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Factors influencing access to agro-processing training for small-scale crop farmers in Gauteng province of South Africa

Danisile Leonah Mthombeni*, Michael Akwasi Antwi and Oluwaseun Samuel Oduniyi

Abstract

Background: The agricultural economy has little room for emerging farmers and there is no strong support system available for the small-scale farmers venturing in agro-processing. In this study, "access to agro-processing training" refers to any processing training rendered to small-scale crop farmers to equip them when venturing in to agro-processing. Small-scale crop farmers trained with high knowledge in processing and skills are pre-disposed to adopting processing as a strategy of making their processed products penetrate the agro-processing market.

Methodology: Data were collected from 307 small-scale crop farmers and STATA version 15 was used to perform fractional regression analyses to determine factors influencing access to training from the five types of agro-processing training (marketing training, processing training, record-keeping training, financial management training and business-plan training).

Results: The results revealed that 26% of the small-scale crop farmers had no access to agro-processing training and 74% of the small-scale crop farmers had access to training. Farming experience had significant influence on the access to agro-processing training for small-scale farmers to function efficiently in the agro-processing industry at 5% level of significance and their coefficient was positive.

Conclusion: Small-scale crop farmers with less farming experience should be encouraged to participate in the agro-processing sector as their participation can result in improved income and food security at the household levels. Furthermore, new agro-processing training programmes should be encouraged as trained farmers are more likely to participate in the value addition activities of agro-processing.

Keywords: Value addition, Agro-processing, Farmers' training, Small-scale farmers, Fractional regression

Background

Encouraging and expanding agro-processing activities of small-scale farming entrepreneurs is not only propelled by developmental objectives but also the changing food consumption taste and preference patterns. These patterns emanate from population growth and increased urbanisation coupled with growth in the middle-class population whose food patterns are skewed towards quality processed food that is convenient [1, 2]. The small-scale agro-processing industries need to be promoted besides medium and large agro-processing industries. Also, they need to improve efficiency and quality by upgrading the agro-processing skills, better product design, more efficient use of materials and improve marketing organisations [3]. In this study, the phrase "agro-processing" is interchanged with "value addition".

The Southern African agricultural economy has little room for emerging farmers and there is no strong support system available for the small-scale farmers

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venturing into agro-processing [4]. In addition, training refers to all agro-processing training that government and NGOs provide to small-scale crop farmers and agro-processors participating in agro-processing activities. The participation of smallholder agro-processing in agro-processing could relate to the restoration of rural poor economic development [5]. The production in agro-processing activities depends on the relationship between farmers, labour and machineries as an input that can be affected by other factors such as education, experience, skills, training, age and gender of the farmer. According to [6] there was a correlation between the decision to participate in agro-processing and the age of the farmer, meaning that when the age of the farmer increases up to a certain age, he or she is more likely to increase the level of participation in agro-processing.

The rural population need to be actively involved in agro-processing and by so doing they will benefit directly from processing operations ensuring food security [7]. Agro-processing provides sustainable economic growth, poverty reduction and food security [8]. According to [9] agro-processing increases food security by promoting reduction of food spoilage and wastage and agro-processed foods encounter higher price stability on the global market and may therefore likely to have increase market opportunities for exports, contributing to income securities particularly in rural communities, which are often engaged in farming.

Most small-scale agro-processors have no formal training on good processing practices. They acquire knowledge and skills in processing from friends or parents who had been processing agricultural products [10]. According to [11] successful development of agro-processing as a beneficiation strategy also requires a thorough alignment of skills, competencies and resources with the needed production to trigger the shift from primary production to the industrial processing of primary products. Access to agro-processing training encourages farmers to participate in agro-processing industries [6]. Agro-processing or processing training in food processing techniques, food safety and quality, food packaging and labelling is beneficial as it enhances work skills [12]. Furthermore, training helps processors to produce products of better quality and improves their business management and marketing skills.

Large agro-processors are the main suppliers for supermarkets and small farmers need to be trained and organised to meet the challenges of supplying those supermarkets and international players [13]. According to [10] when small-scale processors are supported through training and efficient processing equipment, they produce good quality processed products that meet the demand of the industry. Although there are some institutions that provide support to the agro-processors, it is not known whether the agro-processors are aware of their existence and how useful these institutions are to them [12]. Agro-processing training have increased the knowledge and skills of the farmer, which increased the likelihood of the farmers to participate in agro-processing [14]. Lack of formal training can act as a barrier against confidence in marketing agro-processed products even though the quality could be good [4]. According to [15] the transfer of information and knowledge to small-scale farmers (some of whom are illiterate) working in diverse settings and remote locations is very challenging task. The traditional models of transferring knowledge are largely based on extension activities and agricultural cooperatives.

The objective of this study is to determine factors influencing proportion of agro-processing training receive by the small-scale crop farmers to function efficiently in the agro-processing industry. Despite all the information available on how training in agro-processing can ensure value adding to processed products and increasing demand for agricultural produce, limited information exists about the factors influencing access to training in agro-processing of the small-scale farmers. The aim of this paper is to report on the factors influencing access to agro-processing training for small-scale crop farmers. This will enable farmers to identify various factors that influence small-scale crop farmers' access to training.

Materials and methods

Study area

The study was conducted in the Gauteng Province of South Africa. It has the largest population of all the provinces in South Africa, with 11.2 million people making up 22.4% of South Africa's total population. It is the smallest of South Africa's nine provinces at 17,010 square kilometres, which takes up 1.4% of the country's land area. With a gross domestic product (GDP) valued at R811 billion, Gauteng generates 33.9% of South Africa's GDP and 10% of the total GDP of the entire African continent (Fig. 1).

Sampling technique and data collection

There were 966 small-scale farmers in the Gauteng province according to the list obtained from the Gauteng Department of Agriculture and Rural Development (GDARD) in 2017. These farmers were involved in different farming enterprises at different scales, such as animal production, mixed farming, fruit production and vegetable production. According to [4] most of the agro-processing firms are based in Gauteng. The most common farming enterprise practised in the Gauteng Province is crop production. Investigating the extent of smallholder farmers' participation in Gauteng may give

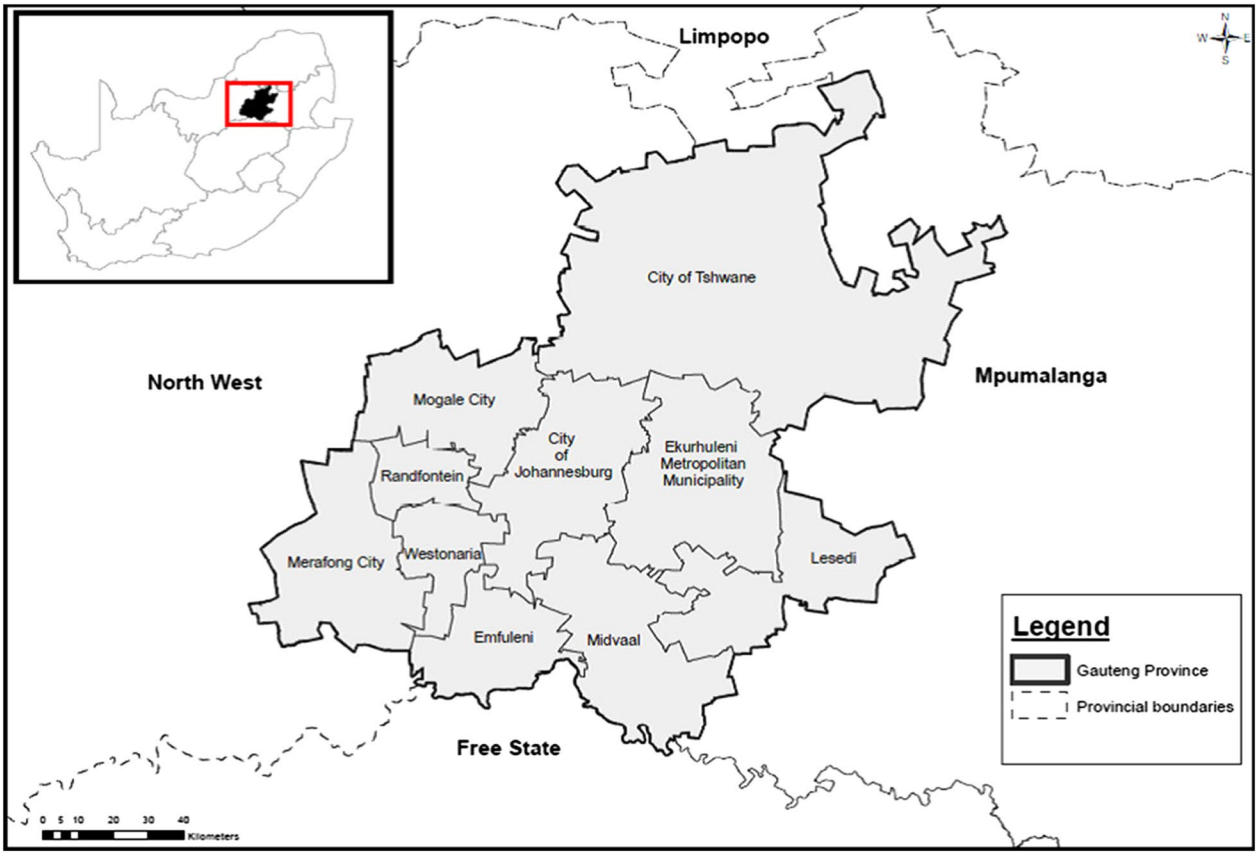

Fig. 1 Gauteng province by district municipalities [30]

a good picture of whether smallholder farmers are integrated into the agro-processing sector and are playing a meaningful role in agro-processing industries.

This study concentrated only on small-scale crop farmers. Therefore, purposive sampling was used to select 500 small-scale crop farmers from the GDARD database, who were only involved in the production of crops, including citrus, ground nuts, grain and vegetables as the sample pool. From the sample pool, a random sampling technique was used to select 307 small-scale crop farmers as the sample size for this study. Random sampling was used to eliminate any bias and to give all participants an equal chance to participate in the study. This was done by selecting any names of farmers on the GDARD list with no order. The study followed a method of determining a sample size by [16] revised by [17] which states that in a population of 500, a sample of at least 217 participants or above can ensure the reliability of the data collected. In this study, 307 questionnaires were used to collect data from small-scale crop farmers in the five district municipalities of Gauteng and captured for data analysis. Proportionate sample technique was used to determine the samples for each of the five study areas: City of Johannesburg Metropolitan Municipality (JHB) = (119/5000) × 307 = 73, City of Tshwane Metropolitan Municipality(CTM) = (69/5000) × 307 = 42, Ekurhuleni Metropolitan Municipality (EM) = (71/5000) × 307 = 44, Sedibeng District Municipality (SD) = (196/5000) × 307 = 120 and West Rand District Municipality (WRD) = (45/85000) × 307 = 28.

A semi-structured questionnaire was used to collect the data, which included the background characteristics of small-scale farmers, their level of participation in agro-processing and their access to agro-processing training they received. A team of three researchers administered the questionnaires through face-to-face interviews with the farmers.

Data analysis

Data were coded according to the different variables in Table 2. It were captured using STATA version 15 and then analysed. Descriptive statistics (the percentage frequencies in particular) were used to analyse the number of agro-processing training attended by the farmers in the last period of 10 years (2009–2019). Following [18] the fractional regression model was used to determine

the factors influencing access to agro-processing training for small-scale farmers to function efficiently in the agro-processing industry. According to [19], this model requires the assumption of a functional form that imposes the desired constraints on the conditional mean of the dependent variable. It captures particular nonlinear relationships, especially when the outcome variable is near zero or one.

This approach was applied to data according to different types of agro-processing training that the small-scale crop farmers had access to. The types of training were marketing training, processing training, record-keeping training, financial management training and business-plan training. A training index was generated from the available training as mentioned. The index is a proportion that is naturally a fraction bounded between zero and one. The assumed covariates affecting the proportion or number of training opportunities received out of the total available are municipality, age, gender, educational level and farming experience.

The model is expressed as follows:

The proportion of agro-processing training available used by a farmer $E(y \mid x)$ is given by

$$E\,y|x = G(x\theta), \tag{1}$$

where y represents the dependent variable; x is the explanatory variables; θ is a vector of parameters.

$G(.)$ is a cumulative distribution function of the standard normal distribution, which takes several forms such as the probit—$G(x\theta) \equiv \Phi(x\theta)$ or log—$G(x\theta) \equiv e^{-ex\theta}$ functions [20].

Equation (1) can be estimated using a quasi-maximum likelihood method (QML), as suggested by [21, 22] on the Bernoulli log-likelihood function:

$$\mathrm{LL_i} = y_i \log[G(x_i\theta)] + (1-y_i)\log[1 - G(x_i\theta)]. \tag{2}$$

The marginal effects of the functional forms for the distribution of $G(.)$ are given by

$$g(x\theta) = \frac{\partial \mathrm{G}(x\theta)}{\partial x\theta}. \tag{3}$$

The outputs of the model are presented in Table 5 in the results and discussion section.

Results and discussion

Results were presented in the form of tables. Descriptive statistics, model fitness, correlation and significance of the variables were discussed.

The results in Table 1 show that small-scale crop farmers who did not receive any agro-processing training amounted to 26%. The results reveals that out of the five different agro-processing training opportunities offered to the small-scale crop farmers, 15.6% received marketing training, 5.2% received processing training, 3.3% (which are the minority) received record-keeping training and 15% received financial (including how to apply for grants and loans) training. The majority of the small-scale crop farmers, 34.9%, received business planning training. In a study conducted by [4] training in agro-processing was classified into three levels, namely manufacturers, distributors and end-user training offered to farmers or entrepreneurs. The training included solar drying of fruit and vegetables, technical and business skills, entrepreneurship, financial access and management. Agronomic training, nutrition training including processing, and then training on marketing were the types of training offered to small-scale farmers for agro-processing purposes [23]. Very few small- and medium-scale agro-processors have received formal training in food processing techniques. Therefore, most small- and medium-scale agro-processors failed to keep abreast of current technological developments in agro-processing and their capacity in technical training and advisory services is limited [4]. Furthermore, [23] reported that most production training in agro-processing was implemented practically in demonstration plots of the small- and medium-scale agro-processors and fewer numbers of women participated in agronomic training (the class/theoretical component). Many of the participants attended field days and learnt by doing and learning from other farmers.

Table 1 Agro-processing training attended by the farmers

No. of training	Frequency	Percentage
0 (No training)	80	26
1 (Marketing training)	40	15.6
2 (Processing training)	16	5.2
3 (Record-keeping training)	10	3.3
4 (Financial training)	46	15
5 (Business plan training)	107	34.9
Total	307	100

The results of descriptive statistics in Table 2 show the means and the standard deviation of the variables. The means shows age, farming experience, municipality and educational level to be the most important variables affecting the access of agro-processing training. These variables had the highest means, namely 2.954, 2.674, 2.671 and 2.264, respectively.

The correlation coefficient shows the relationship of variables measured by values from −1 to 1, where 1 indicates the strongest possible correlation, −1 indicates the strongest possible inverse correlation and 0

Table 2 Descriptive statistics for training index

Variable	Variable measurement	Mean	Standard deviation
Training index	Continues	0.540	0.424
Municipality	JHB Municipality = 1; CTM Municipality = 2; EM Municipality = 3; SD Municipality = 4; WRD Municipality = 5	2.671	1.464
Gender	Male = 1, female = 0	0.472	0.500
Age	Number of years (continues)	2.954	1.105
Educational level	1 = Primary;2 = secondary; 3 = Tertiary; 4 = informal; 5 = Other	2.264	0.791
Farming experience	Number of years (continues)	2.674	0.962

indicates no correlation at all. Table 3 shows that the small-scale crop farmers with less farming experience are associated with less agro-processing training received. The location of the small-scale crop farmers in terms of municipality positively correlates with the farming experience of the small-scale crop farmers. The age of the small-scale crop farmers in terms of years negatively correlate with the gender (males) of the small-scale crop farmers. Again, the gender of the small-scale crop farmers (males) negatively correlates with the farming experience of the small-scale crop farmers. Agro-processing and farming activities stand out as activities that are mainly engage by women [10, 24]. The inequality that exists in accessing agro-processing training in terms of government funding and training between males and females determines how gender will influence the access to agro-processing training by government and NGOs. According to [25], women generally constitute a highest percentage for agricultural productivity and increase economic supports compared to their counterpart who discard farming work and other associated non-agricultural activities in agribusiness to seek white collar jobs in the cities. The age of the small-scale crop farmers negatively correlates with the educational level of the small-scale crop farmers. According to [26], elderly farmers look at farming as just a way of life while young farmers accept it as a business opportunity for family sustenance. Hence, as the young farmers are business- and profit-oriented and are likely to engage in agro-processing, they also accepted the use of technology and equipment in agro-processing as opposed to older farmers. Therefore, it is expected that the coefficient of the variable age will have a negative sign. Again, a study conducted by [6] stated that the younger age group is the target group for competitiveness in the agro-processing industry as they were able to acquire more business technique.

Table 4 reveals that a likelihood ratio Chi-square test is significant at 0.0099. The fractional regression model used to determine the factors influencing access to agro-processing training for small-scale farmers to function efficiently in the agro-processing industry was considered an appropriate technique for further analysis to estimate and compare the set of predictors. Based on the pseudo, R-square contains predictors 2.38% relative to model fit.

Table 5 determines which of the independent variables significantly influence training. The results show that farming experience of the small-scale crop farmers was observed to have a significant influence at ($p < 0.05$) with a positive coefficient. This implies that the small-scale crop farmers with more farming experience in years were more likely to receive more agro-processing training. A study conducted by [27] revealed that an average farming experience of the farmers involved in cassava-based agro-processing was 23.03 years. This indicates that the farmers were not new entrants in the agro-processing business. Smallholder farmers with more farming experience are more likely to participate in agro-processing [6, 28] because farmers with more farming experience are

Table 4 Likelihood ratio Chi-square test

Likelihood ratio Chi-square test	Prob > Chi-square	0.0099
	Pseudo-R-square	0.0238

Table 3 Correlation matrix (Pearson)

Variables	Training index	Municipality	Gender	Age	Educational level	Farming experience
Training index	1	0.024	− 0.033	− 0.028	0.112	− 0.175
Municipality	0.024	1	− 0.037	− 0.102	− 0.024	0.142
Gender	− 0.033	− 0.037	1	− 0.150	0.089	− 0.168
Age	− 0.028	− 0.102	− 0.150	1	− 0.394	0.097
Educational level	0.112	− 0.024	0.089	− 0.394	1	− 0.088
Farming experience	− 0.175	0.142	− 0.168	0.097	− 0.088	1

Table 5 Fractional regression model analysis

Training index	Coefficients	Std Err	*Z*	*p* > (*Z*)
Gender	0.121	− 1.22	0.224	− 0.384
Age	0.020	0.056	0.360	0.718
Educational level	0.152	0.083	1.810	0.070
Farming experience	0.200	0.071	− 2.790	0.005**
Constant	0.303	0.350	0.870	0.386
Variables	**dy/dx**	**Std Err**	***Z***	***p*** **> (*Z*)**
Gender	0.057	0.047	− 1.220	0.222
Age	0.021	0.021	0.360	0.718
Educational level	0.032	0.032	1.840	0.067
Farming experience	0.027	0.027	− 2.890	0.004**
Constant	0.024	0.024	22.90	0.000

***$p < 0.001 = 1\%$, **$p < 0.05 = 5\%$; *$p < 0.10 = 10\%$; $N = 307$

more likely to receive the agro-processing training and may have more knowledge about the benefits of agro-processing. They might also have previously experienced or witnessed losses of physical/raw products due to lack of processing. Kipene et al. [29] reported that farming experience of above 3 years had a positive significant effect on labour productivity for small agro-processors, where 1% increases in experience increased productivity by 0.55%.

Conclusion and recommendations

Regarding access to agro-processing training, 26% of the small-scale crop farmers had no access to training and 74% had agro-processing training in marketing, processing, record keeping, financial management and business planning. This implies that small-scale crop farmers have access to training in agro-processing and are interested in participating in different types of training to improve their agro-processing skills. Considering that farming experience have a significant influence on accessing agro-processing training, it implies that the small-scale crop farmers with more farming experience in years were more likely to receive more agro-processing training. Evidence from the study shows that there is a need for continuous support in training to experienced farmers as they can access training in agro-processing more so than the small-scale crop farmers with less experience. Furthermore, more agricultural training programmes should be stimulated to train more small-scale crop farmers. This will allow these farmers to match the skills of their educated and trained farmers who understand and accept new processing technology for sustainable agricultural production. There is also a need for the government to increase financial assistance and credit programmes for the small-scale farmers as access to credit is important for agricultural development. The findings in this study are applicable in developing countries where small-scale farmers contribute significantly to national food security. In addition, the agro-processing training is important for value addition, reduction of post-harvest losses and income generation.

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Consent for publication
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Competing interests
The authors declare that they have no competing interests.

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