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IMPACT AND SUSTAINABILITY OF AGRICULTURAL TRAINING IN GAUTENG PROVINCE, SOUTH AFRICA: A KIRKPATRICK EVALUATION MODEL

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ABSTRACT

Agricultural training plays a strategic role in improving the competitiveness and productivity of the agricultural sector. Hence, households need training to obtain good agricultural production and produce good agricultural products. This study aimed at identifying and assessing the impact of agricultural training in Gauteng Province in South Africa. The specific objectives were first to pinpoint and describe the socio-economic characteristics of the households, second, to assess and identify the factors contributing to the sustainability of agricultural training. A representative sample consisted of 1089 households spread within the following Districts and Metropolitans: Tshwane Metropolitan (270); Johannesburg Metropolitan (319); Ekurhuleni Metropolitan (141); Sedibeng District (216) and West Rand (204). The quantitative and qualitative designs were used for a detailed questionnaire written in English. Stakeholder discussion and field observations were also part of the data collection. Furthermore, the sustainability methodology and training evaluation model of Donald Kirkpatrick were used to identify the impact of the training on households. A purposive sampling technique was used to select 1089 households. Data were analyzed with the software Statistical Package for Social Sciences (SPSS version 24) and Descriptive and Univariate analyses were conducted. The results identified the following agricultural training challenges: Soil preparation, Seed sowing, Pests and diseases, Marketing, Harvesting, Transplanting and post-harvest storage. The Univariate analysis showed a high level of positive association among Pests and Diseases (Dependent variable) and the following Independent variables: Water source, Crops planted, Land size, Education and Farming experience. In addition, the analysis also found that most households were not economically sustainable and they increased their knowledge and skills in training and their attitude changed after the training. It is thus concluded and recommended that the transfer of agricultural knowledge to support households should be a priority for the government, especially the seven training challenges.

Keywords: *Homestead food gardens, Households, Kirkpatrick training Evaluation model, Gauteng Province, South Africa.*

INTRODUCTION

Smallholder and subsistence farmers play a crucial role in addressing food security and poverty alleviation (Dioula *et al.*, 2013). Furthermore, Salami *et al.*, (2010) defined smallholder farmers as "farmers with a plot size of less than five hectors and grow subsistence crops with the aim of tackling poverty and economic issues". In addition, Maponya *et al.* (2014) emphasized that some of the smallholder and subsistence farmers' production and training constraints include soil preparation, marketing, Pest and Diseases, storage and handling, transplanting, sowing and irrigation. According to Maponya *et al.*, (2015), designing this kind of trainings is a complex challenge, and it requires detailed local knowledge and a proper understanding of the challenges faced by smallholder farmers as agricultural training plays a strategic role in improving competitiveness and productivity of the agricultural sector. Hence, households need training to obtain good agricultural production and produce good agricultural products. This will go a long way in designing programmes that effectively target smallholder farmers training needs.

In addition, training impact can be determined by the Kirkpatrick model, also known as Kirkpatrick's Four Levels of Training Evaluation (Kirkpatrick and Kirkpatrick, 2006). This is a key tool for evaluating the efficacy of training within an organization and is globally recognized as one of the most effective evaluations of training. The Kirkpatrick model consists of 4 levels, namely (1) reaction, learning, behaviour and results (Kirkpatrick and Kirkpatrick, 2006). It can be used to evaluate either formal or informal learning and can be used with any style of training.

The term sustainability can be divided into three: (i) economic, (ii) environmental, and (iii) social (ATTRA, 2003). Firstly, the economic components consist of the yield increase, food safety and quality, farm diversity and market information. Secondly, the environmental component takes in soil fertility, water, energy, biodiversity and waste. Lastly, social components embrace human capital and local community (SAI, 2009).

This study aimed at identifying and assessing the impact of agricultural training in Gauteng Province in South Africa. The specific objectives were first to pinpoint and describe the socio-economic characteristics of the households, second, to assess and identify the factors contributing to the sustainability of agricultural training.

MATERIAL AND METHODS

Study Area

The research focused on the Gauteng Province and consisted of 1089 households spread across the following Districts and Metropolitans: Tshwane Metropolitan (270), Johannesburg Metropolitan (319), Ekurhuleni Metropolitan (141), Sedibeng District (216) and West Rand (204).

Study Design

The research employed both qualitative and quantitative methods concurrently and this was applied with the aim of making sure that one-type limitations of the data is extremely balanced through strengths of the other. Integrating different ways of

knowledge ensured improved understanding. Households were interviewed in such a way to assess the type of vegetables they prefer to grow, the type of soil, and if the soil is suitable for the preferred planted crops. Data collection methods were via interviews, site observations, focus groups, past researches, web and governmental reports. Pre- and post-intervention questionnaires were developed and pilot tested with researchers working on community development within the Agricultural Research Council (ARC) organization.

Sampling Procedure and Analytical Technique

Purposive and snowball sampling techniques were used on selected 1089 households from the Districts and Metropolitans within Gauteng Province. The list of 8800 households were supplied by the Gauteng Department of Agriculture and Rural Development (GDARD) and the research sample size was agreed with the stakeholders. A rule of thumb was applied, which is the minimum selection of 10% of the population and it is considered as a good sample size. Data collected was analysed quantitatively using the Statistical Package for Social Sciences (SPSS) Windows version 25. Descriptive and univariate analysis were done.

Sustainability Concept

The sustainability concept promotes meeting the needs of the present without compromising the ability of future generations to meet their own needs. The concept stands on three pillars namely: environmental, economic, and social sustainability.

Kirkpatrick's Training Evaluation Model

Kirkpatrick's Training Evaluation models allowed the assessment of training impact as follows: (1) Reaction: The trainee's impression of the administration; (2) Learning: The acquisition of knowledge, skills and attitudes (KSA) from the training; (3) Application: The performance of the trainee on the farm following the application of KSA; and (4) Results: Changes that the trainee's performance brought to the farm.

Univariate Regression Analysis

Univariate logistic regression analyses included Wald, likelihood ratio, chi-square test statistics and P-values, parameter estimates and standard errors, and odds ratios and their confidence limits. For logistic regression, values of parameter estimates are not very intuitive as they are calculated on a log scale. Therefore, odds ratios are examined, which are calculated after exponentiation parameter estimates. An odds ratio of <1 indicated a negative association, whereas values >1 indicated a positive association of the tested variable with the outcome. The following econometric model was used to determine association of variables (Greene, 1993): Wi = _ + _Xi + _i (1); Wi is the dependent variable value for person i (2); Xi is the independent variable value for the person i (3); _ and _ are parameter values (4); _i is the random error term (5); The parameter _ is called the intercept or the value of W when X = 0

(6); The parameter _ is called the slope or the change in W when X increases by one (7).

RESULTS AND DISCUSSION

Sustainability of the households

In terms of *economic sustainability*, 90% of the households were consistently experiencing net worth problems while 10% of the household's net worth is consistently going up. In addition, this has resulted in 90% of the households' debts consistently going up. Hence, 90 % of the households indicated that the enterprise profitability were going down year after year. This situation also created a challenge in the household's ability to pay for electricity and water and government support is also limited, as 90% of the households does not rely on government payments. This economic situation is worrisome as according to Maponya and Moja (2012) households with more members who are economically active are generally more food secure than those with less economically active members.

In terms of *social sustainability*, 90% of the households support other businesses and families in the community, while 10% do not. The evidence is based on 90% of the households agreeing that the rand circulates within the local economy as they sell their produce to local businesses and families. However, the attraction of youth in agriculture remains a huge challenge as only 40% of the households indicated that youth do not take over their parents' farms and do not return to the community after graduating.

In terms of *environmental sustainability*, 87% of the households maintain their soil fertility, while 13% of the households do not. The water source for irrigation remains a huge challenge as 90% of the households emphasised that their water source for irrigation is not sustainable. Furthermore, waste is well managed within the community and most households (88%) indicated that biodiversity is not threatened by growing crops. Environmental awareness among communities should always be prioritised as the environmental benefits from recycling water and waste nutrients, controlling shade, dust and erosion, and maintaining or increasing local biodiversity will be increased.

Impact of Households' Agricultural Training

Donald Kirkpatrick training evaluation model was used to assess the impact of training on the households. Four levels of assessment were used namely: Reaction level, Learning level, Application level and Results level (Kirkpatrick and Kirkpatrick, 2006).

The reaction level seeks to determine the level of satisfaction, needs and displeasure about agricultural training (Kirkpatrick and Kirkpatrick, 2006). As indicated in Table 1, about 95% of the households indicated the training as successful and 90 % of the households identified practical activities as the strength of the training while theory (50%) and discussion (40%) parts of the trainings were identified as weak. Most of the households emphasised that the training venue (80%) and training sessions (95%) were of good quality.

Table 1. Households' reaction level.

Reaction			**Percentages**
Thoughts about the training?	Successful		Not successful
	95%		5%
The biggest strengths of the training?	Theory	Practice	Discussions
	5%	90%	5%
The biggest weaknesses of the training?	Theory	Practice	Discussions
	50%	10%	40%
Feelings about the venue?	Good	Fair	Poor
	80%	10%	10%
Did the training session accommodate your needs	Yes		No
	95%		5%

The learning level seeks to determine the acquisition of knowledge, skills and attitudes about the agricultural training (Kirkpatrick and Kirkpatrick, 2006). As seen in Table 2, only 52% of the households identified pests and diseases as a topic, which increased their knowledge and skills, followed by Marketing (23%), Irrigation scheduling (13%) and storage and handling (12%). As shown in Table 2, other topics were also of interest to the households.

Table 2. Households learning level.

Question	**Topic**	**Percentages**
Selecting a topic which has increased your knowledge and skills	Pests and Diseases	52%
	Irrigation scheduling	13%
	Marketing	23%
	Storage and Handling	12%
Other topics	Seed sowing	25%
	Transplanting	25%
	Soil preparation	25%
	Harvesting	25%

The application level seek to understand the performance of the trainee and whether skills, knowledge and attitudes acquired during agricultural training were applied (Kirkpatrick and Kirkpatrick, 2006). As shown in Table 3, about 90% of the households indicated that they have applied their learning to use and all households emphasised that they were able to teach new knowledge, skills, or attitudes to other people and the trainings have changed their behaviour.

Table 3. Household application level.

Question	Percentages	
	Yes	No
Did you apply any of your learning to use?	90%	10%
Are you able to teach your new knowledge, skills, or attitudes to other people?	100%	0%
Are you aware that you've changed your behaviour?	100%	0%

The results level seeks to determine whether some improvements and changes were obtained through the application of skills, knowledge and new attitude during agricultural training (Kirkpatrick and Kirkpatrick, 2006). Table 4 indicated that 54% of the households increased their productivity, 31% of the households increased quality, 9% of the households reduced waste and only 6% of the households' farming passion was increased.

Table 4. Households' results level.

Question	Results	Percentages
The results of the training	Increased production	54%
	Increased quality	31%
	Reduced waste	9%
	Increased farming passion	6%

Univariate Regression Analysis

The results identified the following agricultural training challenges: Soil Preparation, Seed Sowing, Pests and Diseases, Marketing, Harvesting, Transplanting and Post-Harvest Storage. The Univariate analysis showed a high level of positive association among Pests and Diseases (Dependent variable) and the following Independent variables: Water source, Crops planted, Land size, Education and Farming experience. The model fit was predicted by the R^2 at 0.90 (90%) and was always between 0 and 100%. In general, the higher the R^2, the better the model fits the data and the better the interaction between dependent and independent variables. As indicated in Table 5, the odds of farmer's land size, water source, crops planted, education and farming experience were more than 1. This clearly indicated a positive association with pests and diseases as a training challenge. It was not surprising to realise a positive association among water sources, crops planted and land size as pests and diseases are mostly transmitted from water sources especially polluted water. Moreover, this pests and diseases challenge can affect any crops planted in any land size. This required an educated and more experienced smallholder and subsistence farmer to deal decisively with pests and diseases on their farms. According to ARC (2017), many smallholder and subsistence farmers lack knowledge of the cycles of specific pests, diseases and weeds and find it difficult to distinguish their specific characteristics. As a result, they cannot apply suitable

preventive measures or implement proper control measures. To avoid major crop losses, smallholder farmers must be well-trained and monitored to implement affordable and effective measures against pests and diseases (Maponya *et al.*, 2016).

Table 5. Univariate analysis among factors contributing to pests and diseases as a training challenge in the Gauteng District.

Variables	OR and 95% CI
Water Source	1.629[0.21–20.1] 1
Crops Planted	1.09[10.5–77.9] 1
Land Size	1.01[0.33-0.77] 1
Education	1.55[0.10 – 3.89] 1
Farming Experience	1.68[1.21 – 10.4] 1

(N = 1089); OR = Odds Ratio; 95% CI = 95% Confidence Intervals; 1< = No Association; 1> = Association.

CONCLUSIONS

The study identified topics that were of interest to the households namely, marketing, irrigation scheduling, storage and handling, seed sowing, transplanting, soil preparation and harvesting. In terms of sustainability, most of the households were consistently experiencing net worth problems while a small percentage of the household's net worth is consistently going up. Hence, most of the households were not economically sustainable. In addition, most of the households supports other businesses and families in the community. The water source for irrigation remains a huge challenge as most of the households emphasised that their water source for irrigation is not sustainable. In terms of training, most of the households indicated that practical training was the most preferred and they increased their knowledge and skills in training and their attitude changed after the training. It is thus concluded and recommended that the transfer of agricultural knowledge to support households should be a priority for the government. Households should, therefore, be regularly trained to realize a good impact and sustainability over time. This will lead to higher yields, increased income, increased knowledge and skill, food security and resilience to a changing climate.

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