,there is a need to enhance agricultural intensification, increasedyields, and alleviate poverty for communitiesin Sub-Saharan Africa. Furthermore, South African agriculturalsector must be repositioned to foster local economic development, job creation, and enhance food security.

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