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EVALUATING DOMAINS ASSOCIATED WITH ECONOMIC EMPOWERMENT OF SMALL-SCALE FEMALE AGRO-PROCESSORS IN SOUTH AFRICA

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Abstract. Women's economic empowerment has been South Africa's policy priority since the country became a democracy. This paper examines the domains associated with the economic empowerment of small-scale female agro-processors in South Africa. A sequential exploratory mixed methods research design and a close-ended questionnaire were used to collect quantitative data from 503 small-scale agro-processors in five provinces. Qualitative data were collected during five focus group sessions aided by the focus group guide. The results show that production decision-making (β = 0,140; p = 0,003), access to productive resources (β = 0.140, p = 0.001), time allocation (β = 0.327, p = 0.000), and intervention (β = –0.353, p = 0.004) are the critical domains of small-scale agro-processing empowerment. The study revealed that only four domains of women's economic empowerment have significantly improved the economic status of small-scale agro-processors. However, the combination of income, leadership, and intervention (β = 0.009, p = 0.015) was also a significant influencing factor. The study recommends that small-scale agro-processors be provided with necessary policies and legislative control over their production decisions. This authority is coupled with broadening access to productive resources, time allocation, grants, leadership, and projects to actively empower these entrepreneurs.

Keywords: small-scale agro-processing, women's economic empowerment, domains, leadership, income, interventions

INTRODUCTION

Gender equality is identified as a universal right and attempts to increase women's empowerment are a major global priority (Crookston et al., 2021). According to Goulart et al. (2021), women's empowerment is linked to goal five of the Sustainable Development Goals (S.D.G.s), which focuses on achieving gender equality and empowering all women and girls. Women's economic empowerment is part of the strategic goal[s] of most countries, and there are studies on this concept (Kabeer, 1999; Oriana et al., 2014; Sabina et al., 2015; Golla et al., 2018; Crookston et al., 2021). Existing literature on this concept has been highly researched (Laszlo et al., 2020; Jokia et al., 2021; Gupta, 2021). Scott et al. (2016) suggest that economically empowered women can acquire their own economic assets. Doss et al. (2012) define women's economic empowerment as the ability to increase their agricultural income and control their income. At the same time, Crookston et al. (2021) define women's economic empowerment as empowerment for women to advance their economic decisions. Furthermore, women's economic empowerment is defined as a tacit and strategic process of women attaining equal access to and authority over economic resources

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and using them in other areas of their lives (Taylor and Pereznieto, 2014; Hunt and Samman, 2016). According to Kabeer (1999) and Crookston et al. (2021), empowerment can be achieved through the following three dimensions: (1) resources—including education, social support, and assets, (2) agency—the ability to define goals and make decisions, and (3) achievements—well-being and life outcomes that result from the use of agency (Kabeer, 1999 and Crookston et al., 2021).

Various studies have been conducted and frameworks developed to measure and promote gender equality and women's empowerment (G.E.W.E.). The G.E.W.E. indicators have been categorized into the following domains: economic, health, human development, leadership, psychological, security and justice, and sociocultural. The current study focuses on the economic domain, and it focusses on employment indicators, financial decision-making, and income generation (Goulart et al., 2021).

The (initial)[first] framework to measure the domains for women's empowerment in agriculture is the Women's Empowerment in Agriculture Index (W.E.I.A.). It is a survey-based tool co-developed by the International Food Policy Research Institute, the Oxford Poverty and Human Development Initiative, and the United States of America's Agency for International Development (Alkire et al., 2013; Malapit et al., 2017). This well-established, survey-based index is designed to measure the empowerment, agency, and inclusion of women in the agricultural sector (Narayan, 2005; Alsop et al., 2006; Narayan and Petesch, 2007; Ibrahim and Alkire, 2007). Furthermore, it is an innovative new tool composed of two sub-indices, one of which measures the five domains of women's empowerment (see Table 1).

The second framework developed to measure the domains for women's empowerment in agriculture is the Adjusted-WEAI. It provides an alternative to the W.E.A.I. survey instrument; this alternative is shorter and more streamlined while still accurately reflecting the content and coverage of the original index (Malapit et al., 2017). Thus, the A-WEAI survey instrument reflects all five domains of empowerment in agriculture but collects only six out of the ten original indicators. The dropped indicators are autonomy in production; purchase, sale, or transfer of assets; speaking in public; and leisure. The definitions, cut-offs, and aggregation rules remain the same; only the indicator weights have been changed (see Table 1).

The third framework is the pro-WEAI. It includes 12 indicators mapped to three domains reflecting three different types of agencies: intrinsic agency, instrumental agency, and collective agency (see Table 2). A person is deemed adequate on a given indicator if they achieve a certain level. Again, the person is deemed empowered if

Table 1. Comparison of the domains of women's empowerment in agriculture index (W.E.A.I.) and abbreviated women in agriculture index (A-WEAI)

Original WEAI			A-WEAI		
Domain	Indicator	Weight	Domain	Indicator	Weight
Production	Input in productive decisions	1/10	Production	Input in productive decisions	1/5
	Autonomy in production	1/10			
Resources	Ownership of assets	1/15	Resources	Ownership of assets	1/5
	Purchase, sale, and transfer of assets	1/15			
	Access to and decision on credit	1/15		Access to and decisions on credit	1/5
Income	Control over the use of income	1/5	Income	Control over use of income	1/5
Leadership	Group member	1/10	Leadership	Group membership	1/5
	Speaking in public	1/10			
Time	Workload	1/10	Workload	Workload	1/5
	Leisure	1/10			

Source: Alkire et al., 2013; Malapit et al., 2017.

Table 2. Pro-WEAI indicators

Indicator	Definition of adequacy in pro-WEAI
Autonomy in income	Intrinsic Agency More motivated by own values than by coercion or fear of others' disapproval: Relative Autonomy Index1 score ≥1
Self-efficacy	"Agree" or greater on average with self-efficacy questions: New General Self-Efficacy ScaleC score ≥32
Attitudes about intimate partner violence against women	Believes husband is NOT justified in hitting or beating his wife in all 5 scenarios:2 1) She goes out without telling him 2) She neglects the children 3) She argues with him 4) She refuses to have sex with him 5) She burns the food
Respect among household members	Meets ALL the following conditions related to another household member: 1) Respondent respects relation (MOST of the time) AND 2) Relation respects respondent (MOST of the time) AND 3). Respondent trusts relation (MOST of the time) AND 4). Respondent is comfortable disagreeing with relation (MOST of the time)
Input in productive decisions	Instrumental Agency Meets at least O.N.E. of the following conditions for ALL the agricultural activities they participate in, whether related to production, processing, and marketing activities. 1) Makes related decision solely, 2) Makes the decision jointly and has at least some input into the decisions 3) Feels could make decision if wanted to (to at least a MEDIUM extent)
Ownership of land and other assets	Owns, either solely or jointly, at least O.N.E. of the following: 1) At least THREE small assets (poultry, nonmechanized equipment, or small consumer durables) 2) At least T.W.O. large assets 3).Land
Access to and decisions on financial services	Meets at least O.N.E. of the following conditions: 1) Belongs to a household that used a source of credit in the past year AND participated in at least O.N.E. sole or joint decision about it 2) Belongs to a household that did not use credit in the past year but could have if wanted to from at least O.N.E. source 3) Has access, solely or jointly, to a financial account
Control over use of income	Has input in decisions related to how to use BOTH income and output from ALL of the agricultural activities they participate in AND has input in decisions related to income from ALL non-agricultural activities they participate in, unless no decision was made
Work balance	Works less than 10.5 h per day: Workload=time spent in primary activity + (1/2) time spent in childcare as a secondary activity
Visiting important locations	Meets at least O.N.E. of the following conditions: 1) Visits at least T.W.O. locations at least ONCE PER WEEK of [city, market, family/relative], or 2) Visits least O.N.E. location at least ONCE PER MONTH of [health facility, public meeting]
Collective Agency	
Group membership	Active member of at least O.N.E. group
Membership in influential groups	Active member of at least O.N.E. group that can influence the community to at least a MEDIUM extent

Source: Quisumbing et al., 2021.

they have adequate achievements in 9 out of the 12 indicators. Furthermore, this framework includes two subindices measuring men's and women's performance on the 12 indicators. The Gender Parity Index, or GPI, captures women's achievements in the three domains relative to men in the same household (Quisumbing et al., 2021). The literature on women's empowerment also suggests that empowerment in one domain may not necessarily

create empowerment in other domains (Alkire et al., 2013; Malapit et al., 2017; Quisumbing et al., 2021).

Anderson et al. (2021) indicate that published estimates of economic returns to empowering women in agriculture are still relatively rare, primarily based on non-experimental evidence, likely biased towards positive outcomes, and often with limited data quality. At the same time, Slegh et al. (2013) and Derera (2015) assert that the benefits of women's economic empowerment are well-known and documented in the development literature. Golla et al., 2018; Sathiabama (2010); Mayanja and Tipi (2017) indicate that women's economic empowerment enhances national productivity, generates employment, and helps develop economic independence and personal social capabilities among rural women. This includes building self-confidence, enhancing awareness, promoting a sense of achievement, increasing social interaction, improving leadership qualities, solving women's problems within the community, and increasing decision-making capacities at family and community levels. Furthermore, women's economic empowerment is a powerful lever for change, driving gender equality outcomes and broader intergenerational benefits for women, their children, and households (Hendricks, 2019). Women's economic empowerment can contribute to L.E.D., which has a central theme: the creation of jobs (Jokia et al., 2021). Women's empowerment through entrepreneurship is a prospective sector because entrepreneurs create employment for themselves and create jobs for others. Therefore, it reduces gender inequality as well as poverty. According to Nawaz (2009) and Debnath et al. (2020), female entrepreneurship and women's empowerment complement each other. Female entrepreneurship is considered an essential tool in enabling women's empowerment (Maheshwari and Sodani, 2015; Nhleko, 2017). The emphasis on economic empowerment also has potentially transformative effects as it defines how women participate in growth processes and means that they are not merely seen as benefiting from growth (De Haan, 2017). Women's empowerment is likely to lead to better educated and healthier children (De Haan, 2017).

Despite a global focus on gender equality, many persistent factors are still contributing to the disempowerment of women (Crookston et al., 2021). Women's economic empowerment is discussed as the capacity of all women to be wholly involved in, subsidize, and assist in economic growth and development plans (Nhleko, 2017). Women play an important and possibly transformational role in agricultural growth in developing nations, but they are confronted by chronic barriers and economic restraints that limit their continued participation in agriculture, according to Alkire et al. (2013). Mmbengwa (2009) reports that women are empowered through small and medium-sized enterprises (S.M.M.E.s). Research has recognized that small-scale food processing enterprises, as part of the S.M.M.E. regime, have played a significant role in improving the economy of most developed and developing countries (Uzoejinwa et al., 2016). Studies further argue that small-scale agro-processing industries in Sub-Saharan Africa are potential sources of livelihood for many poor people living in this region (Simalenga and Gohl, 1996; Salau et al., 2019; Daninga, 2020). The small and medium-sized agro-processing industries have a functional role in employing a workforce at low capital cost, introducing innovation and entrepreneurship skills, generating higher production volumes, increasing exports, and distributing income across the country because of increased profit from increased investment (Uzoejinwa et al., 2016). According to Augustino (2017) and U.N.I.D.O. (2009), S.A.P.I.s often help motivate women involved in the agro-processing field. According to Simalenga et al. (1996) and Salau et al. (2020), most women work in S.A.P.I.s. Small-scale food processing operations can provide income for many vulnerable people in Sub-Saharan Africa.

Due to this situation, it is globally accepted that small and medium-scale industries, in general, serve as engines of the development of a nation (Kaldor, 1967; Mohamed and Mnguu, 2014). They contribute to employment generation, especially in rural areas, better income distribution, reduced post-harvest food losses, and increased food availability, and act as a training ground for entrepreneurs before investing in large-scale enterprises. In South Africa, commercial agriculture is the leading player in the agro-processing industry, whereas small-scale agriculture plays a limited role despite receiving government support (Mmbengwa et al., 2011). This limited role stems from the fact that small-scale agriculture is resource constrained. The South African government has found it challenging to transform agro-industries into small-scale farming entrepreneurs (Mmbengwa et al., 2020).

This study, therefore, aims to fill this knowledge gap in the literature by evaluating critical domains for the

economic empowerment of women as small-scale agro-processors in South Africa. This paper evaluates the critical domains that affect women's economic empowerment in the small-scale agro-processing industries, unlike earlier studies that have focused on women's empowerment in agriculture. This will enable women's small-scale agro-processors, policymakers, and academia to identify various domains that influence the economic empowerment of women's small-scale agro-processors in South Africa. The specific objectives of the study are as follows:

- To describe the socio-economic characteristics of women in small-scale agro-processors in South Africa's five provinces,
- To identify the critical domains for the women's economic empowerment of small-scale agro-processors in South Africa, and
- To evaluate critical domains for the women's economic empowerment of small-scale agro-processors in South Africa.

The study is relevant considering its potential to contribute to achieving one of the pillars of sustainable economic development under South Africa's National Development Plan (N.D.P.), Industrial Policy Action Plan (I.P.A.P.), and New Growth Path (N.G.P.). The study's findings should also be an important source of information for the establishment of policies and programs aimed at promoting women's economic empowerment in South Africa's small-scale agro-processing industry.

CONTEXTUALIZATION OF THE STUDY

These policies (N.D.P., I.P.A.P., and N.G.P.) have recognized South Africa's agro-processing industry as one of the sectors to spur growth and create jobs due to its strong backward linkage with the primary agricultural sector (DAFF, 2013; Mlambo, 2019). However, I.P.A.P. (DTIC, 2014) notes that the potential of agro-processing has not been fully exploited in the country. For this reason, the enhanced participation of small-scale agro-processors in agro-processing activities can contribute to national objectives such as poverty reduction and job creation. South Africa's agro-processing sector is estimated to contribute about 30.5 percent of the real value-added G.D.P. of the manufacturing sector (Thindisa, 2014).

Furthermore, the agro-processing sector employs an estimated 207,893 people (DTIC, 2014). At that time this figure represented approximately 16 percent of the total employment number for the manufacturing sector and 2.5 percent of the South African economy's total employment number (Limpopo…, 2012). The South African economy experienced a contraction of production in most agro-processing industry divisions during the first quarter of 2013 (DAFF, 2013). During the same period, the agro-processing industry shed 2,369 more formal jobs than it had in the preceding quarter. However, formal jobs were created in the beverages and tobacco, footwear, and rubber products divisions (DAFF, 2013). The average contribution of agro-processing to the output and value-added of the manufacturing sector was 18.2 percent and 19.8 percent, respectively, during 2012–2016. Its contribution to domestic fixed investment was 15.1 percent and to employment 18.0 percent during the same period (International…, 2016).

According to van Lin et al. (2018), the limited participation of rural-based agro-processors, particularly women-owned enterprises, in the agro-processing mainstream value chain in South Africa results from the lack of implementation of the relevant policies. Although government policies aim to empower small-scale agro-enterprises, these policies have not significantly impacted the empowerment of women's agro-processing enterprises (Iheduru, 2004). Ortmann and King (2007) suggest that the agro-processing sector is crucial in supporting small agricultural producers and previously disadvantaged agro-processors in order to achieve commercialization and growth.

Most small-scale agro-processing enterprises are characterized by inefficiency in resource-use, mismanagement, weak responsiveness to market trends, a lack of innovative practices, poor management skills, low levels of trust, and an inability to share information, skills and assets (Child et al., 2005; Miles et al., 2006; Cook and Burress, 2009; DAFF, 2015). Although the Agri-BEE Transformation charter exists to address these challenges, successes from small-scale agro-processors are rare. As a result, several researchers (Lambrecht, 2016; Jordaan et al., 2014; D'Haese et al., 2007; Elfring and Hulsink, 2003; Cook, 1995) have worked on developing a framework in various sectors focusing on value addition, innovation through networking, and organizational performance, but none of these frameworks focused on agro-processing. In South Africa, for small-scale performance agro-processing enterprises, the focus was on internal social dynamics, revenue, and incomes. Nevertheless, none of these

studies focused on developing a framework to empower small-scale agro-processors.

RESEARCH METHOD

Study area

South Africa is located in the southernmost part of the African continent and is bordered by Botswana, Zimbabwe, Mozambique, the Kingdom of Eswatini, and Lesotho. The country comprises nine provinces, namely Limpopo, Mpumalanga, Gauteng, North West, Free State, Eastern Cape, Northern Cape, Western Cape, and Eastern Cape. The study was conducted in five provinces, namely Gauteng, Limpopo, North West, Mpumalanga, and Free State. South Africa is one of the world's most unequal countries, and women face a high level of disempowerment. It has a Gini coefficient of 0.63, and the incidence of poverty is exceptionally high for African women, at 52 percent (SSA, 2021).

Research design

The study was designed to be an explanatory sequential mixed-methods study that yields descriptive and inferential analysis. Hence, its research philosophy was based on a pragmatic paradigm. The mixed-methods approach collects both quantitative and qualitative data sequentially in the design (Creswell and Creswell, 2017). The researcher based the inquiry on the assumption that collecting diverse types of data was the best way to provide an understanding of a research problem which was more comprehensive than using quantitative or qualitative data alone. The mixed-methods approach allowed the study to enjoy both the structure of quantitative research and the flexibility of qualitative inquiry (Cresswell and Cresswell, 2017). The researcher opted for this mixed-methods approach to deepen generalizable quantitative research. This method focuses on creating generalizable outcomes from a qualitative approach and taking a holistic view of tackling a research problem (Strijker et al., 2020). The mixed-methods approach expands and strengthens a study's conclusions, contributes to the published literature, and answers the posed research questions (Schoonenboom and Johnson, 2017).

Population and sampling

The population of the study comprised all small-scale agro-processors in the study area. The study area comprised Limpopo, Gauteng, Free State, North West, and Mpumalanga Provinces. Due to the informal nature of the enterprises and their traditional background and meagre economic contributions, South Africa's government institutions do not have a formal database to derive their accurate population. The population was estimated based on their concentration in various centres located in

Fig. 1. South Africa's map showing provinces
Source: Google Maps, 2019 and Manasoe et al., 2021.

Table 3. Estimated population and sample size for the study

Province	Population	Sample size (n) (1,150/395) · population	Percentage (%) of Sample size in Each Province
Gauteng	300	100	19.9%
Limpopo	200	102	20.3%
North West	150	143	28.3%
Mpumalanga	300	98	19.5%
Free State	200	60	11.9%
Total estimated population	1,150	503	43.5%

Source: Various municipalities and provincial department of agriculture and rural development, 2020.

the study areas (see Table 3). The target population was defined as owners and managers of small-scale agro-processing enterprises located within the study area.

Stratified random sampling was utilized for selecting a sample size of 503 (see Table 3) from an estimated sample frame of 1,150. Stratified random sampling is a probability sampling technique whereby the entire population is first divided into strata. Next, a simple random sample is taken from each stratum, and the combined results from each stratum constitute the representative sample. When randomly selecting people from a population, these characteristics may or may not be present in the sample in the same proportions; stratification ensures their representation (Cresswell and Cresswell, 2017). It is appropriate to identify whether the sample contains individuals in the same proportion as the character appears in the entire population within each stratum. Stratified sampling was appropriate for this study since the number of agro-processing firms differed from one sub county to another. Their products also varied depending on their locations. A simple random sample was obtained from each stratum using computer generated random numbers.

Data collection and analysis

The quantitative data was collected using questionnaires, while the qualitative data was collected using observations and focus group techniques. Qualitative findings were used to confirm and complement the results of the quantitative method. The socio-economic characteristics of small-scale agro-processors were collected using a semi-structured questionnaire. The questionnaires were pre-tested, appropriate experts thoroughly and independently examined the instrument, and necessary corrections were made prior to data collection. The experts gave their critical opinion on the adequacy and relevance of the instrument to the objectives of the study. The observation was harmonized and necessary corrections were made to the instrument before starting the survey. Ethical clearance was obtained before the commencement of the data collection. Participants were requested to provide written or verbal consent for recordings to be made and pictures to be taken before participating in the study.

The study employed two analytical techniques, namely descriptive and inferential statistics. The elements of descriptive statistics such as average, frequency, and percentages were adopted to identify and analyse the socio-economic characteristics of the small-scale agro-processors in the study area. At the same time, one-way factorial Analysis of Variance (ANOVA) was utilized to understand and describe the views of small-scale agro-processors toward the economic empowerment of women. One-way factorial ANOVA is an appropriate method of statistical analysis for assessing the difference between groups on a continuous measurement (Tabachnick and Fidell, 2013). One-way factorial ANOVA is used when multiple independent variables are examined (Allen, 2017). It is a hypothesis-based test, meaning that it aims to evaluate multiple exclusive theories about our data. In one-way factorial ANOVA, there are two possible hypotheses, namely:

- The null hypothesis (H0), which states that there is no difference between the groups and the equality rate.
- The alternative hypothesis (H1), which states that there is a difference between the means and groups.

One-way ANOVA is based on the following assumptions:

- Normality – that each sample is taken from a normally distributed population.
- Sample independence – that each sample has been drawn independently of the other samples.
- Variance equality – that the variance of data in the different groups should be the same.
- Your independent variable – here, "weight", should be continuous – that is, measured on a scale that can be subdivided using increments.

The domain comprised production decisions, access to productive resources, income, leadership, allocations of time, and interventions (Puspitasari and Gayatri, 2020; Shalini and Nasima, 2021). The model below shows how the empowerment domain of small-scale agro-processing was estimated.

$$Y_{ij} = \mu + \alpha_i + E_{ij} \quad (1)$$

where:

Y_{ij} – the economic empowerment domain,
μ – mean of the observation,
α_i – individual contributions,
E_{ij} – individual deviations.

The *F*-statistic was used for statistical tests, testing for the difference in the mean between the factorial layouts.

$$\text{The } F = \frac{\text{between-group variability}}{\text{within-group variability}} = \sum \frac{n_i(\bar{Y}_i - \bar{Y})^2}{(K-1)} \quad (2)$$

where:

$\bar{Y}_i$ – the sample mean in the ith group,
n_i – the number of observations in the i^{th} group,
$\bar{Y}$ – the overall mean of the data,
K – number of the groups.

On the other hand, [size of] the domain of empowerment effects ('size) is estimated using the following formula.

$$\sigma^2 = \frac{(n1 - l)(M_{ss} - M)}{\text{(Number of small-scale agro-processor)}\ (nl)(pl)} \quad (3)$$

where:

σ^2 – partial eta squared,
nl – number of small-scale agro-processors,
pl – number of interventions.

The assumption of normality, which seeks to estimate that the residuals are normally distributed, was determined using this equation.

$$E_{ij} \sim N\ (0, \sigma^2) \quad (4)$$

RESULTS

Descriptive statistics

A total of 503 small-scale agro-processors were sampled in the study. The descriptive results, summarised in Table 4, revealed that females were in the majority [365 (72.6%)], and males were in the minority [138 (27.4%)]. The agro-processing sector, which is mainly made up of women, has the capacity uplift their status and ultimately empower them (Onwufafur and Enwelu, 2013; Mthombeni et al., 2021). Most female small-scale agro-processors are not married (38.1%), compared to those who are married, who constituted 36.7% of the participants. The study further found that most female small-scale agro-processors were self-employed (77.1%), and the next biggest group was pensioners (7.7%). According to Mthombeni et al. (2021), it is worth noting that the elderly agro-processors are not very productive due to the drudgery of agricultural activities; hence fewer of them participated in the study.

Furthermore, the study revealed that female small-scale agro-processors with no schooling, either in primary or secondary education, constituted 73.1% of the participants. However, 24.4% and 2.5% possess (a) certificate and post-diploma qualifications [respectively]. It is worth noting that studies by Proctor et al. (2000) and Mthombeni et al. (2021) state that most small-scale agro-processors are illiterate or semi-literate and have no formal training, and their sources of knowledge on processing and skills are apprenticeships. Melembe et al. (2021) found that most farmers (54.9%) have secondary or high school education, while close to 20% have tertiary education, and less than 10% of the farmers in the study area are without formal education. These findings compare favourably with the findings of the current study.

In addition, 42.7%, 19.7%, 13.2%, and 8.8% of female small-scale agro-processors are involved in drying, powdering, bottling, and canning agro-processing

Table 4. Demographic characteristics of the respondents

Socio-economic variables	Female		Male	
	Frequency	Percent	Frequency	Percent
Gender	365	72.6	138	27.4
Marital status				
Married	134	36.7	47	34.0
Widowed	36	9.8	2	1.4
Divorced	27	7.4	3	2.2
Separated	29	8.0	11	8.0
Never married	139	38.1	35	25.4
No response	0	0.0	40	29.0
Employment status				
Employed	27	7.4	12	8.7
Self-employed	284	77.8	114	82.6
Pensioner	32	8.8	3	2.2
Entrepreneur	20	5.5	9	6.5
Unemployed	2	0.5	0	0
Highest qualifications				
No schooling	41	11.2	5	3.6
Primary and secondary	226	61.9	93	67.4
Certificate	89	24.4	33	23.9
Diploma	7	1.9	6	4.3
Degree	2	0.6	1	0.8
Agro-processing specialty				
Drying	156	42.7	62	44.9
Canning	32	8.8	6	4.3
Bottling	48	13.2	24	17.4
Juicing	23	6.3	11	8.0
Powdering	72	19.7	18	13.0
Paste/puree	14	3.8	4	2.9
Cleaning	20	5.5	13	9.4
Entrepreneurial position				
Director	1	0.3	2	1.4
Owner	334	91.5	126	91.3
Managing director	6	1.6	3	2.2
Manager	24	6.6	7	5.1
Educational background				
Agriculture	132	36.2	51	37.0
Science	95	26.0	40	29.0
Commerce	94	25.8	27	19.6
Engineering	17	4.7	16	11.6
Humanities	25	6.8	3	2.2
Medicine	2	0.5	1	0.7
Employment and experience	Mean	SD	Mean	SD
Experience in the business	5,6466	3,21287	4,6594	2,64022
Experience in the agro-processing	5,3753	3,29484	4,3551	2,71734

Source: survey data, 2020.

activities, respectively. Table 4 indicates that women have lower directorship (0.3%) than their male (1.4%) counterparts. However, the results suggest that women (are)[rate] slightly higher (91.5%) in terms of the ownership of small-scale agro-processing enterprises relative to men (91.3%). Furthermore, the results show that women are dominant (6.6%) at the managerial levels but not in senior management (1.6%). The results indicate that these enterprises are dominated by women (73.1%) who are less educated than men (71%). However, males have much better post-graduate achievement compared to females. Both males and females have an adequate agricultural educational background. Although females have a lower scientific background (26%), they have a much better background in commerce (25.8%) compared to males (19.6%). Lastly, female small-scale agro-processors employ an average of one person; they have over five years' experience in the business and over five years' experience in the agro-processing industry.

The domains for the development of small-scale agro-processors

Tables 5 and 6 show the results of the one-way factorial ANOVA on the domains of the economic empowerment of female small-scale agro-processors. According to the Women's Empowerment in Agriculture Index (W.E.A.I.), the domains for women's economic empowerment include production, resources, income, leadership, and time (Leder, 2016). The study found that domain of production decision making has a significant effect on the economic empowerment of female small-scale agro-processors in the study area, $F(1, 494) = 9.133$, $p < 0.001$, $\eta^2 = 0.018$; access to productive resources, $F(1, 494) = 10.301$, $p < .001$, $\eta^2 = 0.020$; allocation of time $F(1, 494) = 54.077$, $p < 0.001$, $\eta^2 = 0.099$; interventions $F(1, 494) = 39.808$, $p < 0.050$, $\eta^2 = 0.017$. The interaction between income, leadership, and interventions was investigated. Furthermore, it was found that there was a significant effect of the interaction of income, leadership, and interventions, $F(1, 494) = 5.984$, $p = 0.015$, $\eta^2 = 0.012$)]. The results show higher effects for time allocation, followed by access to productive resources, and production decision-making.

The findings concur with Yount et al. (2019), who report that empowerment is a function of adequate time allocated to empowerment initiatives. Therefore, income, leadership style, and policy interventions could inform an entrepreneur's ability to be empowered.

Table 5. The test of the between-subjects effects for the domain of development of small-scale agro-processors

Sources	Type III sum of squares	df	Mean square	F	Sig.	Partial eta squared	Observed power[b]
Corrected model	395.588[a]	8	49,449	39,808	0,000	0,392	1,000
Intercept	16,129	1	16,129	12,985	0,000	0,026	0,949
Production decision making	11,345***	1	11,345	9,133	0,003	0,018	0,855
Access to productive resources	12,795***	1	12,795	10,301	0,001	0,020	0,893
Income	0,833	1	0,833	0,671	0,413	0,001	0,129
Leadership	0,102	1	0,102	0,082	0,775	0,000	0,059
Allocation of time	67,173***	1	67,173	54,077	0,000	0,099	1,000
Interventions	10,642***	1	10,642	8,567	0,004	0,017	0,832
Income × interventions	0,523	1	0,523	0,421	0,517	0,001	0,099
Income × leadership × interventions	7,433	1	7,433	5,984	0,015	0,012	0,685
Error	613,632	494	1,242				
Total	10 614,000	503					
Corrected total	1 009,221	502					

[a]R Squared = 0.392 (adjusted R squared = 0.382).
[b]Computed using alpha = 0.05.
[c]Dependant variable: Development.
Source: survey data, 2020.

Table 6. The parameters of the domain of empowerment of small-scale agro-processing

Parameter	β	Std. error	T	Sig.	95% confidence interval		Partial eta squared
					lower bound	upper bound	
Intercept	2,450	0,68	3,603	0,000	1,114	3,786	0,026
Production decision making	0,140	0,046	3,022	0,003	0,049	0,231	0,018
Access to productive resources	0,140	0,044	3,209	0,001	0,054	0,226	0,020
Income	0,101	0,124	0,819	0,413	–0,142	0,344	0,001
Leadership	–0,024	0,085	–0,286	0,775	–0,191	0,143	0,000
Allocation of time	0,327	0,044	7,354	0,000	0,24	0,414	0,099
Interventions	–0,353	0,121	–2,927	0,004	–0,591	–0,116	0,017
Income × interventions	–0,020	0,031	–0,649	0,517	–0,082	0,041	0,001
Income × leadership × interventions	0,009	0,004	2,446	0,015	0,002	0,017	0,012

* Computed using alpha = .05
Source: survey data, 2020.

These results are consistent with findings by Sraboni et al., 2014; Hannan et al., 2020; Quisumbing et al. (2021). Additionally, there was a significant causal relationship between capacity building and access to information (β = 2.609, p = 0.000). This implies that a unit increase in access to information could increase the growth of

small-scale agro-processing capacity by 260.9% in the South African context. However, access to information positively affected the business network (β = 0.119, p = 0.054). The implication is that an increase in access to information can bring an 11.9 % increase in business networks for agro-processing enterprises in South Africa.

Table 6 shows that production decision making is a significant domain in the determination of the empowerment of female small-scale agro-processors (β = 0.140, p = 0.003), with a partial eta squared of 0.018. Access to productive resources in women's small-scale agro-processing enterprises was highly significant for their empowerment (β = 0.140, p = 0.001). This result implies that increased productive resource provision could lead to a corresponding increase in these entrepreneurs' empowerment. Allocation of time was also highly and positively significant (β = 0.327, p = 0.000) in empowering small-scale agro-processors in South Africa. The combination of income, leadership, and interventions was positive and significant to influence women's small-scale agro-processor empowerment (β = 0.009, p = 0.015). This result is counterintuitive because all the variables were negatively correlated to the empowerment of small-scale agro-processors individually. The study findings are contrary to Malapit et al. (2017), who found that leadership and time remain in the top domains according to the W.E.A.I. and the A-WEAI.

The significant finding or discovery of the study is that the W.E.A.I. has six domains, not five. The following three domains were identified as key to women's economic empowerment: income, leadership, and intervention.

DISCUSSIONS

The production decision-making results concur with Sell and Minot (2018) and Simelton et al. (2021) that when women are economically empowered, they play a more significant role in decision-making and the well-being of their households and enterprises improve. Anderson et al. (2021) found that an increase of one-unit in female production decision-making is associated with a 32 percent increase in maize productivity and further argued that increasing women's control over agricultural resources leads to increased productivity. The current study found that a unit increase in decision-making power given to small-scale agro-processors is likely to result in a 0.140 increase in empowerment of these enterprises.

Quisumbing et al. (2021) report that access to these resources positively impacts agricultural productivity and, therefore, is crucial in empowering the agro-food value system's agricultural agencies. The current study agrees with the W.E.A.I. index conceptualization and the resource base theory (Ragasa et al., 2021). Anderson et al. (2021) found that adequate allocation of women's time to entrepreneurial activities is likely to provide positive and empowering results. Quisumbing et al. (2021) indicated that the domains that contribute most to women's disempowerment are lack of leadership, time burden, and lack of control over resources.

These theories agree with the results of this study, and the results indicate that time allocation has the highest impact on empowering small-scale agro-processing relative to other empowerment domains (η^2 = 0.099). This impact might be influenced by the focus and dedication of small-scale agro-processors to their planned business activities. The results show that a unit increase in the time allocation of entrepreneurial activity will result in a 327% increase in empowerment. The power to use income and direct group members to implement life-changing interventions is crucial to ensuring that small-scale agro-processors gain empowerment (Aziz et al., 2021; Grantham et al., 2021).

The results also show that interaction amongst income, leadership, and interventions is a critical empowerment factor for small-scale women's economic empowerment. Coincidentally, this interaction has premised the empowerment model in the Broad-Based Black Economic Empowerment Framework that South Africa has implemented. However, this policy's implementation patterns suggest that women's empowerment is mainly in the civil service and the service sector, leaving the production sectors such as agro-processing, farming, and mining on the side-lines. The current research suggests that the combination of income in the form of grant disbursement, leadership in directorship and board membership, and intervention in the form of project support will make a meaningful contribution to women's empowerment. This happens when production decision making, access to productive resources, allocation of time, and interventions are included in planning, as long as there is a deliberate implementation of policy to achieve these strategic goals.

CONCLUSION AND POLICY IMPLICATIONS

This study aimed to evaluate the economic empowerment domains of female small-scale agro-processors in South Africa. The objective of assessing these domains for the economic empowerment of small-scale agro-processors in South Africa was to ensure that small-scale agro-processors can participate in the agro-processing industries, thereby reaping economic benefits such as job creation and self-employment. The study found lower percentages of women than men in the directorships of small-scale agro-processing enterprises. These results imply that women are still lagging behind in their representations in the governance of these enterprises, contrary to the women-empowerment policies of South Africa.

The higher ownership of enterprises by women than men is not surprising. It does not confirm the positive impact of the women empowerment policies because the small-scale agro-processing enterprises are categorized as survivalist enterprises in South Africa. Thus, women establish these enterprises to enable their households to survive and not for asset accumulation. This led to the conclusion that women entrepreneurs in this industry need more capacity, training, and after-care support because they have lower educational exposure than their male counterparts. The lack of equity between the genders in the senior management of these enterprises indicates slow societal transformation, and it further deepens the understanding that women's empowerment efforts are not achieving their intended strategic goals. Although women are highly qualified in their commercial and educational backgrounds, it may be interesting to investigate how these areas could help them to be at the apex of the governance in these enterprises. Furthermore, the commercial and educational background makes women highly suited to this type of entrepreneurship and to being successful.

The five parameters have been successfully identified as the significant domains in influencing the economic empowerment of small-scale agro-processors in South Africa. This study directly mirrors the Broad-Based Black Economic Empowerment (B.B.B.E.E.) Act 53 of 2003. The policy advocates for the development of women's human resources and skills, financial support, and enterprise ownership. Although the policy does not emphasize production decision-making, it emphasizes management, rather than leadership. This study concludes that for South Africa to achieve the economic empowerment of small-scale agro-processors, the evaluated domains could empower participants in these industries. This empowerment could result from an amendment of the current women's empowerment policies to emphasize these critical domains.

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DECLARATION ON INTEREST STATEMENT

The manuscript has been extracted from a PhD thesis.

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AGRICULTURAL EXTENSION SERVICE AND VEGETABLE PRODUCTION: THE CASE OF WOMEN FARMERS IN IMBULPE DS DIVISION IN SRI LANKA

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Abstract. This study was conducted to identify the agricultural extension needs of women farmers and to assess the impact of their participation in agricultural extension programs on vegetable production in the area. A sample of 145 women farmers from five Grama Niladhari (GN) divisions of the DS division was randomly selected for the study. Data were collected from a researcher administered survey and analyzed using descriptive statistics and a regression analysis. As per the results, a significant number of the women farmers have participated in most of the extension and training programs. However, some of them haven't registered in the farmer organization present in the area. Agricultural extension agents of the area have focused on dissemination of more information regarding modern farming technologies, organic farming, application of agrochemicals and fertilizers, and improving market systems. The majority of women farmers have used the knowledge received from the extension programs in vegetable farming activities. Furthermore, there is a significant and positive relationship between participation in extension programs by women farmers and an increase in vegetable production. Therefore, encouragement of women farmers to register in the farmer organization, provision of timely important extension service to them, organizing training programs, and workshops to disseminate agricultural information are crucial to further enhancement of vegetable production in this area.

Keywords: agricultural extension, vegetable production, Imbulpe, rural women farmers, Sri Lanka

INTRODUCTION

Most of the women in developing countries are more economically active in the agricultural sector than involved in paid work. Hence, gender specified key issues need to be identified in order to enhance the vegetable production of the women farmers in rural areas. According to the literature findings, globally identified key obstacles put rural women farmers at a significantly disadvantageous condition are poor accessibility to their own farmlands, unavailability of monetary facilities, marketing problems, poor access to agricultural extension and training, and gender discrimination (Glazebrook et al., 2020; Doss, 2018). Among them, access to agricultural extension and training are very important as they can provide cost effective ways of increasing food production and also increase the revenue of the farmers (Abbeam et al., 2018; Ozoya et al., 2018; Ibharhokanrhowa, 2016; Tayo et al., 2016). Extension services enable farmers to adapt the latest technologies and innovations to boost food production under the optimum environmental conditions while protecting the environment. However, increases in food production can vary according to women farmers' access to extension services (Ozoya et al., 2018). Proper extension service is a key component in improving the agricultural production of the farmers and creating a better linkage with the agricultural markets. Thus, it can help to enrich the rural livelihoods and improve food production by facilitating food security

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in the world. However, rural famers, especially women farmers, have limited access to agricultural information.

As per recent statistics, 14.4% of the economically active women stay in rural areas in Sri Lanka (Madurawala, 2018; Annual Labor Force Reports, 2017). The majority of them contribute their labor to the agricultural sector rather than the service sector (Wimalaweera, 2020; Annual Labor Force Reports, 2017).

Figure 1 shows that the labor force participation of women in the agriculture sector is higher than male involvement. Similarly, women who live in Imbulpe area also mainly work in farming activities. Most of the women who lived in rural areas usually get their monthly revenue from the agriculture sector. Thus, women farmers manage to earn a considerable monthly revenue by increasing their vegetable production (FAO, 2018). According to the literature findings, age, education, monthly income, financial accessibility, access to the agriculture inputs, farmland size and ownership, climate change, and extension program participation are the main factors affecting vegetable production of women farmers. Agricultural extension is a system of disseminating agricultural information from the research institutes to the farmers within the shortest possible time. Hence, extension service impact identification of an important aspect in increasing vegetable production (Rahman et al., 2020; Nuskiya, 2019; Ahmad et al., 2007).

The majority of the women farmers have to depend on their spouses or another male counterpart in the family for most of their requirements related to accessibility of agricultural inputs and agricultural extension programs, marketing of agricultural products, etc. (Census..., 2014). Therefore, there is a need for a successful extension service in order to empower rural women to improve performance in agricultural activities. However, there is no proper identification of the impact of agricultural extension service on women farmers and also their effect on vegetable production in this area. Therefore, this study was conducted to find out the agricultural extension needs of women farmers for vegetable production and the impacts of agricultural extension service on vegetable production in this area.

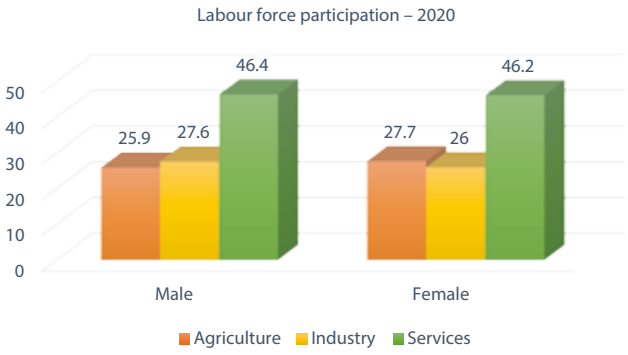

Fig. 1. Labor force participation: Gender perspective
Source: Wimalaweera, 2020.

LITERATURE REVIEW

Women represent more than half of the global population and the majority of them are underprivileged and living in developing countries of the world (World Bank, 2021; Rahman and Naoroze, 2007). When consider rural areas in the world, most of the women farmers perform traditional farming practices related to the pre-planting, planting, harvesting, and post-harvest management activities. Consequently, rural women farmers engage in small-scale farming more than commercial level farming. However, developed countries have mechanized farming practices and a considerably lower level of female contribution within the agricultural sector can be seen (Rathnachandra and Malkanthi, 2020; Ibharhokanrhowa, 2016; Malkanthi, 2016). Normally, women farmers have to perform more domestic activities such as child caring and family welfare activities. They have fewer opportunities to join social networks and thus lack in monetary facilities more than male farmers. However, male farmers have a considerably higher level of access to agricultural information and participation in extension programs than women farmers (Lecoutere et al., 2019; Bahadurghartimagar, 2011). Godwin et al., 2018, has also reported that gender differences effect the use and accessibility of agricultural information sources. Gender inequality is one of the prominent features in developing countries. Therefore, the United Nations has paid more attention to gender equity under the sustainable development goals. They help to reduce the agricultural knowledge barrier for women farmers (Rathnachandra and Malaknthi, 2020; Mojaki and Keregero, 2019; Malkanthi, 2016).

Normally, men have a number of opportunities to enhance their skills and abilities related to their level of education, accessibility to modern farming technologies, agricultural extension service, and also various financing facilities (FAO, 2018). However, it seems that there are problems and difficulties for women farmers

in getting access to these facilities and opportunities. Therefore, it is important to study women farmers' situations, in particular, the accessibility of modern farming technologies, accessibility of agricultural extension service, and also the accessibility of various financing facilities that are highly important for their empowerment and food production.

Female empowerment can be achieved by allowing them to make decisions within the household, having proper social networks, providing proper access to financial and economic resources, more bargaining power with their spouses within the family, and having considerable freedom of mobility (Rathnachandra and Malkanthi, 2020; Ibharhokanrhowa, 2016). However, women are still suffering from various difficulties for the accessibility of extension services because of their high workload and caring for family members (Ozoya et al., 2018; Ibharhokanrhowa, 2016).

Thus, literature findings indicate that there is a considerable knowledge barrier regarding the accessibility of agricultural extension service on food production of the rural women farmers in Sri Lanka. Therefore, this study aimed to find out about the barriers related to agricultural information needs and the impact of the agricultural extension service on their level of vegetable production.

RESEARCH METHODOLOGY

Imbulpe Divisional Secretariat (DS) Division in Ratnapura district in Sri Lanka was selected as the study area of this research (Fig. 2).

In this area, a considerable number of male counterparts go to work in urban areas and women have to perform many tasks such as household activities, child caring, and also farming activities. This DS division is consisted of 50 Grama Niladhari (GN) divisions. However, only five GN divisions were randomly selected for the study. They are: Seelogama, Kinchigune, Puwakgahawela, Muttettuwegama, and Karagastalawa GN divisions. Simple random sampling method was used to select a sample of 145 women farmers. A pilot study was conducted before the filed survey using 8 women farmers to make sure the suitability of the questionnaire as the primary data collection tool. After that, the researcher administered questionnaire survey was carried out from May to August 2019 in order to collect the relevant data. The questionnaire consisted of several sections, including questions to gain necessary information regarding the women farmers socio-economic situation, their participation for extension programs, reasons for not participating in the extension programs by some of them, frequency of extension program conducting by the extension officers in the study area, major focusing areas of agricultural information sharing through the extension programs, sizes of farm lands (acre), and level of vegetable production (Kg/Acre) etc. Data analyses were conducted using descriptive statistics and regression analysis. While descriptive analysis was used to identify the agricultural extension needs in vegetable production, women farmers' agricultural extension needs were identified by providing relevant agricultural information based on the findings of the literature review and the pilot study. Finally, the impact of participation in extension programs for vegetable production was identified through a simple liner regression analysis. Participation in extension programs was considered as the independent variable, and it was measured by the number of times they participated in extension programs during the last three years. For the dependent variable, the level of vegetable production by the women farmers was used. Main vegetables cultivated by these women farmers are Beans, Tomato, Okra, Capsicum, Brinjal/Eggplant and Green chili. There are two cropping seasons obtain for above noted vegetable crops per year time duration. The level of vegetable production was measured as the amount of vegetable production per unit acre (Kg/Acre).

Fig. 2. Map of the Imbulpe DS Division
Source: Annual Report of Ratnapura District, 2014.

Formula 1: Level of vegetable production by the women farmers

$$\text{Level of vegetable production} = \frac{\text{Total vegetable production per year (Kg)}}{\text{Farm land size (Acre)}}$$

FINDINGS OF THE STUDY

Socio-economic factors of the women farmers

The most important socio-economic factors of women farmers were identified, and they were studied in detail. Results are presented in Table 1.

Table 1. Socio-economic factors of women farmers (n = 145)

Factor	Category	Frequency	Percentage (%)
Age	20–39 years	33	22.7
	40–59 years	84	58.0
	60–79 years	28	19.3
Marital status	Single	07	4.8
	Married	130	89.7
	Widowed	08	5.5
Educational level	No primary education	06	4.1
	Primary education	47	32.4
	GCE (O/L)	83	57.2
	GEC (A/L)	09	6.2
Monthly income (LKR)	1–20,000	25	17.2
	20,001–40,000	108	74.4
	40,001–60,000	12	8.3
Number of family members	2–4	28	19.3
	5–7	95	65.5
	8–9	22	15.1

Source: field survey, 2019.

As per the results of table 1, most of the respondents (58%) were under the age category of 40-59 years or middle age. The mean age value of the sample was 48.81 years. Furthermore, 89.7% of respondents were married, and most of them (63.4%) had received education up to GCE Ordinary Level. Also, the majority of the respondents (65.5%) reported that they have 5-7 members in their families. Therefore, up to a certain level, they can use family labor in their farming activities. While 74.4% of women farmers have received in between LKR 20,001 – 40,000 as monthly income, 17.2% of them have reported that it is below LKR 20,000. The mean value of the respondents was LKR 15,061.76.

Agricultural extension needs and vegetable production

Agricultural extension needs for the farmers in vegetable production were studied, and they were tested with these women farmers. The findings are shown in Table 2.

Table 2. Agricultural extension needs and vegetable production (n = 145)

Items	No. of Respondents	Percentage (%)
1	2	3
Have you attended extension training programs organized by extension agents		
Yes	90	62.1
No	55	39.9
If not, why		
Not registered in the farmer organization	18	12.4
Financial constraints	07	04.8
Not invited for any one	04	02.7
Not important to me	14	09.6
Not enough time	12	08.3
How often extension training programs are conducted		
About three months' time	61	42.1
Three months – six months' time	14	09.6
Six months – nine months' time	08	05.5
More than nine months' time	04	02.7
The agricultural extension training focus on		
Modern farming technologies		
Yes	43	29.7
No	50	34.5
Application of agrochemicals and fertilizers		
Yes	59	40.7
No	31	21.4

Table 2 – cont.

1	2	3
Improved crop varieties		
Yes	34	23.4
No	56	38.6
New cropping systems		
Yes	39	26.9
No	51	35.1
Improving market systems		
Yes	64	44.1
No	26	17.9
Organic farming		
Yes	72	49.7
No	18	12.4
Does the training hold often		
Yes	71	48.9
No	19	13.1
Has your vegetable production increased		
Yes	67	46.2
No	23	15.9

Source: field survey, 2019.

Based on the findings of Table 2, a large number of women farmers (62.1%) have participated in extension training programs organized by the extension agents. However, 39.9% of women farmers haven't participated in any extension training program. Out of them, the majority has mentioned that they are not registered in the farmer organization. Therefore, their motivation to register in farmer organization is very important. Moreover, 42.1% of women farmers mentioned that extension agents are conducting extension programs during three months' time intervals. However, 51.7% of respondents mentioned that extension agents usually conduct their extension programs in six months' time intervals. As per the findings, agricultural extension agents of the study area have mainly focused on disseminating information on modern farming technologies, organic farming, application of agrochemicals and fertilizers, and improving market systems. It was significant that 48.9% of women farmers have gained their knowledge from the extension programs. Another important finding was that 46.2% of respondents mentioned that extension trainings have contributed to increases in their vegetable production.

Impact of participation in extension programs on vegetable production

The impact of participation in extension programs on vegetable production was assessed using a regression analysis. Participation in extension programs was considered as the independent variable and measured by the number of extension programs participated by the women farmers during the last three years. The dependent variable was the vegetable production of women farmers. It was measured by the amount of vegetable production per unit acre (kg/acre) per year.

Table 3. Extension program participation and vegetable production of women farmers

Participation in extension programs		Vegetable production (kg/acre)
number of extension programs*	number of women farmers	
0–5	26	110.2
6–10	37	292.7
11–15	09	296.7
16–20	18	386.7

*During three years' time period.
Source: field survey, 2019.

The number of extension programs participated in by most of the women farmers was between 6 and 10. However, a higher amount of vegetable production was shown by the respondents who participated in between 16 and 20 extension programs. The results of the regression analysis are presented in Tables 4 and 5.

As per the results of table 4, R square value (0.556) denotes a moderate level of correlation between women farmers' participation in extension programs and level of vegetable production. Also, it contributes 55.6% of the total variation in the dependent variable explained by the independent variables. $P < 0.05$ indicates that there is a significant and positive relationship between participation in extension programs and increase in vegetable

Table 4. Model summary of the impact of extension program participation and vegetable production

Model	R	R square	Adjusted R square	Std. error of the estimate	Change statistics				
					R square change	F change	df1	df2	Sig. F change
1	.746[a]	.556	.551	84.336	.556	110.402	1	88	.000

a. Predictors: (Constant), Participation in extension Program by the women farmers

b. Dependent Variable: Vegetable production of women farmers

Source: results of regression analysis.

Table 5. ANOVA[a] table of the impact of extension program participation and vegetable production

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	785250.359	1	785250.359	110.402	.000[b]
	Residual	625912.141	88	7112.638		
	Total	1411162.500	89			

a. Dependent variable: Vegetable production of women farmers

b. Predictors: (Constant) participation in extension program by women farmers

Source: results of regression analysis.

Table 6. Coefficients of the impact of extension program participation and vegetable production

Model	Unstandardized coefficients		Standardized coefficients	t	Sig.	95.0% confidence interval for B	
	B	Std. error	Beta			lower bound	upper bound
(Constant)	85.950	18.730		4.589	.000	48.729	123.172
extension program participation	18.737	1.783	.746	10.507	.000	15.193	22.281

a. Dependent Variable: Vegetable production of women farmers

Source: results of regression analysis.

production. According to Table 6, the standard error (1.78) represents the degree of deviation of observed values from the regression line in 95% confidence interval. This value should be below or approximately equal to 2.5 for the increment of the model preciseness. Therefore, this model obtains considerable precision.

The coefficient was denoted as (+) 0.746. It presents the strong, positive relationship between the women farmers' participation in extension programs and increase in vegetable production in this area. Therefore, when women farmers' participation in extension programs is higher, they can increase their vegetable production.

DISCUSSION

According to the mean age value of the sample (48.8 years), most of the women farmers represent the economically active population, and thus, they have a potential to enhance vegetable production. The average

monthly income of the respondents is in between LKR 20,001 and LKR 40,000. Hence, the majority of the women farmers have the ability to earn a considerable monthly income from their vegetable farming activities.

Based on the findings of the regression analysis, there was a significant, positive relationship between the women farmers' participation in extension programs and vegetable production in this area. Meanwhile, similar findings have been reported by a number of researchers from many other countries. According to the study of Ibharhokanrhowa (2016), in Esan West Local Government Area of Edo State, Nigeria, there is an impact of participation in extension programs in vegetable production. In addition to this, Ozoya et al. (2018), it has been reported that there is a considerable level of impact on vegetable production by participation in extension programs. Furthermore, based on the findings of the Abbeam et al. (2018) in Ghana, there is a significant impact of women farmers participation in extension programs on vegetable production. Therefore, FAO in 2003 identified the importance of dissemination of timely important extension services to enhance food production by minimizing the issues associated with food security. In addition, according to a study in Malayasia by Samsudin and Bin, 2010, extension services related to the modern farming technologies and new cropping systems have the potential to increase food production successfully. In Nigeria, agricultural extension acts as an important strategy for boosting vegetable production (Akpomedaya, 2004). The study in Kenya by Chege et al. (2018) showed that extension services positively influence the food security of smallholder farmers of the country. Nevertheless, the profitable nature of smallholder soyabeans production has been found from a gender perspective. The findings revelead that women farmers' soybean production is considerabaly lower than male farmers due to poor participation in education, extension and training programs, higher input prices, lower purchasing prices of the producers, and poor market access. Consequently, these researchers have recommend conducting extension programs for women farmers to upgrade the level of soybean production in Zambia (Mafimisebi et al., 2015).

CONCLUSION

According to the findings of the study, most of the women farmers are in middle age and married. Furthermore, the majority of them belong to the economically active population and have a sufficient level of education and potential to engage in farming without much difficulties. Moreover, up to a certain level they can also use family labor in their farming activities.

Although most of the women farmers participate in extension programs organized by the extension agents, a significant number of women farmers are not doing so, as they are not registered in the village farmer organization. Agricultural extension agents of the area have focused on disseminating information mainly regarding modern farming technologies, organic farming, application of agrochemicals and fertilizers, and improving market systems. The majority of women farmers have gained agriculture knowledge and understanding through the extension programs and use them to enhance their farming practices.

Several factors affect the vegetable production of these rural women farmers. They have comparatively poor access to their own farmlands, a lack of financial facilities, poor marketing facilities, a lack of access to agricultural extension and trainings, the problem of gender discrimination, etc. Out of these factors, access to agricultural extension program shows a conspicuous effect on vegetable production. There is a significant as well as a positive relationship between the women farmers' participation in extension programs and increase in vegetable production in the area. Therefore, when women farmers enhance their participation in extension programs, they are able to increase their vegetable production significantly. Extension service support effective dissemination of up-to-date agricultural information, facilitate well-organized information networks, and facilitate field training for women farmers. Thus, women farmers are encouraged to utilize modern farming technologies, participation in the farmer societies, input accessibility, financial facilities, and market accessibility through the extension programs.

RECOMMENDATIONS

Based on the findings of this research study, the following recommendations can be drawn for further development for vegetable production of women farmers.

- Provision of timely important and suitable extension service for the women farmers in appropriate time durations.
- Motivation of women farmers to register in farmer organizations.

- Persuasion of women farmers to participate in extension programs.
- Provision of latest agricultural knowledge regarding modern farming technologies and innovations for women farmers.

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THE EFFECTS OF SOCIO-ECONOMIC FACTORS ON THE FOOD SECURITY STATUS OF RURAL HOUSEHOLDS IN THE EASTERN CAPE PROVINCE: EVIDENCE FROM FARMING HOUSEHOLDS

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Abstract. Issues relating to food availability, accessibility, affordability, and utilization remain of paramount importance among rural households. In order to formulate or implement relevant food security programs in rural areas, it is essential to have a deep understanding of the food security status of rural households. This study sought to determine the prevalence of food insecurity among rural households in the Eastern Cape Province, as well as its key socioeconomic and demographic factors. A cross-sectional study was carried out on 240 households using questionnaires about food security. A convenience sampling method was used to collect data, along with a structured questionnaire. Descriptive statistics and binary logistic regression were used to analyze the data. The binary logistic regression model revealed that age of household head, education level of household head, access to credit, household income, and household size were all associated with food security status. Thus, this study recommends that the government at all levels (local, state, and federal) have an adequate budget allocated to increasing awareness of the benefits of participating in farming to improve the livelihood outcomes of households.

Keywords: household-level, food security, dietary diversity, socioeconomic characteristics, logistic regression model

INTRODUCTION

South Africa ranks among the countries with the highest rates of income inequality in the world. Compared to other middle-income countries, it has extremely high levels of absolute poverty (SSA, 2014). As a middle-income country, South Africa is characterised by large income inequalities and absolute poverty (Altman et al., 2009). The country's persistent social and economic inequalities have reduced access to food for the poor (Vella, 2012). Furthermore, almost half of the households in rural areas experience inadequate access to food compared to urban households (Ndobo, 2013). The biggest problem of food security has been identified as limited 'access to food' (Department of Agriculture, 2012). South Africa is faced with an acute nutrition problem which is mostly due to low incomes and a lack of proper education on food selection. Rural households are vulnerable to chronic food shortages, unbalanced nutrition, and poor-quality food. This leads to malnutrition, a consequence of an unbalanced diet, which in turn leads to poor physique and low energy output (Neumann et al., 2002). Despite the considerable efforts by national governments and the international community to reduce food insecurity and improve nutrition over the years, food insecurity and malnutrition still persist worldwide.

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Iduku et al. (2012) defined food insecurity as 'when individual human beings lack physical and economic access to healthy, nutritious, safe, and socially acceptable food to live a balanced and productive lifestyle'. Household socio-economic attributes like education, gender, age, and marital status also have a strong effect on food accessibility for low-income households (Masuku et al., 2017). Selepe et al. (2015) noted that the Eastern Cape province has the highest poverty level in South Africa. According to SSA (2016), in the Eastern Cape province, poverty rose from 41.9% in 2011 to 43.3% in 2016. Moreover, the Eastern Cape province has the highest population in all the provinces, with people depending solely on social grants to meet their food security (SSA, 2014).

Malnutrition and its associated health conditions in rural communities are largely caused by eating too little, eating too much, or eating an unbalanced diet that lacks the necessary nutrients (Cleaver et al., 2015). Undernutrition is a type of malnutrition which is defined as the failure to consume adequate energy, protein and/or micronutrients to meet the basic requirements of the body for maintenance, growth, and development. This is the leading nutrition problem in low-income communities and is characterised by low height (stunting), and low weight or being underweight. The second type of malnutrition is overnutrition, leading to being overweight as well as causing non-communicable ailments such as obesity, diabetes, and cardiovascular disease (heart attack, stroke). Scrimshaw (1994) discovered that nutrition insecurity not only has harmful effects on physical growth and work capacity, but also on cognitive development and physical activity in adults and children. Neumann et al. (2002) noted that decreased cognitive function and reduced learning capability affect the productivity not only of individuals, but also of societies and disadvantaged communities collectively. Eliminating hunger and malnutrition is one of the most fundamental challenges facing humanity (Lomborg, 2004). Malnutrition has a significant economic impact. The economic loss to a nation where malnutrition is prevalent can be estimated in terms of lost productivity per individual worker (Cleaver et al., 2015). However, although malnutrition is a problem of national significance for South Africa, it is especially problematic among families involved in subsistence farming (Neumann et al., 2002), thus revealing the weakness of land-based livelihoods in South Africa. Rural communities in the Eastern Cape province are characterized by food insecurity, which does not provide justice in terms of their right to food (Shisanya and Hendriks, 2011). With the same viewpoint, Masuku et al. (2017) stressed that in rural areas, household units lack the lobbying power to influence policymakers, which results in households being vulnerable to food insecurity induced by inadequate access to food. Several studies conducted in the Eastern Cape province attest that food insecurity is an issue that needs urgent attention (Dodd and Nyabvudzi, 2014; Selepe et al., 2015; Megbowon and Mushunje, 2018; Rogan and Reynolds, 2018).

MATERIALS AND METHODS

Study area

The study was conducted in the Eastern Cape (EC), which comprises the former homelands Ciskei and Transkei. Eastern Cape Province (ECP) is the second-largest province in South Africa in terms of land size area but has a population of just 6,562,053 (12.7% of the nation), while Gauteng and KwaZulu Natal provinces have smaller areas but are estimated to have populations of 12,272,263 million (23.7%) and 10,267,300 (10.8%), respectively (Mdoda and Obi, 2019). ECP is considered one of the poorest provinces in South Africa. It consists of six district municipalities, namely, O.R. Tambo, Chris Hani, Amathole, Alfred Nzo, Cacadu, and Ukhahlamba (Lavrakas, 2008), with two metropolitan areas called Nelson Mandela Bay and Buffalo City, and Bisho as the provincial capital (Lavrakas, 2008; UNDP, 2012). Social and cultural contexts that drive poverty are predominant in the EC. The province is characterized as a developing province that is entirely dependent on the automotive sector, through companies such as Mercedes Benz South Africa (East London), Volks Wagen, and Ford (Port Elizabeth), with two special economic zones (SEZs) (Coega in Port Elizabeth and East London), and agricultural productivity. Agricultural productivity is practiced by commercial and small-scale farmers, but small-scale farming dominates amongst agricultural activity. The province has a good health system, but poor implementation is a major challenge despite the existence of National Health Insurance, which is implemented by the province for the benefit of its citizens, both rural and urban, who are not covered by medical aid. The majority of citizens live in abject poverty, and the

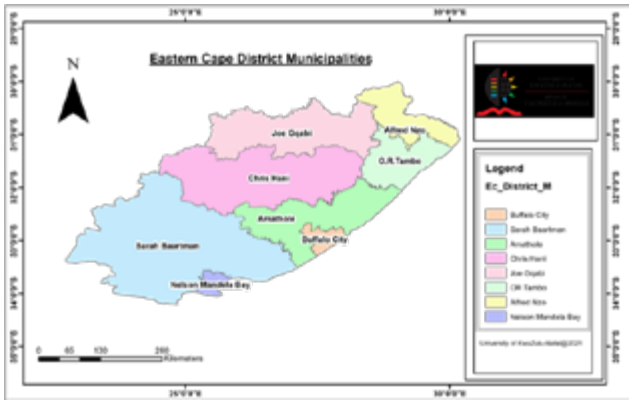

Fig. 1. Map of Eastern Cape Province

province is also bedeviled by high unemployment rates and hunger. The province is dominated by rural communities that rely mostly on agriculture for a living. It is shown diagrammatically in Fig. 1 with all its district municipalities. It is the poorest province in South Africa as the majority of the population (88%) live below the country's minimum poverty line (DAFF, 2017). As a result, unemployment is very high, resulting in people depending on social security from the government and agriculture for a living.

The province is richly endowed with natural resources ranging from luscious grazing lands and pastures to forests; from marine life to rich farming soils; and from water to wilderness. It has all seven of South Africa's ecological zones and its climate is favorable for agricultural production. The province has high rainfall with over 850 mm annually, which encourages agricultural activities. As a result, these areas are characterized by a range of farming activities, from crop production, to vegetable, citrus, and livestock farming. The agriculture in the province is dominated by subsistence farmers residing in rural communities (Chiteni et al., 2020). The crop and vegetable production currently practiced in the province includes the production of cabbage, spinach, potatoes, chicory, maize, tomatoes, and pineapples, which are all successfully cultivated, while livestock farming includes cattle, sheep, goats, pigs, and chickens. The province has abundant water supplies from numerous rivers that run from the mountains to the sea. This makes the area ideal for investigating food security and its determinants.

Sampling procedure, frame, and sample size

The approach of this paper is an inquiry that involves the descriptive approach. This study adopted a cross-section research design to capture detailed information regarding the socio and demographic aspects of the food security status of rural households in the Eastern Cape Province. The data were collected on several variables, such as demographics and household socioeconomic factors, their production, food security status, and challenges faced.

The study made use of a multi-stage sampling procedure. This procedure was used because it allows the researcher to sub-divide the study area into sections, allowing a large sample to be pooled. The first stage of the multi-stage procedure was to select the district municipalities in the province. The district municipalities were O.R Tambo district, Chris Hani, and Amatole. These were selected because their climate conditions favour agricultural production, and there is water available for irrigation purposes as there are irrigation schemes situated in these districts. The second stage involved selecting three local municipalities and 4 villages per municipality where these farmers were situated which produce vegetables. Within these three district municipalities, nine local municipalities and 16 villages were considered in this study. The last stage was to select farmers randomly to make up the sample size of 240 smallholder farmers. The unit of analysis was smallholder potato farmers. The list of smallholder vegetables was used as a sampling frame and was obtained from the Department of Agriculture, farm organizations, and extension officers working in these areas.

The study implemented a systematic and multi-pronged data collection procedure. Data was collected through a single-visit farmer survey and a household survey using a semi-structured questionnaire. The questionnaire was self-administered during single-visit interviews

Table 1. Sample size

District municipality	Sample size
OR Tambo	80
Chris Hani	80
Amatole	80
Total	240

Source: own elaboration.

with respondents and was used as the primary data collection tool using the local language, IsiXhosa. The questionnaires were arranged and administered on a farmer-to-farmer basis. The questionnaire was pretested before it was finalized. Pretesting was done to improve the questionnaire and check on essential aspects such as the time taken to complete the questionnaire and the suitability and appropriateness of the questions. Time considerations were essential in the administration of the questionnaire given the level of farmer tiredness in the study area. Pretesting was done in the same community with a few farmers who did not participate in the main survey. Data collection was conducted by six well-trained enumerators.

The respondents were questioned on farm characteristics, farm production, contribution to household well-being, and challenges encountered. The information varied from farmer to farmer. The questionnaire was structured in such a way that the first part covered socioeconomic variables such as the age of the household head, household size, off-farm income, gender, etc. The second part dealt with productive inputs, dietary factors of the rural indigent households, contribution to household livelihoods, and challenges faced. Data was collected in 2019 during the months of May and September. The unit of analysis was smallholder farmers and farming households.

Data

Table 2 below presents the collected data.

Foster-Greer and Thorbecke (FGT) food security analysis

The study made use of Foster–Greer–Thorbecke (FGT) indices to assess the food security status of the household heads. Omotayo and Aremu (2020) specified that FGT is a class of decomposable poverty measure that is used to show the various food security statuses of households. This approach is the most appropriate to estimate food security as the it involves the setting of a poverty line based on the cost (at current prices) of gaining minimum nutritional intake (Ogunniyi et al., 2021; Ozughalu and Ogwu, 2015). It combines information on the extent of food security (as measured by the head count ratio), the intensity of food security (as measured by the total food security gap), and inequality among the poor (as measured by the Gini and the coefficient of variation ratios). The household food security line was defined as two-thirds of the mean per capita household food expenditure (ZAR), and the statuses of the households were stated to be either food secure or food insecure. The households whose ZAR was above the line were categorized as food secure, while those below were food insecure. The model is shown below:

Table 2. Hypothesized influential factors of food security

Independent variable	Description	Expected relationship (+/–)
Gender of farmer	Dummy, 1 = male, 0 = otherwise	+/–
Age of farmer	Actual years	+/–
Years spent in school by the farmer	Actual years spent in school	+
Marital status of the farmers	Dummy, 1 = married, 0 = otherwise	+
Total monthly income	Actual amount	+
Size of the family	Actual number	+
Availibility of arable land	Dummy, 1 = arable land, 0 = otherwise	+
Membership in the farm organization	Dummy, 1 = member of an organization, 0 = otherwise	+
Farming experience	Actual years	+
Extension services	Dummy, 1 = access to extension services, 0 = otherwise	+
Farm size	Actual hectares	+

Source: own elaboration.

$$P\alpha = \frac{1}{n}\sum_{i=1}^{q}\left[\frac{z - y_i}{z}\right] \alpha 1 \ (y_i \leq z) \quad (1)$$

where:

1 ($y_i \leq z$) denotes that the food insecurity gap does not exist for households with mean per capita expenditure above the food security line,

$P\alpha$ – is the FGT food security index,

n – is the number of sample households,

y_i – is consumption expenditure per adult equivalent of ith household

z – represents the cut-off food security line,

q – is the number of households below the poverty line

α – is the food security aversion parameter, which takes a value of 0, 1, or 2.

Head count index (P0), poverty gap index (P1), and severity index (P2).

HeadCount Index: If $\alpha = 0$, then the FGT measure corresponds to the headcount index, in which no concern for the depth of the shortfall is given. In other words, it is the share of sampled households whose food expenditure per adult equivalent falls below the food poverty line.

Food Security Gap: If $\alpha = 1$, then FGT is equal to the mean distance that separates the food insecure household from the food poverty line (i.e., the measure of the depth of food insecurity). In other words, the food insecurity gap index offers information concerning the detachment between the food poverty line and each household's food expenditure per adult equivalent. It captures the mean aggregate consumption shortfall relative to the food poverty line across the sample. It is, therefore, a much more influential measure than the headcount ratio because it considers the distribution of the food below the poverty line. That is, it reflects the per capita cost of eradicating food insecurity.

Food Insecurity Severity Index: if $\alpha = 2$, then FGT measures the severity of food insecurity. It is sensitive to inequality among the food insecure households. It considers not only the distance separating the food insecure from the food poverty line but also inequality among the food insecure.

The FGT poverty measures were calculated using the Distributive Analysis Stata Package (DASP) version 2.3 (Maziya et al., 2020; Araar and Duclos, 2013). Food security restriction is a non-negative parameter indicating the degree of sensitivity of the food security measure to inequality among the poor. The incidence of food insecurity (headcount index), estimated when $\alpha = 0$, measures the share of households below the poverty line. The food security depth index (food security gap), estimated when $\alpha = 1$, captures information regarding how far households are from the poverty line. The food insecurity index (food security gap square), estimated when $\alpha = 2$, considers not only the distance separating the poor from the poverty line (the poverty gap) but also the inequality among the poor. TGT estimated food insecurity incidence, gap, and severity, and many previous studies have used this model, such as Sani and Kemaw, 2019; Omotayo, 2016; Obayelu and Orosile, 2015.

Modelling the probability of a household being poor

The study made use of the minimum per capita calorie adult equivalent caloric intake. In South Africa, an amount of R714 per adult equivalent per month was used as the poverty line, as recommended by Statistics South Africa in their 2016 prices (SSA, 2017). This study uses the Lower-Bound Poverty Line (LBPL) as it has emerged as the preferred threshold that is commonly used in South Africa's poverty reduction targets outlined in the Medium-Term Strategic Framework, National Development Plan, and Sustainable Development Goals. This study is in line with Maziya et al. (2020), who made use of this model to estimate household food security.

The R714 value was estimated to have a daily energy requirement of 2200 kcal per capita, as endorsed by the South African Medical Research Council for a healthy and active life. Measuring food security status using consumption expenditure is very common and is a better indicator than income for measuring household food security status. A household is considered to be poor when the household expenditure is inadequate to meet the food and other basic needs of household members.

Binary logistic regression

The study made use of a binary logistic regression model to estimate the determinants of food security in the study area. Studies such as Abdullah et al. (2019), Anyaeji and Arene (2010), Cheteni et al. (2019), Felker-Kantor and Wood (2012) used this model to estimate the factors influencing household food security status. This means that household food security status was taken as a dependent variable and regressed against 13 hypothesized

explanatory variables as indicated in the table of variables above. The logistic function is known to be flexible and applicable. This method was chosen because it is a standard analysis method when the outcome variable is dichotomously measured as having a value of 1 or 0. Household food security in this study is dichotomous as farmers and households are either affected or not affected by socioeconomic and demographic factors. Since the dependent variable, food security status of households (food secure, food insecure), is dichotomous (binary), the binary logistic regression model was used as a tool to estimate the determinant factors of food security among households. The binary logistic model empowers one to select the predictive model for dichotomous dependent variables (Ayele, 2020). It describes the relationship between a dichotomous response variable and a set of explanatory variables.

The binary logistic regression model is widely used to analyze data with dichotomous dependent variables. Hence, it was considered a suitable model to use for this study because the dependent variable was dichotomous in nature. In addition, it was essential to generate dummy variables to use the selected socioeconomic knowledge about food security status. The independent variables used in the analysis are shown in Table 2 above. Binary logistic regression is advantageous because it estimates the dichotomous outcome variables, which are more straightforward and flexible, to make the results more meaningful for interpretation (Sigigaba et al., 2021). This model was employed because it accommodates two categories in the dependent variable. It can resolve the heteroscedasticity problem, and it satisfies the cumulative normal probability distribution. Hence, the binary logistic model was selected for this study.

The model was selected because of its capacity to better answer our main research questions and because of our data and sample characteristics (the association between the variables and the slope shows how the log odds ratio in favor of food security status changes as the independent variable changes). Additionally, the significant explanatory variables do not have the same level of impact on the food security status of farmers. The relative effects of a given quantitative explanatory variable on household food security status was measured by examining food security elasticity, which is why Logit is the most suitable model to be used. The variables that were assumed to influence the household food security status were tested for multicollinearity. The Logit model was used as it offers the possibility to save the predicted variables used to estimate household food security status automatically. The binary logistic model fits this type of study due to the cumulative nature of the variables used in the study since they assume a cumulative normal distribution, which leads to efficient estimators. This model characterizes adoption by the sample farmers so that it allows maximum likelihood estimation. The model is stated thus:

$$In = \frac{[(p(y = 1/x)]}{[(1 - p(y = 1/x)]} = \alpha + \beta_1 X_1 + \ldots + \beta_n X_n \qquad (2)$$

where:

p – predicted probability of being food secure,
$1 - p$ – predicted probability of not being food secure,
α – the constant of the equation,
β – the coefficient of the independent variables,
X – independent/explanatory variables.

It must be kept in mind that the estimated coefficients do not simply affect the change in corresponding explanatory variables on the probability of the outcome. Relatively, the coefficients replicate the effects of individual explanatory variables on their log of odds. The positive coefficient displays that the odds ratio increases as the explanatory variables increase, and conversely, the odds ratio decreases as the explanatory variables decrease. The binary logistic regression coefficients were estimated by utilizing the maximum likelihood estimation methodology. As we know that the dependent variable, food security, is a dummy variable in its nature, we hypothesized that the following demographic, socioeconomic, and other factors influenced household food security status, accounting for the specific locality as shown in Table 2, because the literature suggests that food security varied considerably from one community to another, and even within the same region.

RESULTS AND DISCUSSION

Socioeconomic characteristics

Table 3 below shows the socioeconomic characteristics of the households in the study area. The descriptive results revealed that the mean age of household respondents was 45.67. 65% of the households were female and 35% male, with the majority of household members having spent about 10 years in school. The mean household size was 4.53 people with 24% employed household

Table 3. Socioeconomic characteristics of households

Variables	Mean	SD
Age	45.67	20.45
Household income	5 345.65	43.87
Household size	4.53	2.35
Years spent in school	10.23	5.32
	Frequency	Percentage
Sex		
Male	77	35
Female	143	65
Access to credit		
Yes	66	30
No	154	70
Married		
Married	119	54
Single	101	46
Occupation		
Farmer	117	53
Employed	52	24
Unemployed	51	23

Source: own elaboration.

heads and 23% unemployed household heads. About 54% of households were married and 46% were single, with a mean household income of R5 345.65. 30% of households had access to credit. However, the majority of households had no access to credit (70%).

Food security status

Household food security is conceptualized as a complex phenomenon with various aspects and differing trajectories. This study estimated food security status to understand the concept that the predicament of households facing food shortages differs depending on the scarcity households suffer, which is often unequally dispersed from one household to another. Table 4 below shows the FGT results for food security among farming households.

The measure of household food security made use of Foster–Greer–Thorbecke (FGT) Food Security analysis,

Table 4. Food insecurity levels among farm households

Food insecurity indices	FGT Value
Food insecurity incidence (headcount)	0.553
Food security gap	0.10
Food insecurity severity index	0.22
Mean per capita household food expenditure (ZAR) R714	

Source: own elaboration.

which involves a consumption expenditure threshold level below which a household or individual is considered poor. In this study, a monthly food expenditure of ZAR 714 was considered an absolute poverty level for a household, as stated by Stats SA (2017). This means that farmers and households that were unable to earn at least ZAR714 of financial resources a month to meet their consumption needs remained moderately poor. The extent of household food security status across the EC province was estimated using the FGT poverty indices. The food insecurity parameters used were measured using α parameter, which takes a value of 0, 1, or 2. The food insecurity incidence (headcount)) ($\alpha = 0$), food security gap (depth food insecurity) ($\alpha = 1$), and food insecurity severity index ($\alpha = 2$) are shown in Table 4. The results indicate that the majority of the farmers and households in the study area were poor as they fall below the poverty line. The percentage of poor households was measured in absolute headcount (0.553) as it varies between the districts. This implies that 55.3% of the sampled farmers and farming households are unable to meet the daily recommended food security threshold. The incidence of food insecurity in the province is the result of poor education, limited economic opportunities, and households that remain trapped in unproductive subsistence agriculture, as well as disadvantages entrenched in social, cultural, and political inequalities. These results were in line with Omotayo et al. (2022) and Muzah (2018), who found that rural communities are living below the poverty line, resulting in a high incidence of food insecurity. The food security gap was 0.10 (10%), which implies that if resources could be organized to meet 10% of the caloric requirement of every food-insecure household, it could reduce food insecurity by making resources available to households. The food insecurity severity index was 0.22 (22%), which

represented the severity of food insecurity of the farmers and farming households.

Estimation of the Logit regression model of determinants of food security status

A logit model was estimated to elicit the factors influencing the current food security status of households. The socioeconomic variables listed in Chapter Three in Table 3.4, were considered for the model and tested for their significance at 10%, 5%, and 1% significance levels. Five explanatory variables were identified to be possible determinants of food security in the study. These were age of household head, education, income level, access to credit, and household size. The binary logistic specification is suited to models where the endogenous variable is dichotomous, which in this case are the households who are food secure and those who are food insecure. Logistic regression provides a model for observing the probability of a household being food secure or food insecure.

Table 5 presents the results of the binary regression model and the measures of goodness-of-fit. The chi-square is (33.049; $p < 0.01$). The results show that the model was suitable for explaining the determinants of the food security status of households. Variables included in the model were significant in explaining the variation in the food security situation of the households in the study areas. These variables are age, education level, income, household size, and access to credit.

Table 5. Logistic regression analysis determining the factors affecting household food insecurity

Independent variable	Estimated coefficient	Standard error	P-value
Age	–0.017	0.008	0.022**
AnyEdu	0.800	0.283	0.005***
Income	0.00029	0.000	0.002***
Household size	–0.095	0.057	0.045**
Access to credit	0.938	0.519	0.007***
Constant	–1.243	0.567	0.028
Chi-square		35.049	
2 Log likelihood		334.207	
Cox & Snell R square		0.121	
Nagelkerke R square		0.163	
Correctly predicted		68.4%	

and * indicates significant at the 5% and 1% level respectively.
Source: own elaboration.

Estimation of the Logit regression model of determinants of food security status

A logit model was estimated to elicit the factors influencing the current food security status of households.

Income

The results suggest that household income levels were positively related to food security and significant at the 1% level. This indicates that the higher the household income, the higher the probability that the household will be food secure. An R1 increase in household income is associated with an increase in the probability of a household being food secure of 0.029%, ceteris paribus, which seems very little, but of course this is only in relation to an R1 increase. This was to be expected because increased income, other things being equal, means increased access to food. These results are supported by the research of Babatunde et al. (2007). Household income is important as it determines how much can be spent on various household needs. The quantity and quality of a household's expenditure patterns are highly correlated with the purchasing power of the household. These findings are consistent with similar studies on food security. Bashir et al. (2012) also found a positive impact of income on food security.

Age

The results show that the age of the household head has a positive estimated slope coefficient that was significant at a 5% level. This indicates that the older the household head, the higher the probability that the household will be food secure. A unit increase in the age of the household head will increase the probability that the household is food secure by 0.0041. This could be attributed to the fact that the productivity of old household heads will increase as they get older. The study also considered the possibility that there was a non-linear relationship between the dependent variable and age. This was discovered by including the square of the age variable in one of the regressions so that in every other respect it was the same as the previous logic regression and no other age variables were significant in any conventional way, meaning very few other variables were significant.

These results contradict the findings of Babatunde et al.(2007), who claimed that an increase in age decreases food security.

Household size

The results indicate that household size has a negative estimated slope coefficient which was significant at a 10% level. A unit increase in household size will reduce the probability of a household being food secure by 0.0229. These results were expected because an increase in the members of a household means more people are eating or putting pressure on limited resources. The results are in line with the findings of Oluyole et al. (2009).

Education level

According to Garrett and Ruel (1999), literate household heads are more likely to adopt new skills and ideas which in turn have positive effects on food security. The results suggest that households whose heads have at least some education are more likely to be food secure, at a 1% significance level. By contrast, Garrett and Ruel (1999) found a negative and significant association between educational level of a household head and food security.

Access to credit

The results suggest that a household's access to credit was positively related to food security and significant at a 1% level. This indicates that the higher the household's access to credit, the higher the probability that the household will be food secure. Credit, if acquired at the right time, can increase the likelihood of a household procuring production necessities such as seeds, chemicals, and fertiliser, among other inputs (Kuwornu et al., 2012), which could improve production and thus the household food situation (Iftikhar et al., 2017). It was therefore anticipated that household access to credit would positively correlate with household food security status.

CONCLUSIONS

Household food security is conceptualized as a complex phenomenon with various aspects and differing trajectories. The study estimated food security status to understand the concept that the predicament of households facing food shortages differs depending on the scarcity households suffer, which is often unequally dispersed from one household to another. The measure of household food security made use of Foster–Greer–Thorbecke (FGT) Food Security analysis, which involves a consumption expenditure threshold level below which a household or individual is considered poor. The extent of household food security status across the EC province was estimated using the FGT poverty indices. The food insecurity parameters used were measured using α parameter, which takes a value of 0, 1, or 2. The food insecurity incidence (headcount)) ($\alpha = 0$), food security gap (depth food insecurity) ($\alpha = 1$), and food insecurity severity index ($\alpha = 2$) are shown in Table 4. The results indicate that the majority of the farmers and households in the study area were poor as they fall below the poverty line. The percentage of poor households was measured in absolute headcount (0.553) as it varies between the districts. This implies that 55.3% of the sampled farmers and farming households are unable to meet the daily recommended food security threshold. A logit model was estimated to elicit the factors influencing the current food security status of households. The logistic regression model was chosen as a method of analysis because it can estimate the probability of a particular event occurring and accommodate both discrete and continuous explanatory variables. The results show that the model was suitable for explaining the determinants of the food security status of the households. The variables included in the model were significant in explaining the variation in the food security situation of households in the study areas. These variables are age, education level, income household size, and access to credit. Age, education level, and income significantly influenced household food security in the study, which is consistent with expectations from the findings of previous studies. However, household size was found to negatively influence household food security, seemingly because large family size can imply poverty with limited income and resources. Generally, the level of education of household heads was quite low in the study area. However, the education of household heads tended to be a significant determinant of household food security.

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FACTORS AFFECTING LIVELIHOOD STRATEGIES OF SMALLHOLDER TOBACCO AND NON-TOBACCO FARMERS AND OFF-FARM HOUSEHOLDS BENEFITTING FROM LAND REFORM IN ZIMBABWE

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Abstract. The main objective of this paper was to determine the factors that affect the livelihood strategies of resettled smallholder farmers in Zimbabwe. The study was conducted in Manicaland Province in Zimbabwe, and the respondents were stratified into four groups. These were smallholder farmers resettled under the A1 and A2 models, as well as tobacco and non-tobacco smallholder farmers. The two models differ in how they were implemented and supported, which might lead to them having different livelihood strategies. A total of 300 respondents were surveyed, consisting of 114 tobacco and 149 non-tobacco farmers and 24 off-farm and 13 wage-earner households in Manicaland province. The study used a Multinomial Logit model to investigate the factors influencing a household's decision to choose different livelihood strategies. In the model, the dependent variables included four livelihood strategies, while the explanatory variables included various household social-economic and institutional factors. The results obtained from the multinomial logistic regression model established that gender and land size were significant at a level of 1%, and education, household size, access to credit and access to inputs were significant at 5% in the adoption of tobacco farming, access to credit and gender were significant at a 1% level in the adoption of non-tobacco farming, while education was significant at a 10% level in adopting off-farm were found to be significant in determining the adoption of the tobacco farming in the study area up to less than 10% probability level in adopting off-farm activities. Smallholder farmers who did not adopt tobacco farming indicated that limited land size, shortage of labour and access to tobacco inputs were the major impediments to adopting tobacco farming. The government should support the efforts of smallholder farmers to increase their livelihood strategies through unveiling credit lines for farming activities. Access to inputs for smallholder farmers should be made a priority by the government through the provision and fair distribution of adequate agricultural inputs.

Keywords: livelihood strategies, land reform, multinomial logit model, Manicaland, Zimbabwe

INTRODUCTION

The agricultural sector in Zimbabwe contributes a significant amount to the national economy, livelihood support and employment (Mango et al, 2020). It generates a large proportion of national income and foreign exchange earnings. According to Chingosho et al. (2021) the agricultural sector still plays a critical role in Zimbabwe, hence it is necessary to improve agricultural development strategies if the economy is to be revived in the future. The tobacco industry in Zimbabwe experienced a decline in production to as low of 48.8 million kg in 2008, down from a peak of well over

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200 million kg in 2000 (TIMB, 2009). The tobacco industry is, however, on the road to recovery following the adoption of multiple currencies in 2009, resulting in an increase in production to about 60 million kg being produced in 2009 (TIMB, 2009). The tobacco output continued to increase, doubling to 123 million kg in 2010 and to about 144 million kg in 2012 (TIMB, 2012). According to the annual statistical report by TIMB (2020), tobacco farming generated an average of $782 m from exports in the 2020 farming season, which reveals that it's an important source of income in the country. Tobacco farming has an integral role in Zimbabwe since it is the largest tobacco leaf producer in Africa and the sixth largest in the world, after China, Brazil, India, the USA and Indonesia (Chingosho et al., 2021).

It is important to understand the factors which have influenced the livelihood strategies used in Manicaland to attain different levels of food security status. These livelihood strategies refer to the combination of choices and activities that households undertake in order to achieve their own objectives (Scoones, 1998). Several studies have established that it is increasingly difficult to rely on farming activities alone as the core activity for rural households as a way of improving livelihood and reducing poverty (e.g., Stifel, 2010 and Yishak et al. 2014). One phenomenon that is of paramount importance in the rural development literature is the promotion and support of non-farm activities. Three major directions which households can undertake to choose the combination of strategies that best suit their proposed objectives given the available resources are whether to do tobacco farming or non-tobacco farming, or to undertake non-farming activities. Different livelihood strategies are influenced by several factors which also ultimately influence the food security status of smallholder farmers.

RELATED LITERATURE

Most studies broadly classify livelihood strategies into agricultural intensification and diversification and migration of livelihood sources at the household level (Barrett et al., 2001; Galab et al., 2002; Adugna, 2005; Berehanu, 2007). Little attention is, however, given to the specifics of what comprises non-farm activities and under which localities these are constituted (Lun et al., 2018). As a result, gaps still exist in the literature with regard to the specific activities that comprise on-farm and non-farm activities at various household localities and their relative contributions to food security.

Moreover, other studies also cite the general influence of household and institutional factors on the adaptation of livelihood strategies, ranging from gender and education to credit and extension (Bezemer and Lerman, 2002; Rao et al., 2004; Holden et al., 2004; Brown et al., 2006). However, more effort is focused on econometric modelling with regard to the direction and significance of influences at the expense of looking for the specific reasons reported by respondents. More often than not, policy insights based on such approaches have errors of commission and omission. The study by Chingosho et al. (2021) investigated the prevalence of tobacco-related indebtedness among smallholder farmers and the correlates of such indebtedness in Zimbabwe. The study established that most small-scale farmers are unhappy with the financial returns on tobacco farming and most are in tobacco-related debt. This study targets both on-farm and off-farm livelihood activities, as reported by smallholder tobacco and non-tobacco farmers, with the implicit goal of understanding locality-based livelihood adaptation strategies to improve food security in their communities.

MATERIALS AND METHODS

The study area

Th study focused on the province of Manicaland, which is one of the ten provinces in Zimbabwe. Manicaland province has an altitude of 1695m and a mean summer temperature of 26°C. Manicaland province stretches across Natural Regions I to V. However, most of the province lies in Natural Regions I and II, which have high rainfall and where temperatures range from 3°C to 28°C, though there is some probability of frost in winter along the mountain regions (Jerie and Ndabaningi, 2011).

This province was chosen because it contributes a significant amount (23 percent) of the country's tobacco production (third highest tobacco producing province, with Mashonaland West being the highest on 30 percent, and Mashonaland Central on 26 percent) and because its resettled smallholder farmers in the chosen districts of Mutasa, Mutare and Makoni survive mainly from income obtained from tobacco farming (Jerie and Ndabaningi, 2011). According to Jerie and Ndabaningi, tobacco, which is mainly produced in Manicaland province, is the most important cash crop and

potentially a major source of foreign currency in Zimbabwe. Manicaland province receives an average rainfall of between 600 mm and 800 mm per annum, which is enough to support tobacco cultivation, which requires about 50 mm to 60 mm of rainfall every month (Jerie and Ndabaningi, 2011).

The specific study areas within the province (Mutasa, Makoni and Mutare) were chosen based on two main criteria. These have almost the same type of agro-ecological zone (NR I and II) and tobacco and non-tobacco farming smallholder households. Moreover, these districts generally have the same type of soils, which are fersiallitic soils (Galang, 2002). This type of soil is derived from granite which originated from granite rocks. The soils are different colours, including dark grey and light colours. Furthermore, these soils are mostly sandy, which can easily be eroded and therefore possess poor nutrient levels. As a result, these soils require good conservation and the use of several inputs such as manure and fertilisers. This means that smallholder farmers resettled in Manicaland require several livelihood assets for them to successfully undertake their preferred livelihood strategies and obtain the desired livelihood outcomes.

Sampling procedure

This study employed a multi-stage sampling technique with stratified and random components. Samples were drawn from three districts, namely Mutare rural, Mutasa and Makoni. Stratification was carried out initially according to the A1 model of land reform or the A2 model for farmers, the latter according to whether smallholder farmers are tobacco or non-tobacco farmers. The reason for the former type of stratification is that land reform emerged from different models. According to Moyo (1998), the differences in the amount of land households obtain ultimately influences the livelihood strategies of those households.

Initially, a purposive sampling technique was applied to ensure tobacco growing districts such as Mutare, Mutasa and Makoni were included. The purposive sampling technique is particularly useful since this is an evaluation research method which involves identifying the smallholder tobacco and non-tobacco farmers who were resettled for evaluation. According to Lisa (2008), purposive sampling enables the researcher to understand the actual situation on the ground better and to identify and differentiate the needs of all relevant groups involved. Random sampling was applied in each stratum to obtain the respondents for the study. A total of three hundred respondents were interviewed using a researcher administered structured questionnaire to obtain information on factors affecting the livelihood strategies of smallholder tobacco and non-tobacco land reform beneficiaries in Manicaland province in Zimbabwe.

Mathematical representation of the multinomial logit regression model

A multinomial logit regression model highlights key household attributes such as age and gender of household head, family size, farming skills, access to credit, land size, income and constraints that differentiate households pursuing different livelihood strategies. The assumption is that, to identify the determinants behind a rural household's decision to pursue various livelihood strategies in a given period, a rational household head chooses among the four mutually exclusive livelihood strategy alternatives that will make the household derive maximum utility. Following Greene (2003), suppose for the i^{th} respondent faced with j choices, the utility choice j is specified as:

$$U_{ij} = Z_{ij}\beta + \varepsilon_{ij} \quad (1)$$

If the respondent makes choice j in particular, then we assume that U_{ij} is the maximum utility the i^{th} respondent could obtain among the j utilities. So, the statistical model is derived by the probability that choice $_j$ is made, which is:

$$\Pr(U_{ij} > U_{ik}) \text{ for all other } K \neq j \quad (2)$$

Where:

U_{ij} is the utility to the i^{th} respondent form livelihood strategy j

U_{ik} is the utility to the i^{th} respondent from livelihood strategy k

According to Brown et al. (2006), the household's choice is the optimal allocation of its asset endowment if the i^{th} respondent's utility is maximised as a result of the selected livelihood strategy. As a result, the i^{th} household's decision can ultimately be modelled as maximizing the expected utility by selecting the j^{th} livelihood strategy among J discrete livelihood strategies, i.e.,

$$\max_j = E(U_{ij}) = f_j(x_i) + \varepsilon_{ij}, j = 0 \ldots J \quad (3)$$

For an outcome variable with J categories, the j^{th} livelihood strategy that the i^{th} household chooses to maximize

its utility could take the value 1 if the i^{th} household chooses the j^{th} livelihood strategy and 0 otherwise. Consequently, the probability that a household with characteristic x chooses livelihood strategy j, P_{ij} can be modelled as:

$$P_{ij} = \frac{\exp(X_i^{'}\beta_j)}{\sum_{j=0}^{J}\exp(X_i^{'}\beta_j)}, J = 0...\ 3 \qquad (4)$$

Applying the requirement that $\sum_{j=0}^{J} P_{ij} = 1$ for any i where:

P_{ij} – probability representing the i^{th} respondent's chance of falling into category j

X – predictors of response probabilities

β_j – covariate effects specific to j^{th} response category with the first category as the reference.

To remove an indeterminacy in the model, when carrying out appropriate normalization, it should be assumed that $\beta_1 = 0$ (this arises because probabilities are equal to 1, so only J parameter vectors are needed to determine the $J + 1$ probabilities) so that $\exp(X_i\beta_j) = 1$, (Greene, 2003) implying that the generalized equation (4) above is equivalent to:

$$\Pr(y_i = j / X_i) = P_{ij} = \frac{\exp(X_i\beta_j)}{1 + \sum_{j=1}^{J}\exp(X_i^{'}\beta_j)}$$

for $j = 0, 2 \ldots J$ and

$$\Pr(Y_i = j) = \frac{e^{\beta_j x_i}}{\sum_{k=0}^{j} e^{\beta_k x_i}}, j = 0,\ 1 \ldots J \qquad (5)$$

where:

β_i – a vector of coefficients on each of the household attributes i,x

β_k – the vector of coefficients of the base alternative j denotes the specific one of the $j + 1$ possible livelihood choices.

RESULTS

Farmers' demographic and socio-economic profile

The demographic and socio-economic characteristics of the sampled households in Manicaland province were analysed using descriptive statistics. These statistics include gender of the household head, marital status, age of the household head, level of education, household size, farming activities and sources of income. Response variables that had an effect on the dependence of either tobacco or non-tobacco farming on all the other response variables were tested using the Chi-square test.

The average age of the majority of smallholder farmers of both tobacco and non-tobacco was generally high as it was in the range of 45–55 years. Furthermore, the average family size for both tobacco and non-tobacco farmers was at least about seven, which is an indication of high dependency ratios. The majority of the sampled households in the resettled areas, A1 (86%) and A2 (88%), were headed by men. Furthermore, the results of this study also revealed that 90.8 percent of tobacco farming households and 84.4 percent for non-tobacco farming households were headed by men. For the tobacco and non-tobacco resettled farmers, all the respondents had at least attained primary education, which reveals that all farmers are functionally literate. The results also established that A2 farmers have much greater land holdings on average (9.067 hectares) than A1 smallholder farmers (average 3.060 hectares). Moreover, A2 smallholder farmers have been found to produce more output of tobacco (6.584 tonnes) and maize on average (3.489 tonnes), whilst A1 smallholder farmers only managed an average of 2.657 tonnes of tobacco and 1.455 tonnes of maize on average.

Results of the multinomial logistic regression

The estimation of factors affecting livelihood generation was carried out using the multinomial logistic regression model. The results of the multinomial logistic regression model are shown in Table 1 below. In the multinomial logistic regression model, the dependent variable is ordered where: 1 – tobacco farming household; 2 – non-tobacco farming household (crops and livestock); 3 – household active in off-farm activities and 4 – wage-earner household (formal employment). Examination of the literature shows that the category which is redundant should be taken as the reference category, hence formal employment was considered to be the reference category in the model. Consequently, a positive sign for the variable in the multinomial model reflects a higher likelihood of participation in the main source of income (livelihood strategy) indicated. However, a negative sign for the variable in the multinomial model reflects a lower likelihood of participation in the main source of income indicated.

The chi-square value is significant at one percent, implying that the explanatory variables taken together influence the livelihood strategies adopted by smallholder

Table 1. Results of the multinomial logistic regression in the model (model included only significant variables at 0.1 level)

Variable	Tobacco farming			Non- tobacco farming			Off- farm activities		
	Estimate	SE	P(Sig)	Estimate	SE	P(Sig)	Estimate	SE	P(Sig)
Intercept	–25.797	3.673	.000	–27.692	3.669	.000	–25.352	3.984	.000
Gender	14.908	.653	.000***	15.014	.594	.000***	0.791	0.0230	0.200
Household size	.505	.208	.015**	.422	.205	.180	.344	.225	0.127
Education	0.376	.183	0.04**	.0800	.527	.129	1.114	.620	0.072*
Land size	2.271	.712	.001***	0.278	.712	.132	.881	.752	0.242
Access to credit	3.581	1.404	.011**	5.051	1.412	.000***	0.451	0.624	0.34
Access to inputs	2.010	.920	.029**	1.587	.906	0.080*	1.457	.990	.141

N = 300 (tobacco farming household – 114; non-tobacco farming household – 149; household active in off farm activities – 24 and wage-earner household – 13). Model chi-square = 149.994; $p < 0.0001$, –2 log likelihood = 402.994, Pseudo R^2 (Nagelkerke) = 0.887. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. The reference category is: 4 (formal employment).
Source: field data.

farmers in Manicaland. The Pseudo-R^2 refers to the Nagelkerke's Pseudo-R^2. Verbeek (2008) suggests that the interpretation of the pseudo R^2 (Nagelkerke) be done with great caution since it does not have the same interpretation as the R^2 in the ordinary least square regression. A positive value means that the explanatory variable increases the chances of the livelihood strategy being pursued with an increase in its magnitude.

After including all variables which might influence household livelihood generation, the results indicated that there was an unexpected singularity in the Hessian matrix, and therefore, no meaningful conclusions could be drawn. To correct for unexpected singularities in the Hessian matrix, it was necessary to exclude some of the predictor variables which were not significant in the model such as age group, income, access to extension services, skills and several other constraints. As a result, variables which were significant at 0.1 levels were included, as shown in table 1 below.

Interpretation of econometric results

The multinomial logit regression model successfully estimated the significant variables which influenced the livelihood strategies used by resettled smallholder farmers in Manicaland. The results showed that the model had strong explanatory power since the p value obtained was less than 0.0001. Furthermore, the Pseudo R^2 (Nagelkerke) of 0.887 revealed that the explanatory variables managed to predict about 89 percent of variations in livelihood strategies for the respondents, indicating that the model was well specified. The following variables were found to be significant determinants for smallholder farmers in the study area to decide to adopt tobacco farming: gender, number of households, crop production land and challenges of access to markets and to credit. The results of the estimated equations of the final multinomial logistic regression model were discussed in terms of the significance and signs on the parameters. Table 1 shows that the set of significant explanatory variables varies across the groups in terms of the levels of significance for all livelihood choice categories.

Gender or sex of household head significantly affected the choice of livelihood strategies (both for tobacco and non-tobacco smallholder farmers) due to culturally defined roles and differential cultivation of crops, since cash crops such as tobacco farming are considered to be male crops, whilst grains and legumes are considered to be female crops in much of Africa, and particularly in Zimbabwe. This is in line with the findings of Adugna (2005) and was also stated by Zimstat (2013). Household characteristics like having a male head increased the probability of being a tobacco farmer, whilst having a female head increased the probability of the household being involved in the cultivation of non-tobacco farming for the respondents in Manicaland. This result is consistent with the results obtained by Demeke and Haji (2014), who established that male headed households

are more likely to be commercial farmers, as opposed to women, who are usually involved in subsistence farming. This is also in contrast to the findings established by Mango et al. (2020) which revealed that gender showed no significant difference in the conservation of miombo woodlands in tobacco farming regions of Mutasa in Zimbabwe. In this study, gender of household head was found to positively and significantly ($p < 0.01$) affect the livelihood strategy of the household, as expected.

Household size coefficient is positive and statistically significant at a 5% level of probability for tobacco farming. A larger family size is an important determinant for the adoption of tobacco farming, which is a labour-intensive farming practice. These results are in line with the findings of Hollaway et al. (2002), Takane (2007) and Kisaka-Lwayo (2012), who established that large family sizes are an indication of the availability of labour required for cash crops such as tobacco. Family labour is also of paramount importance in meeting the peak labour demands required for tobacco farming.

Educational level of household head (**Education**) proved to be one of the key factors which positively influences the likelihood of choosing the livelihood strategies of tobacco farming and off-farm activities. Educational attainment is crucial for understanding and adopting livelihood strategies that bring better returns, such as tobacco farming, and for understanding the need to diversify into other non-farm activities so as to reduce farming risks such as low output prices and bad weather conditions. These results are in line with the findings of Ayuya et al. (2012), which established that farmers who have attained higher education are able to analyse and respond to new and better livelihood strategies. Barret et al. (2001) also revealed that educational level is an important determinant of whether or not farmers adopt off-farm activities to diversify their earnings, which is also in line with the findings of this study. However, the results contradict the findings of Destaw (2003), who established that education has no effect on livelihood strategies. The results are also in contrast to the findings established by Mango et al. (2020), which revealed that educational level showed no significant differences in the conservation of miombo woodlands in tobacco farming regions of Manicaland in Zimbabwe.

The coefficient of **land size** was positive and statistically significant at a 1% level of probability for tobacco farming. The positive coefficient for tobacco farming households reflects the fact that larger farms appear to have a greater propensity to adopt tobacco farming, hence the necessity for more land to be given to smallholder farmers to be able to cultivate high returning cash crops such as tobacco. Smallholder farmers consider off-farm activities as an income source of last resort, hence the need for more land to be made available to them so that they can utilise it for production. These results are consistent with the studies of Balint (2005), Mahelet (2007), Takane (2007) and Demeke and Haji (2014), which showed that cultivated land size positively influenced the share of sale of cash crops and established a highly significant positive relationship between cultivated land and production of cash crops.

Access to inputs had a positive and statistically significant effect at 5% and 10% levels of probability for tobacco and non-tobacco smallholder farmers respectively. This shows that access to inputs is a key component for both tobacco and non-tobacco smallholder farmers in Manicaland. These results agreed with the findings of a survey carried out by ZimVac (2013), which established that the major reasons for reduction in the area planted by smallholder farmers were the late availability and unavailability of crop inputs. Moreover, these findings are also in line with the findings of a report by Poverty Reduction Forum Trust (2013), which reiterated that, generally, the downward trend in agricultural output by farmers in Zimbabwe is attributed to insufficient agricultural inputs.

As expected, **access to credit** for farming activities was found to have a positive and significant impact on the likelihood of choosing tobacco and non-tobacco farming. It also explains why most of the households were diversified since the majority of smallholder farmers in the study area lacked access to credit lines. These results also imply that both formal and informal credit facilities are a very important livelihood asset for rural farmers, not only for them to finance agricultural input activities, but also to acquire crucial livelihood assets such as cattle, trucks and barns. Furthermore, the results of the study consequently suggest that farmers' access to credit would play an important role in promoting smallholder farmers' agricultural output, leading to agricultural development. These results agree with the findings of Brown et al. (2006), Holden et al. (2004) and Berehanu (2007). This implies that making credit lines available to smallholder farmers will accelerate agricultural production and positively contribute to the

economic growth of a country like Zimbabwe. These findings were also supported by a report by the Poverty Reduction Forum Trust (2013) which noted that agricultural production in rural Zimbabwe is generally on the decline as a result of a lack of credit lines for farmers.

CONCLUSION

The study used a Multinomial Logit model to investigate the factors influencing a household's decision to choose different livelihood strategies. In the model, the dependent variables included four livelihood strategies, while the explanatory variables included various household socio-economic and institutional factors. The results obtained from the multinomial logistic regression model established that six variables (gender, household size, education, land size, access to inputs and access to credit) were found to be significant in determining the adoption of tobacco farming in the study area, up to less than a 10% probability level. Smallholder farmers who did not adopt tobacco farming indicated that limited land size, shortage of labour and access to tobacco inputs were the major impediments to adopting tobacco farming.

RECOMMENDATIONS

The results of the multinomial logistic regression model established that access to credit was a major challenge affecting the livelihood strategies undertaken by resettled smallholder farmers in the study area. The government should support the efforts of smallholder farmers to increase their livelihood strategies and improve the contribution of agriculture towards GDP through unveiling credit lines for farming activities. This will go a long way to enabling smallholder farmers to engage in better and higher returning livelihood strategies such as tobacco farming. Non-tobacco smallholder farmers reported that they failed to adopt tobacco farming (during data collection) due to a lack of access to credit, hence, mobilising and increasing rural credits to smallholder farmers in Zimbabwe should be prioritised during policy formulation. Consequently, Agribank needs to be enabled to effectively extend financial support to smallholder farmers in the country. Moreover, it is not entirely up to the government alone to fund agriculture, other players such as private companies and Non-Governmental Organisations (NGOs) should also chip in to help the cause, and systems should also be put in place for the bulk of agricultural production to be self-financing.

Access to inputs for smallholder farmers should be made a priority by the government through the provision and fair distribution of adequate agricultural inputs. This can be done through allocating adequate funds to the Ministry of Agriculture, as well as by supporting the Presidential Input Scheme. Private players should also play their role to ensure adequate supply of inputs to smallholder farmers. Tobacco contractors should also mobilise more funds in order to give enough inputs such as fertilizers and chemicals to contracted tobacco smallholder farmers and also to extend the facility to potential tobacco smallholder farmers. This will enable more resettled smallholder farmers to engage in tobacco farming, thereby improving their livelihood strategies.

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MARKETABLE SUPPLY OF HONEY: EVIDENCE FROM FARMERS HOUSEHOLDS IN ETHIOPIA

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Abstract. Identifying determinants of honey market supply in smallholder producers were the objective of the study. Both primary and secondary data were collected. A total of 150 honey producer households were selected randomly from honey producer households and data were collected by individual interviews using a pre-tested structured questionnaire and a focus group discussion. Secondary data were collected from published and unpublished sources. The data was analyzed using descriptive statistics and multiple linear regression models. The model result revealed that beekeeping experience, training participation, colony number, frequency of extension contact and types of beehive owned significantly affect the volume of the honey marketed. The study highlights the importance of providing training, arranging field days and creating a forum for experience sharing, providing of a modern hive and giving good extension services.

Keywords: Abuna Gindeberet, honey, market supply, multiple regressions, smallholder producer

INTRODUCTION

Ethiopia has a longer tradition of beekeeping than other countries in the world since the time of King Ezana, around the 3rd century AD, and as a result of its forests and woodlands (Workneh, 2011). Additionally, in 2013, the country produced 45,000 tons, which accounted for about 27% and of African and 3% of world honey production, making the country the largest producer in Africa and tenth in the world (FAOSTAT, 2015). However, beekeeping research and development activities were initiated in 1965 with the establishment of the Holeta Bee Research Center (HBRC), aiming to improve the productivity of the subsector (Desalegn and Kebede, 2005).

Beekeeping requires little land and is therefore an ideal activity for small-scale, resource-poor farmers (Arage et al., 2018) and is valued as an environmentally friendly agricultural activity. It mainly produces natural honey and its associated by-products - beeswax, royal jelly and pollen. However, according to the CSA (2017), Ethiopia's total honey production is about 47.71 million kg, of which the greater proportion of honey (90%) is harvested from traditional hives, with about 95% of hives being 'traditional'. The Ethiopian climate and the extended flowering season are favorable for apiculture, but beekeeping has been a marginalized activity in most developing countries and is widespread in most parts of Ethiopia (Adilo et al., 2005). Despite Ethiopia's huge potential, honey production has not been fully exploited in the country due to a number of factors (Awraris et al., 2012). According to Kassa et al. (2018), honey producers faced marketing problems due to the remoteness of some kebeles, low farm gate prices and long market chain, which results in a low level of marketing. Improved information and marketing enable farmers to

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plan their production and marketing more effectively. However, current knowledge on bee product marketing is poor and inadequate for overcoming the problems identified in the marketing system (Awraris et al., 2012).

According to Kassa et al. (2018) in their study on the factors affecting the market supply of honey in Chena district, which uses multiple linear regression model, beekeeping experience and distance from the nearest market have a significant positive and negative effect on market supply, respectively. However, the findings of the study by Tizazu et al. (2017) on the determinants of honey market supply using multiple linear regression models inferred that these variables have no significant effect on the market. In addition, Samuel's (2014) studies of the honey market chain, and the case of Sodo Zuria, multiple linear regression model findings indicate that the age and family size of the household head had a negative impact, while beekeeping training, the number of modern beehives used, the educational status of the household head, the previous year's price, total livestock holding and agro ecology were positively related with the volume of honey supplied to the market. From this we see that there is a gap between the studies on the determinants of the honey market supply from place to place, and even district to district. Even though both honey and honey by-products are economically and socially important, no study has been conducted to improve the sector. Therefore, this study helps to identify market supply determinants of honey producers in Abuna Gindeberet district.

METHODOLOGY

Study area

This study was conducted in Abuna Gindeberet district of West Shewa zone, Oromia regional state, Ethiopia. Abuna Gindeberet district is located about 170 km west of Addis Ababa and 128km from the zonal town Ambo. It is characterized as midland (32%) and low land (68%), which is about 13 midland and 28 low land kebeles. The district has a total of 44 kebeles, of which 41 are rural administrative kebeles with a total population of 181,853, where 49.93% were male and 50.07% were female. Beekeeping is practised with about 14,569 honey bee colonies, totalling approximately 299 Modern hives, 1114 Transitional hives and 13,156 Traditional hives in the study area (AGDLFDO, 2018). The district is suitable for honey production due to its favorable agro ecology and beekeeping activities, as it houses for bee forage. Honey production is commonly practised during two production seasons, but more intensively used in the first season that is during flowering season. The first and second season run from September to November and from April to May, respectively.

Types, source and method of data collection

The data were gathered using survey questionnaires from a sample of households of honey producers in the district in question. Enumerators who are working in the selected rural *kebeles* as development agents were selected for data collection. Before data collection, the enumerators were trained in the techniques of data collection and the questionnaires were pre-tested to evaluate the appropriateness, simplicity, understanding and relevance of the questions, as well as the time taken for an interview. Data were collected using a structured questionnaire from honey producer households.

Sampling procedures and sample size

A multi-stage sampling technique was employed for this study. Firstly, *kebeles* were classified in to midland and lowland agro ecology because the district has about 13 midland and 28 lowland *kebeles* and all *kebeles* were honey producers. Secondly, two *kebeles* among each agro ecology selected randomly, namely Goro jalate and Kolu from the lowland, and Yagot and Irjajo from the midland *kebeles*. The third stage, honey producers and non-producers identified and at the fourth stage, 150 sampled households were randomly selected from honey producers using probability proportional to sample size. The formula for sample size determination for a heterogeneous population is given by the Cochran's formula (1997).

$$n = \frac{pq(Z)^2}{e^2} = \frac{0.5 \cdot 0.5(1.96)^2}{0.08^2} = 150 \qquad (1)$$

where:

n – sample size
p – 0.5
q – 1-p and
e – 8% allowable error
Z – value of standard variant at a given confidence level and to be worked out from the table showing the area under the normal curve is 95% $z\alpha/2 = 1.96$

Methods of data analysis

Descriptive analysis: Inferential statistics such as the chi-2 test and t-test were used in the process of examining and describing the characteristics of the sampled household.

Econometric analysis: Different models could be employed to analyze the determinants of market supply, although the most commonly used are multiple linear regression, Tobit and Heckman's models. If some households prefer not to participate in a particular market in favor of another, while others may be excluded by market conditions, the Tobit or Heckman models are used to analyze the market (Komarek, 2010). However, in this study, multiple linear regression models were used to analyze the determinants of smallholder honey supply to the market. This model was selected because of the assumption that all honey producers participate in the market, and practical applicability. Following (Greene, 2003), the econometric model specification of supply function in matrix notation is as follows:

$$Y_i = X'\beta + U_i \quad (2)$$

where:

Y_i – amount of honey supplied to the market
β – vector of the estimated coefficient of the explanatory variables
X' – vector of the explanatory variables and
U_i – error term

When some of the assumptions of the Classical Linear Regression (CLR) model are violated, the parameter estimates of the above model may not be the Best Linear Unbiased Estimator (BLUE). Thus, it is important to check the presence of heteroscedasticity, omitted variable and multicollinearity among the variables that affect the supply of honey in the district.

Multicollinearity test: It is necessary to test the multicollinearity problem among the explanatory variables, which seriously affects the parameter estimates. According to Porter (2008), multicollinearity refers to a situation where it becomes difficult to identify the separate effect of independent variables on the dependent variable because of an strong relationship existing among them. The Variance Inflation Factor (VIF) was used to check multicollinearity among explanatory variables. As a rule of thumb, if the VIF is greater than 10, the variable is said to be highly collinear (Gujarati, 2009). A measure of multicollinearity associated with the variance inflation factors (VIF) is computed as:

$$\text{VIF} = \frac{1}{1 - R_i^2} \quad (3)$$

Where:

R_i^2 is the multiple correlation coefficients between explanatory variables, and the larger the value of R_i^2, the higher the value of VIF, causing higher collinearity in the explanatory variable.

There are a number of test statistics for detecting heteroscedasticity. The Breusch-Pagan / CookWeisberg test for heteroscedasticity was used to detect any linear form of heteroscedasticity in this model. Finally, Ramsey RESET test (test for omitted variables) was employed to test specification errors which may occur due to the exclusion of relevant variables and link test conducted for model specification.

Hypothesized variable

Table 1 shows the types and number of variables used, how the variables are described and also how the variables are measured while conducting this study.

Table 1. Summary of variables determining producers' honey market supply

Variable	Description	Type	Measurement	Hypotheses
1	2	3	4	5
SHH	Sex of the HH head	Dummy	1 – male, 0 – female	+
HHSz	Household size	Continuous	Adult equivalent	±
EDLHH	Education level of HH	Continuous	Years of schooling	+
AECOL	Agro ecology	Dummy	1 – midland, 0 – lowland	+

Table 1 – cont.

1	2	3	4	5
DISNM	Distance from nearest market	Continuous	Hours	–
EXPR	Beekeeping experience	Continuous	Years	+
TRAINP	Training participation	Dummy	1 – trained, 0 – not	+
COLONY	Number of colony	Continuous	Number	+
ACREDIT	Access to credit	Dummy	1 – yes, 0 – no	+
FEXTCO	Frequency of extension	Continuous	Number	+
TBH	Type of beehive used	Categorical	1 – traditional, 2 – traditional & transitional, 3 = traditional & modern and 4 – all	±

Source: own computations, 2019.

RESULT AND DISCUSSION

Characteristics of sampled households

According to Table 2, the family size of sampled household results revealed that the mean of the family size of household in adult equivalent was 7.30 in midland and 5.54 in lowland agro ecology with an aggregate of 6.47. Since honey is not labor-intensive agricultural activity, a large number for family size is not as important, because it increases the level of consumption at home. The t-test results showed that household size was statistically significant at a 10% significant level, meaning that the household size between lowland and midland agro ecology was not equal. In the terms of the distance to the nearest market in the study district, the average distance needed for the farmer to travel to the nearest market was about 1.12 (1:07) hour and 1.89 (1:53) walking hour for midland and lowland agro ecology, respectively, with an overall average of 1.49 (1:29) walking hour per trip. This creates variations among the sampled households to purchase inputs and to sell their produce at the required period of time and at affordable prices. The t- value inferred that there were significant differences in the distance traveled to the nearest market center at a 10% level of significance. This shows that there is a difference in walking hour for agro ecology in honey marketing.

Another importance attribute was the educational status attained by the household head during the years of schooling. Education also enables a person to perform basic communications for business purposes, as well as production practices. From all the sampled household heads, the average educational status was found to be 5 years of schooling approximately with an average of 6 and 4 years of schooling for midland and lowland agro ecology, respectively. In other words, some farmers did not attend formal education, while others attended formal education in the district up to 15 years of age. These results on the two-tail t-test show that education level was statistically significant at a 10% level of significance. This implies that there was a significant difference in educational status of lowland and midland agro ecology. In other cases, in terms of the number of colonies owned by a sampled household, there were on average about 6.22 and 9.37 honey bee colonies existing in midland and lowland agro ecology, respectively, with an aggregate of 7.71 numbers of hives in the study area. This implies that there were households with a large number of colonies to produce an ample amount of honey for sale as well as for economic growth. The result of the two-tail t-test shows that the number of colonies owned was statistically significant in between lowland and midland agro ecology at a 5% level of significance.

Regarding the types of honey beehives owned, 71.33 % of sampled households owned only traditional hives, with 30% from midland and 41.33% from lowland agro ecology. About 8.67% of the households had both traditional and modern hives. However, 13.33% of midland and 3.33 % of lowland with a total of 16.67% sampled households owned all types of beehives, which means traditional hives, transitional hives and modern hives. According to Table 2, the types of beehives owned were statistically significant at chi-squared results of 1%. This implies that there was a significant difference in having traditional

Table 2. Mean and proportion of household characteristics by agro ecology

Variables	Category	Midland (*N* = 79)	Lowland (*N* = 71)	Both (N=150)	t-/χ^2 value
Sex of the household head	Male	71(47.33)	65(43.33)	136(90.67)	0.1241
	Female	8(5.33)	6(4.00)	14(9.33)	
Family size (man equivalent)		7.30	5.54	6.47	–4.154*
Education of household head		5.62	4.03	4.87	–3.112*
Distance from nearest market		1.12	1.89	1.49	5.625*
Market information	Yes	50(33.33)	41(27.33)	91(60.67)	0.4818
	No	29(19.33)	30(20.00)	59(39.33)	
Experience in beekeeping		10.23	9.11	9.70	-0.9768
Training	Yes	53(35.33)	50(33.33)	103(68.67)	0.1932
	No	26(17.33)	21(14.00)	47(31.33)	
Access to credit	Yes	18(12.00)	10(4.67)	28(18.67)	1.8644
	No	61(40.67)	61(40.67)	122(81.33)	
Number of beehives owned	Traditional	338(29.24)	640(55.36)	978(84.60)	2.5678**
	Transitional	58(5.02)	12(1.02)	70(6.06)	
	Modern	91(7.87)	12(1.02)	103(8.91)	
Volume of honey supply		66.84	79.45	72.81	0.8781
Frequency of extension contact		1.98	1.66	1.84	–1.3403
Types of beehives owned	Traditional hive	45(30.00)	62(41.33)	107(71.33)	17.76***
	Traditional and transitional	3(2.00)	2(1.33)	5(3.33)	
	Traditional and modern	11(7.33)	2(1.33)	13(8.67)	
	All in one (all hive types in one)	20(13.33)	5(3.33)	25(16.67)	

Source: computed from survey data, 2019.

hives, transitional hives, modern hives and combination of all beehives in one between midland and lowland.

Determinants of honey market supply

Interpretation of OLS estimates is possible if and only if the basic assumptions of multiple linear regression models are satisfied. Thus, prior to running a regression of the OLS model, model specification error, existence of multicollinearity, heteroscedasticity and omitted variable test were detected.

To monitor the effect of the hetroscdasticity, robust standard error is used. The VIF test indicates no serious multicollinearity problem, where all VIF values were ranging between 1.08 and 3.04 with a mean value of VIF 1.72, which is less than 10 among continuous explanatory variables, and the Contingency Coefficient for dummy variables tested. The existence of omitted variables was also checked using the Ramsey Reset test. The results showed that there were no problems of omitted variables. Among the hypothesized eleven variables included in the regression model, five variables were found to significantly affect honey market supply at the household level.

Experience in beekeeping: As expected, the beekeeping experience of the sampled households significantly and positively affected the volume of honey sold at a 10% significance level. This result is in line with the findings of Kassa et al. (2018) and Ayantu (2018), who illustrated that as beekeepers experience increased, the volume of honey supplied to the market also increased.

Training participation: The model results imply that participation in beekeeping training significantly affected the volume of honey supplied at the 5% significance level. It is known that providing training to honey producers can fill the knowledge gap that constrained production, productivity and marketing. This is in line with the findings of Tizazu et al. (2017), and also those of Samuel (2014), who depicts beekeeping training significantly affects the volume of honey supplied at the HH level.

Number of beehives owned (colony): As hypothesized, this is a highly significant variable affecting the quantity of honey supplied to the market at a 1% significance level. This indicates that producers with more beehives can harvest a greater amount of honey and have the probability of supplying more honey to the market. Tizazu et al. (2017) and Kassa et al. (2018) confirmed that the use of a large number of colonies directly related to the amount supplied to the market and return earned by the beekeeper.

Frequency of extension contact: A contract extension was positively and significantly related to the volume of honey supplied at the 10% significance level. This is mostly due to the fact that beekeepers who frequently contact extension workers concerning the honey production, harvesting, transferring and handling methods contributed to increasing the amount of honey supplied to the market. The result is consistent with the findings of Kassa et al. (2018) and Tizazu et al. (2017).

Types of beehives owned: This is a categorical variable that affects the decisions of honey producers to sell a particular amount of the honey they produce. The model result shows that using both modern and traditional beehives, and having traditional, transitional and modern hives together affected the volume of honey supplied significantly and positively at a 5% and 1% level

Table 3. OLS estimated result of the determinants of honey market supply in the study area

Variables		Coefficient	RSE	t-ratio	p-value
Sex of household head		18.233	11.132	1.64	0.104
Household size		–0.626	1.104	–0.57	0.571
Education level		–0.685	0.842	–0.81	0.417
Agro ecology		9.419	6.474	1.45	0.148
Distance from market		4.133	3.873	1.07	0.288
Beekeeping experience		0.432*	0.248	1.74	0.084
Training participation		11.452**	4.958	2.31	0.022
Colony number		9.451***	1.220	7.75	0.000
Access to credit		0.163	7.183	0.02	0.982
Extension contact frequency		4.456*	2.547	1.75	0.082
Types of beehives owned	Trad. and Trans.	–2.184	12.037	–0.18	0.856
	Trad. and modern	30.139**	12.415	2.43	0.017
	Combination of all	40.83891***	12.64624	3.23	0.002
_cons		–51.3992***	17.85706	–2.88	0.005
Number of observation		150			
F (13, 136)		42.06			
Prob > F		0.0000***			
R-squared		0.9110			

Source: own computation from survey results, 2019.

of significance, respectively. This indicates that having only traditional hives in large number doesn't increase the volume of honey supplied in relation to the number of hives when compared with modern hives. The result was confirmed by Ayantu (2018) and Kassa et al. (2018).

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary and conclusion

The study focused on factors affecting the market supply of honey in the study area. The data were collected from a total of 150 producers using structured questionnaires. Inferential statistics and econometric (multivariate probit) models were used to analyze the data collected using STATA Software version 13 and excel sheet.

Abuna Gindeberet district is suitable for honey production due to its favorable agro ecology and availability of bee forage. The results revealed that the total production of honey was estimated to be 158,489 kg from 14,569 honey bee colonies, with late October to beginning of December being the peak honey production and harvesting season.

In conclusion, econometric results of the multiple regression models indicated that experience in beekeeping, participation in training, the number of colonies owned, the frequency of contact extensions and the type of beehives positively and significantly affected the volume of honey marketed as expected. All variables with a significant effect positively determined the amount of honey marketed in the study district.

Recommendation

From the study findings, the following policy recommendation can be made.

- Training significantly affects the honey marketed in the study area, because honey production and the management practices of the farmers are mostly based on traditional knowledge. Therefore, improving the honey producers' skills and knowledge, providing required materials and training producers will minimize problems and create the capacity for farmers to expand their production and increase the volume of honey supplied and assist faster delivery of the products. Therefore, all relevant bodies should pay attention to training provision.
- Improving the technical know-how of beekeepers based on using the best practices of experienced beekeepers as a point of reference would help to set targets in increasing market supply of honey. In particular, fostering positive attitudes toward partnership, networking and learning from one another by arranging field days, cross visits and creating a forum for experience sharing need to be developed among honey producers.
- Using a combination of different types of hives is critical in increasing productivity per hive (modern), and the efficient utilization of resources (input) is beneficiary. The relevant bodies should focus on increasing hive productivity through promoting and providing modern hives. In order to overcome the shortage of modern beehives, the government and NGO should pay attention to providing the required material, such as honey extractors.
- It is better to have a small number of modern beehives than having many traditional hives. This would increase productivity and marketing practices of farmers and enables them to link with honey and honey product marketing. To boost the marketed surplus across farmers, there is also a need to focus on the number of colonies owned, and especially modern hives by improving, facilitating and giving priority.
- The frequency of extension contacts is improved by the existing technology, bringing beekeepers into more extension services and referring them to the necessary advisory services can help beekeepers increase their honey market supply to the market.

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THE IMPACT OF THE RECAPITALISATION AND DEVELOPMENT PROGRAMME ON AGRICULTURAL PRODUCTIVITY IN SOUTH AFRICA

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Abstract. Since the dawn of democracy in 1994, the South African government has had various farmer support programmes. This study investigated the impact of the Recapitalisation and Development Programme (RADP) on agricultural production in Gauteng province, South Africa. A survey was conducted involving all 51 beneficiaries of RADP in Gauteng province. Primary data were collected through face-to-face interviews using a semi-structured questionnaire. Descriptive statistics and two-tailed t-test analysis were performed on the data using the Statistical Package for the Social Sciences (SPSS) version 24. The results show that the overall impact of RADP on agricultural production (crops and livestock) was not statistically significant. However, the area cultivated with maize and spinach improved significantly, while potatoes, soya beans, cabbage, tomatoes and green peas showed an insignificant increase in their cultivated area. It is recommended that key production requirements be identified to assist RADP in providing support that improves the agricultural production of the beneficiaries.

Keywords: support programmes, agricultural production, beneficiaries, South Africa

INTRODUCTION

Farming has many challenges because it is highly dependent on natural resources such as soil, water and vegetation. In addition, natural disasters such as hail, fire, hurricanes and floods negatively impact agricultural production (Zhang et al., 2015). Apart from natural conditions, farming also requires resources from other industries such as chemicals (pesticides, herbicides and fungicides), manufacturing (machinery and equipment) and others (Eaton et al., 2008; Alia, 2017). For most emerging farmers in South Africa who were previously disadvantaged, some of these challenges pose a bigger threat to the productivity of their enterprises. Globalisation and overly subsidised farms in developed countries present a competitive challenge for emerging farmers in developing countries (Sikwela, 2013; Scott, 2017). As a result, farmers in developed countries have access to better production technologies that enable them to produce on a larger scale and export their products to developing countries, thus creating unfair competition (Hopewell, 2019). Consequently, most emerging farmers in developing countries need support programmes to overcome these challenges. In addition, the growing global population and challenges of food security, particularly in developing countries, make it even more crucial to establish support programmes (Gautam, 2015). In South Africa, the dawn of democracy in 1994 led to the development of policies that gave some previously disadvantaged farmers access to farmlands and farmer support programmes that had only been accessible to the minority (white farmers) before this. The assistance offered by support programmes can be in various forms,

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such as financial grants, infrastructure development, production inputs, training, skills development and market access. Some of the factors that determine the type of farmer support to be offered include a business plan presenting the farm's needs, financial availability and the objectives of the programme (Xaba and Dlamini, 2015). In addition, the programme's criteria will also determine the type of support offered to the farmers (beneficiaries).

With South Africa currently going through a land reform process, previously disadvantaged groups of people have improved access to farming land (Ntlou, 2016). It is, therefore, necessary to establish agricultural support programmes to ensure food security and agricultural development (Gautam, 2015). Although access to land has improved among previously disadvantaged people in South Africa, access to resources is still a challenge. According to Binswanger-Mkhize (2014), the beneficiaries of land redistribution programmes in the country have inadequate post-settlement support. The intended beneficiaries of land reform do not always receive adequate post-settlement support; in some instances, there are delays, and, as a result, some of these farms have little to no production taking place (Prinsloo, 2008; Phatudi-Mphahlele, 2016; Shabangu et al., 2021). These delays can disturb land markets and business confidence in agriculture and result in major food insecurity (National Planning Commission, 2011). The provision of adequate resources to farmer support programmes is therefore necessary to improve food security and agricultural productivity. In developed countries, the focus of support programmes is to subsidise farmers in order to maintain a commercial standard, minimise costs associated with production and to give farmers a competitive edge, both locally and globally (Benin et al., 2013). The aim of South African farmer support programmes is to ensure sustainable agricultural production, food security and job creation in primary agriculture, as well as allowing farmers to graduate to a commercial level, ultimately transforming the agricultural sector (Cousins, 2013). Since democracy began in 1994, the South African government has introduced the following programmes: Settlement Land Acquisition Grant (SLAG), Comprehensive Agricultural Support Programme (CASP), Micro Agricultural Financial Institution of South Africa (MAFISA), Ilima Letsema, Recapitalisation and Development Programme (RADP) and Fetsa Tlala food production initiative. In a developing country such as South Africa, farmer support programmes are targeted towards land reform beneficiaries and assisting struggling emerging and subsistence farmers. Several studies have been conducted in South Africa to evaluate the impact of farmer support programmes on agricultural production. Mabuza (2016) and Phatudi-Mphahlele (2016) found that South African farmer support programmes have a positive and significant impact on crop yields. In addition, the impact on livestock production was found to be positive and statistically significant (Mabuza, 2016). A study conducted by the University of Pretoria (2015) found that crop yield and number of livestock kept by CASP beneficiaries increased in the post-support period. Nonetheless, statistically significant impacts of the programme were not determined, even though agricultural production improved.

RADP is one of the farmer support programmes introduced by the South African government in the 21st century (year 2010) to provide financial support to the beneficiaries of land reform programmes, who had little or no support after accessing land through the government (McLaren et al., 2015; DAFF, 2017a). Thus, RADP intends to support emerging and subsistence farmers in the country (DRDLR, 2013). The programme is aimed at improving the productivity of agricultural enterprises and food security, growing smallholder farmers to a commercial standard, creating job opportunities in the agricultural industry and ensuring that development in rural areas is monitored. It offers interventions such as mentorship, strategic partnerships and funding, which is required by farmers to develop their enterprises. As a result, participation in RADP is significantly influenced by strategic partnership, tax compliance, farm potential income from land acquisition and affiliation to farmers' organizations/associations (Shabangu et al., 2021). In addition, working with partners (strategic partnership) and receiving third party assistance has the likelihood to significantly increase the farm income of RADP beneficiaries. From a production perspective, the programme has significantly improved the number of livestock kept by the beneficiaries and the area under agricultural production (Mabuza, 2016). The aforementioned study that evaluated the impact of RADP on agriculture focused on areas under production and the number of livestock kept by the beneficiaries. The findings were generic because the types of crops cultivated and livestock kept were not evaluated separately. Therefore, it is difficult to ascertain the impact of RADP on each type of crop cultivated and livestock kept by the farmers. The purpose of the study

was to determine the impact of RADP on agricultural production in Gauteng province between 2010 and 2016.

MATERIALS AND METHODS

Study area

The study was conducted in Gauteng, South Africa and involved RADP beneficiaries (farmers who received support from RADP). The map of Gauteng province is depicted in Fig. 1. The province covers 1.5% of the surface area of South Africa, covering 18,178km² (South Africa Government…, 2018). Gauteng has three metropolitan municipalities (City of Tshwane, City of Johannesburg and Ekurhuleni Metropolitan municipality) and two district municipalities (Sedibeng and West Rand). According to Stats SA (2018), the province has the highest population in South Africa, with 14.7 million residents. Gauteng is situated in the economic hub of South Africa (Alexander et al., 2013) and contributes towards a third of the country's Gross Domestic Product (Stats SA, 2018). According to the Gauteng Province Treasury (2019), agriculture was the highest-growing sector in the first quarter of the 2018/2019 financial year, with a Gross Domestic Product (GDP) of 24.8%. Agricultural

Fig. 1. Map of Gauteng province
Source: Mkhize and Kanyile, 2020.

production in the province includes grains, livestock and vegetable production (Kok, 1998; Dludla, 2014). The major crops produced in Gauteng are maize, dry beans and soybeans, which make up 6%, 7% and 7% of the country's total output, respectively (DAFF, 2017b). In 2016, the province had about 24.2% of the country's layer chickens and 10.1% of broilers (SAPO, 2016).

Research approach and sampling

A quantitative research approach and a survey research design were employed in the study. The survey design has benefits in that geographical dependence is reduced when a survey design is conducted remotely; extensive flexibility in data analysis can be achieved as a result of asking many questions; the data to be collected can be of a large range; and the design is easy to administer (Wyse, 2012). The study population included all beneficiaries of RADP in Gauteng, South Africa, which included crop farmers, livestock farmers and those practising mixed farming. The initial population size from the information obtained at the Department of Rural Development and Land Reform was 124 beneficiaries. However, there were duplications on the list, and, after corrections, 70 beneficiaries were identified. It was also discovered that some of the beneficiaries on the list were not yet funded. As a result, 51 farmers benefitted from RADP before the study was conducted. Considering that the population size was 51, a census was conducted whereby all beneficiaries of the programme were selected to participate in the study.

Data gathering

Data were collected between August and December 2017, using a semi-structured survey questionnaire. The respondents who could read and write did this through face-to-face interviews and completion of the questionnaire. The research was carried out at the respective beneficiaries' farms. Beneficiaries were contacted by telephone to make appointments before being visited to conduct the interviews. The respondents who participated in this survey were required to sign a consent form before partaking in the study to indicate that their participation was voluntary and, therefore, they could withdraw at any time without penalty. The purpose of the study was explained to the respondents and sufficient opportunity was given for them to ask questions and prepare for the interview. The beneficiaries were assured that their names would not appear on the questionnaire or be mentioned in the publications resulting from this study.

Data analysis

Quantitative data was captured in Microsoft Excel 2016 and transferred into SPSS version 24.0 for analysis. Descriptive statistics and a two-tailed t-test were used to analyse the data. A t-test was chosen because it can determine significant differences between the means of two groups (Jackson, 2009; Berenson et al., 2012). To determine whether RADP significantly influences agricultural production (crop yield and number of livestock), a two-tailed test was used to analyse output "before" and "after". This included the area cultivated in hectares, yield in tons and the number of animals kept. Significant differences were determined at 5% alpha level ($p \leq 0.05$).

RESULTS AND DISCUSSION

Socio-economic and demographic characteristics of the participants

The results presented in Table 1 show that the majority (51%) of the respondents were female, of which 46–55 years was the dominant age group for RADP beneficiaries in the study area. A larger proportion (98.0%) of the respondents were black Africans and married (78.4%). Thus, the programme provided support to previously disadvantaged groups of people in South Africa and promoted gender equity. The highest educational level of most respondents was university education, with more than one third (39.2%). Therefore, most recipients of RADP could read and write because they had basic (primary and secondary) and tertiary education (university and college). Regarding acquisition of agricultural land, more than three quarters were farming on government land attained through Proactive Land Acquisition Strategy (PLAS). The findings implied that RADP was highly accessible to the beneficiaries of land reform in South Africa, especially land redistribution. On average, the farm size of the respondents was 195.4ha, with a minimum and maximum of 2.2 and 891ha, respectively. This meant that the beneficiaries of RADP were smallholder and large-scale farmers. Again, the beneficiaries of the programme were experienced farmers ($\bar{X}$ = 12.5 years) who received support about three years prior to data collection. The average family size was less than ten ($\bar{X}$ = 6 years).

Area under cultivation

According to Table 2, the number of hectares (area) on which spinach, maize, soya beans, tomatoes and green

Table 1. Respondents' socio-economic and demographic information (n = 51)

Variable	Frequency	Percent
Age		
<35	0	0.0
36–45	7	13.7
46–55	21	41.2
55–65	14	27.5
>65	9	17.6
Gender		
Female	26	51.0
Male	25	49.0
Race		
Black Africans	50	98.0
Coloured	1	2.0
Marital status		
Married	40	78.4
Single	5	9.8
Widowed	4	7.9
Divorced	2	3.9
Level of education		
University education	20	39.2
Secondary education	19	37.3
Primary education	9	17.6
College education	3	5.9
Type of land acquisition method		
PLAS	40	78.4
Private	5	9.8
Old state land	5	9.8
Restitution	1	2
Variable	(Min-Max)	Mean
Farm size (ha)	2.2-891	195.4
Family (number)	2-26	6.0
Year received RADP (years)	0-7	3.4
Farming experience (years)	2-32	12.5

Source: field data (2017).

Table 2. The impact of RADP on the area cultivated by the respondents (n = 51)

Type of crop	Average area cultivated (ha)		T-test	Significance (2-tailed)
	before	after		
Spinach	0.12	0.35	–1.439	0.156
Potatoes	0.59	0.00	1.000	0.322
Maize	25.22	64.52	–2.917	0.005
Soya beans	0.29	2.43	–1.429	0.159
Cabbage	0.02	0.00	1.000	0.322
Tomatoes	0.04	0.09	–0.988	0.328
Green peas	0.00	0.20	–1.030	0.308
Average	3.75	9.66	–0.829	0.229

Source: field data (2017).

peas were cultivated increased due to the support received from RADP, but not for potatoes and cabbage. The decrease in the cultivation area of potatoes and cabbage occurred because farmers preferred crops that are easier to cultivate and highly profitable, such as spinach. This might also be because farmers find it easier to access the market for crops such as spinach. Regarding statistical significance, the results show a significant impact on the area cultivated for maize. However, the overall impact of RADP on the area cultivated by the beneficiaries in Gauteng was insignificant (p = 0.229). In contrast, the results of a study conducted by Mabuza (2016) found a significant increase in the area cultivated by farmers in Gauteng after receiving RADP funds. Furthermore, Antwi and Nkwe (2013) reported a significant increase in land cultivated by farmers after they received government support through CASP. These results show that farmer support programmes have the potential to significantly increase cultivation areas amongst the beneficiaries. The insignificant results in the study could be a result of the number of years since RADP was received. On average, farmers received support from RADP about three years before the data were collected. The other reason could be that farming enterprises can take longer to yield a positive result and only show a significant impact in later years (Anseeuw, 2014).

Crop yields (outputs)

Table 3 shows that there was an increase in the crop yield of the beneficiaries since they received support from RADP. However, the overall impact was not statistically significant (p = 0.246). The yield of maize and spinach increased significantly at a 1% (p = 0.005) and 5% (p = 0.017) level of significance, respectively. On the other hand, the yield of soya beans, tomatoes, potatoes and green peas increased insignificantly ($p > 0.05$). Furthermore, the findings show an insignificant decrease in the yield of cabbage. This is consistent with the results of a study by Andani et al. (2020), where maize yield increased significantly because of farmer support programmes. In addition, Mabuza (2016) reported a statistically significant increase in the yield of maize for RADP farmers compared to the yield of other crops cultivated across six South African provinces (Free State, Eastern Cape, Gauteng, KwaZulu-Natal, Limpopo and North West). Phatudi-Mphahlele (2016) also found a statistically significant increase in the yield of cereal crops after farmers had received CASP. Regarding potato production, the results are in contrast to Cavatassi et al. (2010), who revealed a significant increase in the yield of potatoes for producers who received support in Ecuador. Chibbomba (2018) and Uddin and Dhar (2018) also reported increases in yield for farmers who received support in Zambia and Bangladesh. However, it was not indicated whether the increase in yield was statistically significant. This implies that support programmes do not always improve farmer's agricultural

Table 3. The impact of RADP on yield of crops cultivated by the respondents (n = 51)

Type of crop	Average yield (t)		T-test	Significance (2-tailed)
	before	after		
Spinach	0.07	0.16	–2.469	0.017
Potatoes	0.07	0.10	0.930	0.357
Maize	93.27	253.77	–2.877	0.006
Soya beans	0.88	5.51	–1.361	0.180
Cabbage	0.07	0.00	1.000	0.322
Tomatoes	0.01	0.02	–0.586	0.561
Green peas	0.01	0.07	–1.099	0.277
Average	13.48	37.09	–0.923	0.246

Source: field data (2017).

productivity. Even though the current findings show that the overall impact of RADP on agricultural productivity in Gauteng was positive and insignificant, there is a potential that yield will increase significantly in the future if they continue farming because the outputs of all crops improve.

Livestock production

Table 4 depicts that the number of broilers, layers, cattle, goats, pigs and sheep did not change significantly after the farmers had received support from RADP. On average, the significant value of the number of livestock kept (all animals) was 0.524, which shows that production did not improve significantly after support was received, though the average livestock number did increase from 326 to 814 before and after support, respectively. The low growth in small and large stock was largely because the sizes of the farms did not increase and because farmers keep livestock as a secondary enterprise. In contrast, Mabuza (2016) reported a significant increase in livestock kept by RADP beneficiaries in a study across six South African provinces (Limpopo, Eastern Cape, Free State, Gauteng, North West and KwaZulu-Natal). However, the results of these studies reflect what is happening across the six provinces, hence, in Gauteng, the findings are different. Because Gauteng is a small province, some of the factors that affect herd size include lack of camps and land degradation due to overstocking (Mapholi et al., 2014). The results from Gauteng could also be due to farm sizes not increasing when farmers receive support as Gauteng consists mostly of small farms (Prinsloo, 2008). Although the beneficiaries in Gauteng did not experience significant increases in the number of livestock kept after receiving farmer support grants, there have been improvements in animal production. This is because the number of animals such as layers, pigs and broilers increased by 148%, 88% and 29%, respectively. Nonetheless, the average number of cattle, sheep and goats did not change in the post-support period.

Table 4. Average number of animals of the respondents before and after receiving RADP (n = 51)

Type of animals	Average number of animals		T-test	Significance (2-tailed)
	before	after		
Broilers	1 922	2 551	–0.738	0.464
Layers	245	608	–01.603	0.115
Cattle	21	21	–0.028	0.978
Sheep	4	4	–0.345	0.731
Pigs	9	17	–1.180	0.244
Goats	2	2	–0.504	0.617
Average	367	534	–0.733	0.524

Source: field data (2017).

CONCLUSION AND RECOMMENDATIONS

The study found that the size of land on which the majority of the crops (spinach, maize, soya beans, tomatoes and green peas) were cultivated increased after the farmers had received the RADP funding. However, the increase was only significant for the area in which maize was cultivated (p = 0.005). Most of the crops in the study were vegetables, which explains the insignificance of the impact as these producers opted to improve production systems (e.g., acquisition of tunnels) as opposed to increasing the area cultivated. While maize farmers used RADP funds to increase the size of the land cultivated, vegetable farmers opted to build various production structures with mechanised irrigation. This in return improved the quality of their products, even though production did not significantly increase. With regard to yield, the study discovered that only the yield of maize (p = 0.006) and spinach (p = 0.017) improved significantly. This correlates with the results of the area cultivated in this study, which showed that the area cultivated with maize increased significantly. Other crops that increased in yield were soya beans, tomatoes and green peas. However, this increase was statistically insignificant. Vegetable farmers select crops to be cultivated based on season and demand, which explains the decrease in the cultivation and yield of certain crops, such as cabbage and potatoes. The beneficiaries also have limited access to reliable high-value markets, hence their inability to expand the size of the land cultivated for quite a number of enterprises. It can be concluded that RADP had an insignificant impact on livestock production because overall, the number of livestock kept by the farmers did not increase significantly, even though there was an increase after the farmers received support from the programme. Although poultry (broilers and layers) and piggery production had the highest increase

compared to other livestock types, it was not statistically significant ($p \geq 0.05$). Other livestock enterprises (sheep, cattle and goats) barely increased. In general, it is concluded that RADP did not have a significant impact on agricultural production (crop yield and numbers of livestock) in Gauteng. It is recommended that DRDLR should identify key production requirements to enable RADP to provide the type of support that will significantly improve the agricultural production of beneficiaries. Furthermore, the government should establish effective communication with beneficiaries, especially in matters related to the allocation (budgeting) of funds, to ensure that all their needs are taken into consideration during the distribution of funds, production inputs and infrastructure. In addition to the support provided to farmers through RADP, the government should consider creating a loan scheme, such as the one offered by Grain SA, to assist farmers annually with production since most do not have a title deed or, therefore, the necessary collateral to apply for loans from commercial financial institutions. This will assist farmers as receiving a one-off support package from RADP may not be sufficient to improve their production significantly.

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FACTORS AFFECTING INCOME GENERATION AMONG SMALLHOLDER FARMERS WITH AGRICULTURAL COOPERATIVE MEMBERSHIP IN ZAMBIA

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Abstract. This study analysed the effects of cooperative member characteristics on income generation among smallholder farmers in Chibombo district of Central Zambia using logistic regression from a sample size of 398 co-operative members. The aim of the study was to analyze factors affecting income generation among small-holder famers with membership in agricultural cooperatives, and to identify factors that increase their income. Data were collected in May 2020 using a questionnaire. The empirical data indicated that income increased when there were increases in the cultivated area, primary education and cooperative membership period of 5–10 years but decreased with marriage, being widowed and a farming experience period of 5–10 years. The other factors had no significant effect. Thus, the study concludes that increasing cultivated area, duration of cooperative membership and attending at least primary education would better income generation among cooperative members.

Keywords: agricultural co-operative, smallholder farmers, member incomes

INTRODUCTION

Zambia's rural population has been rated as experiencing high poverty levels (Central Statistical Office, 2015) and agricultural cooperatives have been considered an important vehicle for improving farmer incomes in a bid to reduce poverty as the heavy economic reliance on copper mining has not helped overcome it (Chisanga and Chapoto, 2015). The agricultural sector remains the most critical and important option in the fight against rural poverty due to its massive potential for increasing employment and eliminating hunger since approximately 67 per cent of the most active population in the country depends on the sector with smallholder agriculture being the main source of livelihoods and employment (Central Statistical Office, 2015). Thus, improvements in the sector are more likely to affect a considerable segment of the country's population (Lolojih, 2009; Ministry of Commerce, Trade and Industry, 2019) especially through cooperatives (Birchall, 2005). Studies on agricultural co-operatives have been widely undertaken on co-operative performance, ownership and governance, and finance, among others (Ahmed and Mesfin, 2017; Abate et al., 2014; Abebaw and Haile, 2013). Cooperatives are understood to provide the capacity to raise the scale of business performance and incomes for smallholder farmers at a higher than farm-gate level in the marketing chains (Johnson et al., 2002; Jones, 2004; Barham, 2007). Although co-operative membership has been found to improve access to better commodity prices, membership heterogeneity has been found to cause uneven distribution of the benefits and operational inefficiency (Jia and Huang, 2011). However, in spite of the known problems associated with cooperatives, they are still considered as an important vehicle

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for taking development and industrialization to the rural poor (World Bank, 2003; 2008; Chirwa, 2012) through access to high value markets (Markelova et al., 2009).

RESEARCH PROBLEM

Although cooperatives are considered as instruments for raising rural incomes, the real impact in rural Zambia is not understood due to poverty levels that have remained high. It is hypothesized that cooperatives, as business institutions, should promote social innovations and entrepreneurship for learning business skills which can drive members out of poverty (Novkovic, 2008) and developing resilience against it (Borda-Rodriguez and Vicari, 2014). Since poverty is high in rural Zambia, there are real questions as to whether cooperatives are meeting the income improvement objective among its members. Thus, the study sought to address the following questions: (a) are there member income improvements among members? (b) are there any factors associated with income changes among cooperative members? (c) if yes, what factors could be associated with income improvements and non-improvements? Based on these questions, the objectives were to isolate income improvements among cooperative members and identify factors responsible for such improvements among cooperative members in the Chibombo district of Zambia.

MATERIALS AND METHODS

The study was conducted in Chibombo district in Central Zambia in May 2020 on a population of 83,600 using a sample size of 398 small-holder farmers belonging to cooperatives selected using the Yamene (1967) equation. Members of cooperatives were purposively sampled using Snowball sampling technique. A questionnaire with questions on farmers' characteristics and whether farmers had experienced income improvements since joining cooperatives were administered. Binary data were collected and summarized for each farmer, and a correlation matrix was run to isolate strongly correlated variables. A logistic regression was finally run using STATA software on the selected variables. Income change data were collected as (0,1) with 0 being non-improvement and 1 being improvement after joining cooperatives for the dependent variable. For the selected independent variables, age was captured as (0,1) with 1 being 35–59 years and 0 being all the other years. Marital status was captured at three different levels. The married were captured as 1 and the otherwise as 0. The separated were captured as 1 and the otherwise as 0, whereas the widowed as 1 and the otherwise as 0. For education, those without education were captured as 1 and the otherwise as 0, whereas the primary educated as 1 and the otherwise as 0. On farming experience, those with 5–10 years were captured as 1 and the otherwise as 0. On off-farm income, farmers with off-farm income were captured as 1, whereas those without as 0. On land ownership, farmers with own land were captured as 1 and those without as 0. On size of cultivated area, farmers cultivating above 2 hectares were captured as 1 and those with 2 hectares or less as 0. On paid up membership, farmers with paid up membership were captured as 1 and the non-paid as 0. Lastly, on cooperative membership duration, farmers with 5-10 years were captured as 1 and the otherwise as 0. Variables such as gender, farm size, and secondary and tertiary education were left out because they were highly correlated with some of the selected independent variables. The analysis involved testing the null hypotheses that regression coefficients were significantly different from zero against the alternative that they are significantly different from zero. Farmer factors with coefficients significantly different from 0 were concluded to affect income of farmers. Among these factors, those with positive coefficients were concluded to improve farmer incomes, whereas those with negative ones were concluded not to improve incomes.

RESEARCH FINDINGS AND DISCUSSIONS

Table 1 shows the 13 variables used in the study.

Based on the mean, the table shows that respondents in the study were mostly of the age 35-59 years and were mostly married. On level of education, most respondents had primary education and most had 5–10 years of experience in farming. Respondents also had mostly off-farm incomes, had their own land, were paid up cooperative members, and had indicated improved incomes after joining cooperatives. On the contrary, most members indicated that cooperative membership was mostly not of the 5–10 years, and cultivated 2 hectares or less of their farms.

The logistic regression outputs are presented in Table 2, and they reveal that

Table 1. Description of research variable outcomes

Variable				Min	Max
AGE (35-59 or otherwise)	388	0.619	0.486	0	1
MRDOW (married or otherwise)	388	0.750	0.434	0	1
SEPOW (separated or otherwise	388	0.008	0.088	0	1
WDWOW (widowed or otherwise)	388	0.093	0.291	0	1
NEDOW (no education or otherwise)	388	0.039	0.193	0	1
PEDOW (primary education or otherwise)	388	0.608	0.489	0	1
EXP (5-10 years of experience or otherwise)	388	0.768	0.423	0	1
OFINC (off farm income or otherwise)	388	0.575	0.495	0	1
OWNLD (own land or otherwise)	388	0.979	0.142	0	1
CULTAREA (cultivated area – above 2 ha or otherwise)	388	0.461	0.499	0	1
PUPCOOPM (cooperative paid up members – yes or otherwise)	388	0.876	0.330	0	1
MEMDR (membership duration – 5–10 years or otherwise)	388	0.278	0.449	0	1
INCIMP (income change – increased or otherwise)	388	0.724	0.447	0	1

Source: own elaboration.

Table 2 shows the regression results which indicate that membership duration, cultivated area, experience, primary education, no education and marriage had an effect on income improvement since their coefficients were all significantly different from 0. Farming experience of 5–10 years, cooperative membership period of 5–10 years and cultivated area above 2 hectares were found to affect income at 1% level of significance, whereas primary education was found to significantly increase farmer incomes at 5% of level significance and no education and marriage at 10% level of significance. Thus, farming experience, cooperative membership and cultivated area were found to be the most significant factors affecting member incomes in cooperatives followed by primary education, whereas marriage and no education were found to be the least affecting factors. Of these factors, membership duration, cultivated area and primary education were found to increase incomes among cooperative members. On the contrary, experience, lack of education and marriage were found to decrease incomes of cooperative members. The table also reveals that age, marriage separation, death of spouse, off-farm income generation, owning land and being a paid up cooperative member were not found to affect incomes of cooperative members since their coefficients were found not to be significantly different from 0.

The effect of cultivated area on income seems to agree with the hypothesis in ICA (2018) which argues that membership to cooperatives increases sharing of knowledge on production skills, leading to increased sales and incomes. Furthermore, agricultural cooperative membership allows for knowledge and technological transfer owing to not only the spill-over effects but also because collective action promotes innovation and learning among members of the agriculture co-operative (Chagwiza et al., 2016). The effect of cultivated area could also be attributed to effective input use as argued by Kuteya et al. (2016). In addition to this, Chibbompa (2018) states that the current farm support has more beneficiaries than the previous system (Imboela, 2005). However, Kuteya and Kabwe (2015) argue that income improvements could only be better in good rainfall seasons since in poor seasons sales could be poor (RALS, 2015) due to risks of poor rainfall (Siegel and Alwang, 2005).

Small-land holdings could work against income generation. RALS (2012) states that 64 per cent of

Table 2. Regression results

Variable	Coefficients	P–value	Observation
Intercept	2.466	0.039	**
AGE (35-59 or otherwise)	0.007	0.980	ns
MRDOW (married or otherwise)	–0.745	0.066	*
SEPOW (separated or otherwise	19.363	0.998	ns
WDWOW (widowed or otherwise)	–0.237	0.684	ns
NEDOW (no education or otherwise)	–1.140	0.058	*
PEDOW (primary education or otherwise)	0.538	0.046	**
EXP (5-10 years of experience or otherwise)	–0.990	0.007	***
OFINC (off farm income or otherwise)	–0.322	0.231	ns
OWNLD (own land or otherwise)	–0.634	0.575	ns
CULTAREA (cultivated area – above 2 ha or otherwise)	1.335	0.000	***
PUPCOOPM (cooperative paid up members – yes or otherwise)	–0.401	0.314	ns
MEMDR (membership duration – 5–10 years or otherwise)	1.071	0.001	***
Chi-square	66.273		
Observations	388		

***$p < 1\%$, **$p < 5\%$, * < 10%, ns – $p > 10\%$.
Source: own elaboration.

smallholder farmers in Zambia own less than 2 ha of land, while 30 per cent own from 2 ha to under 5 ha and only about 6 per cent own more than 5 ha. The Crop Forecast Survey (2011) indicated that 54 per cent of the smallholders cultivated all the land they owned, while 41 per cent cultivated less than they owned and 4 per cent cultivated more than they owned. Hichaambwa and Jayne (2014) state that smallholder farmers in Zambia own less than two hectares of land. Considering that there is a direct relationship between land and agricultural production and productivity, land size limitations explain the low levels of income among smallholder farmers especially in countries where the agriculture sector predominates (Deininger and Ohinto, 1999). Since the land constraint is cross-cutting among agricultural co-operative members and non-members, its impact on low productivity is easily felt by both groups.

The insignificant effect of off-farm incomes could be synonymous with the need for alternative sources of funding from cooperative membership (Nurudeen and Olumuyiwa, 2021). Moreover, Akwabi-Ameyaw (1997), Sitko et al. (2012) and Mason et al. (2013) all argue that most agricultural co-operatives in Zambia and Africa are formed with the view to accessing government support. Co-operatives are generally seen as cost-effective channels through which benefits including subsidies, credit and training to a group of farmers may be undertaken more effectively and efficiently (Chirwa and Kydd, 2005). In addition, dealing with cooperatives allows for the government to support, although they tend to be turned into political tools for canvassing votes (Mason et al., 2016). Mason et al. (2013) found that access to farming inputs under government support had positive effects on increasing yield and incomes throughout Zambia, but the extent to which the programme's benefit was attributable to co-operative membership remains unclear because of it being used as a conduit for accessing subsidies offered by the government. Other studies such as IFAD (2018) observed that government support tends to have lower positive effects on agricultural production, productivity and incomes. Experience in cooperative membership also entails having training opportunities

that see inexperienced farmers improve on their skills and knowledge and various other capacity building efforts (OECD, 2016). King and Ortmann (2007) contends that the best way to adapt in a beneficial fashion may be through the sharing of ideas, information, and knowledge among farmers, as well as the incorporation of outside knowledge from other organisations in the private and public sectors such as government agencies, not-for-profit organisations, and international development agencies. Therefore, an agriculture co-operative developed to improve access to new ideas and methods is likely to have substantial gains in both the short and long term. It can also result in forced commercialization of small-holder agriculture (Bernstein, 2010) which leads to reduction in government support dependence in the long run (Akwabi-Ameyaw, 1997) and increases advocacy for infrastructure and policy improvement (Kuteya and Kabwe, 2015; OECD, 2016). However, there are arguments that income improvements among cooperative members could be attributed to government support rather than farmer initiative in cooperatives (Sitko et al., 2012; Mason et al., 2013; Kuteya et al., 2016). Cooperatives have also been identified as sources of income improvements through use and adoption of improved agricultural technologies as observed by Lolojih (2009).

CONCLUSION

The study concludes that farmer incomes improve among cooperative members who, generally, are in the following categories: large cultivated area, 5–10 years of cooperative membership, and primary education. Thus, higher than primary education is not necessarily critical in raising farmer incomes among cooperatives members. However, incomes tend to be lower in the following farmer categories: 5–10 years farming experience, widowed and married, but it remains more or less unchanged under the other marriage categories. Age, off-farm incomes, being paid up members and land ownership do not necessarily affect incomes of members. The study recommends primary school educated members to join cooperatives to raise their incomes. Moreover, farmers need to increase land under cultivation.

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