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## Influence of Farming Experience and Knowledge on Selection of Climate Change Resilient Strategies among Female Agripreneurs in the Mopani of Limpopo Province South Africa


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MPNG (20%): Data collection, manuscript draft writing, review & literature review.
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## Abstract

*The study examined the influence of farmers' farming experience and knowledge on their selection of climate change resilient strategies among female agripreneurs in the Mopani of Limpopo Province, South Africa. Data were collected using structured questionnaires and analyzed with the Statistical Package for Social Sciences (SPSS) version 27. Frequency and percentage were used to gain insight into the distribution of their socio-economic characteristics. A multinomial logistic regression model was used to determine the influence of farming experience and knowledge in selecting climate change resilience strategies among female agripreneurs. The study revealed that female agripreneurs with a vast farming experience of more than ten years were well-capacitated in adopting biological, chemical, and environmental resilient strategies. Furthermore, it was noted that all groups of agripreneurs had incorporated environmentally resilient strategies for their reliability, cost-friendliness, familiarity, and workload. The study also revealed that female agripreneurs who opted for technological and biological knew pest and disease control and pest scouting, respectively. The study recommends that farmers with vast farming experience be climate change resilience champions within their regions, as their experience is instrumental.*

## Introduction

Climate change has emerged as one of the most pressing global challenges of the 21st century, with far-reaching implications for various sectors, including agriculture (Intergovernmental Panel on Climate Change, 2021). The climate is changing, and the beginning and length of growing seasons are significantly impacted by it, negatively impacting the natural resources essential to agricultural production, primarily land and water (Aryal et al., 2020). According to Muluneh (2021), climate change brings greater instability in crop production, food supplies, and market prices. It will, in turn, worsen food insecurity and poverty in developing countries, adversely affecting people's livelihoods. Improved understanding of the impacts of climate change on agriculture and the adaptation practices to cope with these impacts are essential to enhance the sustainability of agriculture and to design policies that reduce poor farmers' vulnerability to climate change (Mpofu, 2021). A study conducted by Koutsoyiannis (2021) defined climate change as a change in the state of the climate that can be identified by changes in the mean and the variability of its properties and that persists for an extended period, typically decades or longer. According to the Intergovernmental Panel on Climate Change (IPCC) (2021), a leading authority on climate science, climate change, among other definitions, can be a significant alteration in Earth's climate patterns that extends beyond natural variability. According to Corwin (2021), there is a need to improve agricultural productivity and reduce yield inconsistency over time in areas where the impacts of climate change are expected to be severe.

It is evident that females are more involved in farming than males, and female farmers are more likely to adapt to resilient strategies (Addaney et al., 2021); this is also supported by a study conducted in Thulamela Municipality by Gwebu (2022), which confirmed that female farmers are the dominating group with 53.9% while male farmers made up to 46.1%. According to Addaney et al. (2021), female farmers have displayed remarkable resilience to climate change by finding innovative ways to overcome these obstacles and increase their productivity. Another study revealed that most female farmers are farming grains (maize), which helps them improve food security in their households (Dibakoane et al., 2022). The study was anchored by the increasing demand for maize and cash crops due to the rising global population. Subsequently, for the rural farmers, the increased use of maize as animal feed and commercial food calls for sustained maize production as a source of food, income, and employment for the Mopani district. The study's objectives were to identify and describe the socioeconomic characteristics of female agripreneurs within the study sample and to determine the influence of farming experience and knowledge on the selection of climate change resilient strategies among female agripreneurs.

## Methodology

The study was conducted in the Mopani district, located within the northeastern Limpopo Province, South Africa quadrant. Mopani District comprises five local municipalities: Ba-Phalaborwa, Greater Giyani, Greater Letaba, Greater Tzaneen, and Maruleng. The Mopani district, which is a Lowveld region, contributes significantly towards the activity of agriculture on the provincial level. The district has a total population of 1,092,507 and 296,320 households between Latitude 23°45'59.8 "S and Longitude 30°50'09.6 "E (Stats SA, 2021). However, the district faces challenges due to its low annual rainfall, ranging from 400mm to 900mm. This limited water availability

leads to severe water shortages and frequent drought conditions, especially in the lower-lying areas. According to Briggs (2021), the climate in this study area falls under the category of humid subtropical, characterized by dry winters and hot summers. Limpopo province is the largest producer of maize in South Africa, with 62% provided by smallholder farmers. Furthermore, maize is the most cultivated grain crop in South Africa, followed by soybeans, wheat, sunflower, and sugar cane (FAOSTAT, 2019).

The study used a simple random sampling technique to select a sample size of 104 maize and cash crops producing female agripreneurs. The study area was chosen because maize and cash crop farming significantly enhance livelihoods through consumption and income generation. A list of registered farmers was obtained from the Mopani extension service offices. Each maize and cash crop farmer was allocated a number randomly picked for inclusion in the study. The use of simple random sampling was to ensure that each farmer had an equal chance to participate in the study. The study used the Rao soft sample size calculator to calculate the appropriate sample size. A population of 142 maize and cash crop farmers was inputted on the Rao soft sample size calculator. A recommended sample size was chosen due to its 95% confidence level and margin error of 5.35%. This approach ensured that the sample was representative of the population within the study area and afforded each farmer an equal chance of being selected for the study. Face-to-face interviews were held with the respondents, and structured questionnaires were administered to the respondents.

The study used the Multinomial Logistic Regression model to analyze the influence of female agripreneurs' farming experience and their agricultural knowledge on the selection of climate change resilient strategies. The model was preferred for its strength in analyzing assessments across more than two categories (Brownlee, 2020). Therefore, the empirical multinomial logistic model was specified as:

$$Y_i = f(X1, X2..., X6) \quad \ldots\ldots\ldots\ldots (1)$$

Where Yi is the polychotomous dependent variable, it is the type of resilient strategies chosen by the agripreneurs. Due to a wide range of resilient strategies, the study a pool of commonly used strategies within the study area and further classify them into four common categories. (Yi) is defined as 0 for Biological, Technological = 1, Chemical = 2, Environmental = 3, and Mixed = 4, while Xs denote the explanatory variables. In the analysis, the mixed strategies served as a reference category.

**Table 1: Description of explanatory variables used in the analysis.**

| Name of description | Type of measurement | Expected sign |
|---|---|---|
| Emerging agripreneurs | 0=1-11 months, 1=1 year, 2=2 years,3=3 years, 4=4 years, 5= 5 years | -/+ |
| Experienced agripreneurs | 0=6 years,1=7 years,2=8 years,3=9 years | + |
| Matured agripreneurs | 0=10 years, 1= more than 10 years | + |
| Pest scouting knowledge | 0=Beginner knowledge ,1= Moderate knowledge, 2=Advanced knowledge | + |
| Pest & disease knowledge | 0= Beginner knowledge, 1=Moderate knowledge, 2=Advanced knowledge | + |
| Soil Management Knowledge | 0= Beginner knowledge, 1=Moderate knowledge, 2=Advanced knowledge | + |
| Fertilizer Management Knowledge | 0=Beginner knowledge, 1=Moderate knowledge, 2=Advanced knowledge | + |

Source: Author's computation, 2023.

## Results and Discussions

### Climate Change Resilient Strategies among Female Agripreneurs

### Biological resilient strategies

Results in Table 2 show that the selection of the biological resilient strategies by matured female agripreneurs (r=0.059) was statistically significant. The coefficient value suggests that being mature positively correlates with selecting biological strategies. The findings imply that female agripreneurs with farming experience of 10 years and above had developed and were aware of various climate change resilience strategies. Biological resilient strategies such as cover crops and rainwater harvesting are well executed by farmers who have been observant and learning the best time and procedures. Within the study sample, rainwater harvesting has been relatively low among female farmers; their selection as preferred resilient techniques is usually shared among female agripreneurs who have been in production for some time. The use of biological strategies is common among mature farmers in that they adhere to market and regulatory forces and pest resistance to conventional pesticides as they contribute to the growth of crops (Baker et al., 2020). Possessing pest scouting knowledge (r=0.000) was also statistically significant in selecting the biological resilient strategies. Pest scouting knowledge is helpful in decision-making regarding aspects such as crop nutrient management, irrigation frequency, and height management. The in-depth pest scouting knowledge develops with time; hence, women agripreneurs with such knowledge essentially opt for biological resilient strategies. Lastly, the soil management knowledge (r=0.406) also significantly influenced the selection of the biological resilient strategies.

The results also show a positive relationship between soil management knowledge and opting for biological resilient strategies. With the cover crops being part of the biological resilient strategies, the findings show that most farmers who opted for such strategies possessed soil management knowledge. Soil management knowledge includes knowing when and how to add fertilizer, which significantly contributes to other complementary resilient strategies such as the cover crop practice, hence women agripreneurs' selection of the biological resilient strategies. In a similar study, soil management knowledge enhances farmers' capacity to manage effectively the soil in a low-input environment, which guarantees adequate soil fertility (Occelli et al., 2021).

### Technological resilient strategies

Table 2 also shows that selecting technologically resilient strategies was common among the experienced agripreneurs (r=0.561). The results indicate that being an experienced woman agripreneur propelled the use of technological resilient strategies. The technologically resilient strategies women agripreneurs adopted within the study sample included resilient seeds, irrigation systems, and mixed landscapes. Women agripreneurs who opted for the technological strategies were experienced, as the use of technology is associated with specific skills and knowledge about the technology. This could be influenced by the knowledge and skills they have accumulated over the years with technological advancements. A similar study also revealed that maize farmers have been using technological advances, including cultural and landscape management practices and chemical pesticides, as their coping strategies towards the

impacts of climate change (Kasoma et al., 2021). The results also uncovered that possessing pest and disease control knowledge (r=0.259) significantly influenced the selection of technologically resilient strategies. The results imply that adopting technologically resilient strategies is rare compared to other resilient strategies as it needs specific knowledge and skill. The use of resilient seeds needs a specific skill, and it is associated with the technological advances within the agricultural sector. Hence, its adoption is associated with technology-literate farmers.

**Chemical resilient strategies**

Being matured agripreneurs (r=0.058) significantly influenced the adoption of chemical resilience strategies. The results indicate that being a matured agripreneur increases the probability of selecting a chemical resilient strategy by 0.058 units, as shown in Table 2. The results suggest that most matured agripreneurs were vested in fertilizer application and pesticides, hence the influence on adopting chemical resilient strategies as depicted by the positive coefficient of 0.058. Possessing soil management knowledge (r=0.080) statistically influenced the selection of the chemical among female agripreneurs. The findings suggest that soil management knowledge is helpful for soil structure preservation and fertilizer usage. Hence, it resonates well with the selection of chemical resilient strategies.

The study reveals that fertilizer management knowledge (r=0.206) significantly influenced the selection of chemical resilient strategies. Chemical management knowledge is handy in the correct application level of fertilizers for specific crops; hence, it largely influences farmers' adoption of chemical resilient strategies. The findings agree that fertilizer application is commonly practised among long-serving farmers. The current findings align with Safo et al. (2023), who indicated that chemical usage is dominant among experienced farmers as they find it easier to use once acclimatized with the procedures than other strategies.

**Environmental resilient strategies**

The findings show that selecting environmentally resilient strategies and their knowledge of pest and disease control are common to all three groups of farmers (Table 3). From the study, the most adopted environmentally resilient strategies among farmers were crop rotation, diversification, soil conservation, and crop management. Most environmentally resilient strategies were preferred among the farmers for their cost-friendliness and associated workload. Furthermore, adopting environmentally resilient strategies was also dominant among all the groups of farmers in that they are viewed as the traditional climate change adaptation strategies, suggesting that farmers are familiar with such strategies despite their years of farming experience. Agripreneurs who possess pest and disease knowledge (r=0.343) also select environmentally resilient strategies, which implies an increase in the probability of selecting environmental strategies when women agripreneurs accumulate more knowledge on pest and disease control. Such strategies are more concerned with environment conservation through environmentally friendly pest and disease control measures. The findings supported Bista et al. (2020), who indicated that most groups of corn producers adopt integrated pest management approaches, integrating physical, chemical, and biological methods to reduce the impact of the pest on the crops.

**Table 2: Parameter estimates of climate change resilient strategies among female agripreneurs.**

| Explanatory variables | Biological strategies | Technological strategies | Chemical strategies | Environmental strategies |
|---|---|---|---|---|
| | Coefficients | Coefficients | Coefficients | Coefficients |
| Emerging agripreneurs | .026 | -.051 | -.134 | .712 |
| Experienced agripreneurs | -.829 | .561 | -.406 | 3.690 |
| Matured agripreneurs | .059 | -.080 | .058 | 5.377 |
| Pest scouting knowledge | .000 | .000 | .000 | .002 |
| Pest & disease control knowledge | -.117 | .259 | -.011 | .343 |
| Soil management knowledge | .406 | 3.690 | .080 | .407 |
| Fertilizer management knowledge | -.058 | 5.377 | .206 | .191 |

Note: P≤0.05. Source: field survey, 2023.

## Conclusion and Recommendations

The climate change resilient strategies adopted by women agripreneurs were biological, chemical, technological, and environmental. The study uncovered that all three groups of female agripreneurs had adopted environmentally resilient strategies for their reliability, cost-friendliness, familiarity, and workload. The study recommends that women farmers with vast farming experience be climate change resilience champions within their regions, as their experiences are instrumental.

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