



AgEcon SEARCH

RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

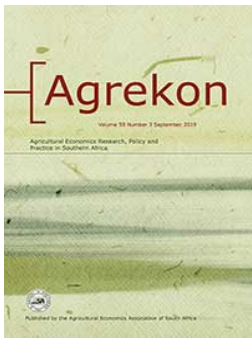
AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.



Agrekon

Agricultural Economics Research, Policy and Practice in Southern Africa



ISSN: 0303-1853 (Print) 2078-0400 (Online) Journal homepage: www.tandfonline.com/journals/ragr20

Livelihood strategies and their determinants among smallholder farming households in KwaZulu-Natal province, South Africa

Collin L. Yobe, Maxwell Mudhara & Paramu Mafongoya

To cite this article: Collin L. Yobe, Maxwell Mudhara & Paramu Mafongoya (2019) Livelihood strategies and their determinants among smallholder farming households in KwaZulu-Natal province, South Africa, *Agrekon*, 58:3, 340-353, DOI: [10.1080/03031853.2019.1608275](https://doi.org/10.1080/03031853.2019.1608275)

To link to this article: <https://doi.org/10.1080/03031853.2019.1608275>



Published online: 31 May 2019.



Submit your article to this journal [↗](#)



Article views: 671



View related articles [↗](#)



View Crossmark data [↗](#)



Citing articles: 11 View citing articles [↗](#)



Livelihood strategies and their determinants among smallholder farming households in KwaZulu-Natal province, South Africa*

Collin L. Yobe, Maxwell Mudhara and Paramu Mafongoya

School of Agricultural, Earth and Environmental Sciences, University of KwaZulu-Natal, Pietermaritzburg, South Africa

ABSTRACT

Rural people seek diverse opportunities to increase and stabilise their welfare. An understanding of factors that influence livelihood strategies adopted across rural households can further improve policy-making. This study identifies livelihood strategies adopted by smallholder farmers and the factors influencing the choice of their strategy. A structured questionnaire was administered to 400 randomly selected rural households from the Umzimkhulu and Ndwedwe local municipalities in the KwaZulu-Natal province of South Africa. Principal component analysis (PCA) and K-means cluster analysis were used to analyse the outcomes. The application of PCA on dummy variables depicting participation in livelihood activities reduced the number of dimensions. Next, PCA factor loadings served as input into K-means cluster analysis; K-means clusters represented household livelihood strategies. Multinomial logistic regression applied to the K-means clusters determined factors influencing the choice of livelihood strategies at the household level. The results indicate that years of formal education, household size, dependency ratio, arable dryland area accessed by the household, and savings of household heads, the location of the household and source of agricultural information were the main determinants of livelihood choice. These findings suggest that policymakers should design policies that are sensitive to household-level characteristics in promoting livelihood strategies.

ARTICLE HISTORY

Received 19 February 2018

Accepted 28 March 2019

KEYWORDS

Rural households; livelihood strategies; principal component analysis; K-means cluster analysis; multinomial logistic regression

JEL CLASSIFICATION

O180; Q120

1. Introduction

Rural households pursue a number of strategies that generate income required to meet their livelihood objectives and farming is an integral part of such strategies (Babulo et al. 2008). Puttergill et al. (2011) highlight that rural household's preferences are shifting towards consumer-based lifestyles and these preferences require cash income. The requirement to sustain such preferences is a strong motivation for rural households to engage in many livelihood activities. Several studies have shown that rural households adopt and engage in a range of livelihood activities to sustain their objectives (Fabusoro et al. 2010; Mutenje et al. 2010; Alemu 2012; Diniz et al. 2013).

A livelihood strategy is "an organized set of lifestyle choices, goals and values, and activities designed to secure an optimum quality of life for individuals and their families or social groups"

CONTACT Collin L. Yobe ✉ collinyobe@gmail.com 📧 School of Agricultural, Earth and Environmental Sciences, University of KwaZulu-Natal, Private Bag X01, Scottsville 3209, Pietermaritzburg, South Africa

*The article is based on the following paper delivered at the conference –Yobe, C.L., Mudhara, M., Mafongoya, P. 2016. Determinants of Livelihood Strategies among Households in Smallholder Farming Systems: A Case of Kwazulu-Natal, South Africa. Presented at LEVSA/AEASA conference 2016, Muldersdrift, Gauteng. Link: https://c.yomcdn.com/sites/www.aeasa.org.za/resource/collection/5E4D51D5-AECB-47C5-91CA-8569C7C087DD/programme_final_2016corr.pdf.

(Walker, Mitchell, and Wismer 2001). Poor households adopt livelihood diversification for survival, while richer households use this strategy for the accumulation of income (Motsholapheko, Kgathi, and Vanderpost 2012). Mutenje et al. (2010) suggested that diversification pursued as a survival strategy is called distress-push or desperation-led diversification, and when pursued as an accumulation strategy it is called opportunity-led diversification. Motsholapheko, Kgathi, and Vanderpost (2012) underscore that the economic status of a household is an important determinant of the diversification strategy it adopts. They also add that rich households may find it relatively easy to pursue opportunity-led diversification because they have the resources and financial investments at their disposal that enable them to access such opportunities. Dossa et al. (2011), Diniz et al. (2013) and Nainggolan et al. (2013) have shown that livelihood strategies can be clustered to reveal existing typologies. From their work, we learn that clustered livelihood activities are important in distinguishing the different interaction of the livelihood strategies of rural households, exploring the diversity within rural communities, and allowing researchers to gain a better understanding of the nature of these typologies.

In view of the diversification strategy identified above, rural households in developing countries allocate their labour to farming and non-farming sectors. In South Africa, the common livelihood strategies among rural households are migration, agriculture and social grants (Todes et al. 2010; Alemu 2012; D'Haese et al. 2013; De Cock et al. 2013). The contribution of agricultural income towards the total rural household income is small compared to other income sources (Van Averbeké and Khosa 2007; De Cock et al. 2013). Most rural households who practice farming, do so for subsistence (Puttergill et al. 2011; D'Haese et al. 2013; De Cock et al. 2013) and/or income (Twine 2013; Sikhweni and Hassan 2014). According to Scoones (2009), diverse livelihoods emerge from multiple activities interacting with each other.

Several factors influence smallholder farmers' choice of livelihood strategies and dependence on agriculture (Ellis 1998; Alemu 2012). Household-level factors include assets, demographic composition and economic characteristics, while exogenous factors include technologies, access to markets, etc.. An understanding of the factors influencing the livelihood strategies among rural households can lead to improved policy-making, well-being, and economic growth towards meeting the targets set in the National Development Plan (NPC 2013) and those of the Department of Agriculture, Forestry and Fisheries (DAFF 2013).

Apart from understanding rural households' preferred livelihood strategies, underlying determinants driving them towards any of the livelihood choices are equally important for an investigation. These livelihood strategies can clarify the dynamics of choices made by rural households. Such clarification may allow for suitable policy interventions that can address the challenges faced by rural households.

This study seeks to identify the livelihood strategies made by rural households in KwaZulu-Natal (KZN) and the factors that influence their choices of a livelihood strategy. The hypotheses for the study are that rural households differ in their choice of livelihood strategies, and specific household characteristics determine the livelihood strategy they pursue.

2. Data and methods

2.1 Study site

Data were collected from two local municipalities (LMs), i.e., Ndwedwe and Umzimkhulu in the KZN province of South Africa. The purposively selected LMs represent areas with significant agricultural production. KZN is in the southeast of South Africa. Ndwedwe LM is situated 60 km north of Durban and approximately 20 km north-west of Tongaat, in the Ilembe District Municipality (DM) (29.531°S 30.934°E). Ndwedwe has a population of 140,820 people and comprises 29,200 households, of which 13,710 practise agriculture (Stats SA 2015). Umzimkhulu local municipality (LM) falls under Harry Gwala DM. Umzimkhulu town is located 105 km from Pietermaritzburg and 18 km south-west of Ixopo (30.263°S 29.940°E). Umzimkhulu LM is home to 180,302 people and has 42,909 households,

24,538 being agricultural (Stats SA 2015). These LMs are in the rural areas of KZN South Africa and provide a good location for a case study. The 2011 census reveals the difference in the unemployment rate (46.6% vs 48.7%) and the proportion of non-income earning households (15.6% vs 33.0%) between Umzimkhulu and Ndwedwe, respectively (Stats SA 2015).

2.2 Data collection

Data were collected between February and April 2015 through household surveys, using a structured questionnaire. The questionnaire was pre-tested before being administered to 400 households. The sample size was determined by the guidelines provided by Israel (1992). Given that the total number of households from the two LMs was 72,109, the guidelines provide that sample sizes of 370, 383, and 384 would have a 5% margin of error on a 95% confidence level for population sizes of 10,000, 100,000, and 500,000, respectively. A sample size of 400 households would be adequate for this study. A multi-stage random sampling was used. At the first stage, wards were selected from each LM and households were randomly sampled at the second stage. Umzimkhulu has 20 wards, and Ndwedwe has 19. The questionnaire captured information on the household demographic composition, socioeconomic factors, and livelihood activities of rural households. The questionnaire was adapted from a study by Babatunde and Qaim (2010) and captured questions on livelihood activities. Respondents identified the activities in which they participated and the income generated from each of them.

Six trained enumerators fluent in both Zulu and English conducted the interviews in isiZulu. The enumerators were familiar with the study areas and had experience in questionnaire administration. In cases where the household head was absent, the enumerators were able to complete the questionnaire using information obtained from the available household members. Data were coded, entered and cleaned before analysis and the analysis was then conducted by means of the Statistical Package for Social Science (SPSS).

2.3 Analytical techniques

2.3.1 Multivariate approach for classification

The study used the multivariate approach to develop typologies of livelihood strategies, i.e., principal component analysis (PCA) and K-means cluster analysis. PCA is a multivariate statistical method used to reduce the number of variables into a smaller number of “dimensions”, with minimal loss of information (Jolliffe 2002). PCA attempts to reduce the dimensionality of the data by obtaining a few orthogonal linear combinations, i.e., PCs, of the original variables with the largest variance; these new variables in the PCA account for as much variation in the original data as possible (Jolliffe 2002; Manly 2005). This means that the first PC is the linear combination with the largest variance, while the second one is the linear combination with the second largest variance and orthogonal to the first PC, and so forth. According to Costello and Osborne (2005), Varimax rotation is used for simplifying the factor structure of the data and therefore making its interpretation easier and more reliable. They add that basic aspects of the analysis, such as the amount of variance extracted from the items, cannot be improved by this rotation. Furthermore, they mention that Varimax rotation, which produces factors that are uncorrelated, is the most preferable rotation method over other available rotation orthogonal methods (i.e., quartimax, and equamax).

Following Diniz et al. (2013), Nainggolan et al. (2013) and Dossa et al. (2011), the retained components from PCA were used as inputs in the K-means clustering technique. Kaur and Kaur (2013) point out that PCA scores are suitable inputs for the K-means cluster analysis since K-means algorithm requires continuous and numeric variables. Therefore, to apply K-means clustering directly to qualitative data, e.g., on dummy variables representing livelihood strategies, is inappropriate. Hair et al.

(2006) add that K-means cluster analysis corrects for potential misclassification of observations at the boundaries between clusters.

Dichotomous variables for household livelihood activities captured in the data, i.e., household involvement in cropping, livestock, social grants, agricultural wages, non-agricultural wages, self-employment, remittance and migration, lack a clear group structure. These activities fail to show combinations of activities of the households. Jolliffe (2002) posits that cluster analysis is important in cases where such a group structure is lacking. Following Vyas and Kumaranayake (2006), and Achia, Wangombe, and Khadioli (2010), PCA was applied to the dummy variables to reduce the dimensionality of the data and categorise the households into distinct livelihood strategies (Jolliffe 2002). The PCA scores of livelihood strategies which were initially extracted and retained were followed by Varimax rotation, for the reasons highlighted above. The Kaiser–Mayer–Olkin (KMO) and Bartlett’s sphericity tests were used to assess the suitability of the variables for PCA. According to Hair et al. (2006), variables are considered suitable if the KMO values are greater than 0.5 and Bartlett’s sphericity test is statistically significant at $p < .05$. PCs with Eigenvalues equal to or greater than 0.7 were retained, following (Jolliffe 2002).

Garson (2009), cited in Chibanda, Ortmann, and Lyne (2009), suggested that hierarchical clustering is suitable for data sets with a sample size of less than 250. According to Kaur and Kaur (2013), K-means algorithm performs better than hierarchical algorithm on data sets with observations greater than 250. Therefore, this makes K-means clustering appropriate for a data set with 400 observations. This technique identified and classified the respondents into a reasonable number of clusters that best represent their livelihood strategies.

2.3.2 Multinomial logistic regression

A multinomial logistic (MNL) regression model was used to estimate the effects of the variables that determine the household choice of livelihood strategies. The explanatory variables in the model are livelihood assets and socioeconomic factors (e.g., the number of household members and income). The motivation for using this model was to predict the likelihood of a household with given characteristics, choosing an identifiable combination of livelihood activities.

The probability associated with a smallholder household choosing a livelihood strategy is denoted P_{nj} ($j = 1, 2, 3$ and 4), where n represents the household; $j = 1$ represents the rural household choosing livelihood strategy in cluster 1; $j = 2$ represents the rural household choosing livelihood strategy in cluster 2; and so on. If the unobserved portion of the utility (ϵ_n) is identically and independently distributed (iid) across alternatives, then the MNL model is specified according to (Train 2009), as follows:

$$P_{nj} = \frac{e^{(\beta' X_{nj} + \gamma' H_{nj})}}{\sum_{j=1}^4 e^{(\beta' X_{nj} + \gamma' H_{nj})}} \tag{1}$$

1) If the β s and the γ s are set to zero for one of the activities (for instance, cluster 1), the MNL model for each activity ($j \neq 1$) can be expressed as:

$$P_{nj, j \neq 1} = \frac{e^{(\beta' X_{nj} + \gamma' H_{nj})}}{1 + \sum_{j=2}^4 e^{(\beta' X_{nj} + \gamma' H_{nj})}} \quad (j = 2, 3 \text{ and } 4) \text{ and}$$

$$P_{n1} = \frac{1}{1 + \sum_{j=2}^4 e^{(\beta' X_{nj} + \gamma' H_{nj})}} \tag{2}$$

where H_n is a random disturbance and X_{nj} are the explanatory variables.

Table 1. Explanatory variables used in the multinomial logistic model (MNL) model and their definitions.

| Variable name | Variable definition |
|-----------------|--|
| AGE_HEAD | Age of the household head in years |
| EDUCATION_YEARS | Years of formal education of the household head |
| GENDER | Sex of the household head (Dummy: GENDER = 1 if the head is male; and 0 if otherwise) |
| HHLID_SIZE | Size of the household represented by the number of household members |
| DPNDCY_RATIO | Dependency ratio of the household. This ratio is computed by dividing the sum of dependents (i.e., 0–14 and above 65 years) by the rest those aged between 15–64 |
| TOT_ASSETS | Total value of household assets (in South African rands) |
| TOT_INCM | Total annual amount of income (in South African rands) earned and/or received by the household unit |
| DRYLANDSIZE | Hectarage of dryland accessed by the household for crop production |
| SAVING_DMY | Savings (both formal and informal) of the household per year (Dummy: Yes = 1 if the household has savings; and 0 if otherwise) |
| AREA_DMY | Location (Dummy: Ndwedwe = 1, Umzimkhulu = 0) |
| EXTWORK_EXT | PCA index representing extension workers as information sources |
| COMMNTY_EXT | PCA index representing the community meetings as information sources |
| COMMODTY_EXT | PCA index representing the commodity organisation as information sources |

2.4 Description of the explanatory variables

Table 1 presents the descriptions of the explanatory variables selected for the MNL regression.

According to Khatun and Roy (2012), educational level of household members may lead to livelihood diversification. They posit that educated household members secure salaried jobs, and the less educated and illiterate ones take up wage-earning occupations. Studies by Jogo and Hassan (2010) and Khatun and Roy (2012) show that uneducated rural household members are more likely to engage in livelihood activities that do not need formal learning as a prerequisite. Also, Jogo and Hassan (2010) emphasise that education is crucial for better employment opportunities in the non-farm sector. Fabusoro et al. (2010) observed that households that are large and have an extended family structure tend to have some of its members access livelihood activities such as migration. Rural households in South Africa with high dependency ratios frequently their members receive social grants (Todes et al. 2010). Khatun and Roy (2012) also observed that the location of a household influences livelihood diversification; variation in location-specific agro-climatic factors can affect the choice of livelihood strategies such as the case with agriculture. Overall, these studies reveal the effects of some of the variables on the choice of a livelihood strategy.

3. Results

This section presents results of the household demographic setting, livelihood strategies and multivariate analysis.

3.1 Household demographics and description of livelihood strategies

Table 2 provides summary statistics of the independent variables. The average age of household heads was 57 years. Their average years of formal education were six years, and the average household size was six members. The mean values of the independent variables are shown for all the clusters. For example, the dependency ratio is the least in Cluster 2 with a value of 27.97 which is much less than the overall sample average of 39.44. Also, the value of total assets is the highest for Cluster 2 with a value of R128, 000 which is greater than the overall sample average of R87, 000. The F-test conducted between the clusters and independent variables shows statistically significant results for dependency ratio, hectarage of the dryland accessed, the location of the households, and PCA indices for extension workers and community workers.

The average dependency ratio is 39.44 per household. The dependency ratio is a measure of the number of dependents in the age category 0–14 and above 65 years for the total population (aged 15–64) (Cohen 2003). Therefore, if the dependents are more than the rest of the population, the

Table 2. Descriptive statistics of the variables ($n = 400$).

| Variable | Cluster | | | | Total | F-statistic |
|--------------------------|---------|--------|-------|-------|-------|-------------|
| | 1 | 2 | 3 | 4 | | |
| | Mean | | | | | |
| AGE_HEAD | 57.42 | 53.36 | 56.98 | 55.76 | 56.56 | NS |
| EDUCATION_YEARS | 5.25 | 6.70 | 5.35 | 5.12 | 5.51 | NS |
| HHL_D_SIZE | 6.48 | 5.92 | 6.70 | 5.24 | 6.40 | NS |
| DPNDCY_RATIO | 41.45 | 27.97 | 42.99 | 36.64 | 39.44 | *** |
| DRYLANDSIZE (Ha) | 0.73 | 0.27 | 0.51 | 0.29 | 0.58 | *** |
| TOT_INCM (000) (Rands) | 53.00 | 56.00 | 40.00 | 46.00 | 50.00 | NS |
| TOT_ASSETS (000) (Rands) | 74.00 | 128.00 | 86.00 | 81.00 | 87.00 | NS |
| EXTWORK_EXT | 0.04 | 0.19 | -0.21 | 0.07 | 0.00 | * |
| COMMNTY_EXT | 0.25 | -0.12 | -0.30 | -0.59 | 0.00 | *** |
| COMMODTY_EXT | 0.03 | 0.07 | -0.14 | 0.17 | 0.00 | NS |
| AREA_DMY (%) | | | | | | |
| Ndwedwe | 41.3 | 12.8 | 19.8 | 1.3 | 75.0 | *** |
| Umzimkhulu | 10.5 | 3.8 | 7.8 | 3.0 | 25.0 | |
| GENDER (%) | | | | | | |
| Male | 25.5 | 9.3 | 10.8 | 1.8 | 47.3 | NS |
| Female | 26.3 | 7.3 | 16.8 | 2.5 | 52.8 | |
| SAVING_DMY (%) | | | | | | |
| Yes | 19.3 | 6.3 | 8.3 | 0.8 | 34.5 | NS |
| No | 32.5 | 10.3 | 19.3 | 3.5 | 65.5 | |

Note: * $p < .1$; ** $p < .05$; *** $p < .01$; NS = not significant.

Source: Survey data (2015).

dependency ratio would reflect a large value, and vice-versa. The dependency ratio varied across the clusters; Cluster 3 has the highest value of 42.99. The analysis of variance (ANOVA) determined the association between the dependent variables across the clusters. Variables that represented the location of the household, extension, arable land used by the household and the dependency ratio of the household showed a statistically significant relationship with the clusters.

3.2 Multivariate analysis results

The results of the multivariate analysis, which employed both the PCA and K-means analysis, are presented below.

The level of household participation in each of the livelihood activities is presented in Table 3.

The results of captured rural household members' participation, by either a "yes" or "no" response, in livelihood activities show that 95.8% and 70.3% of the households involved in cropping and live-stock activities, respectively; social grants with 91.3% of the households having received social grants.

The application of PCA on the eight livelihood strategies produced seven PCs that explained 91.82% of the variance in the dummy variables (Table 4). The KMO and Bartlett's sphericity tests

Table 3. Household participation in livelihood strategies.

| Dummy variable short name | Dummy variable description | Frequency | Percent |
|---------------------------|---|-----------|---------|
| P_CROP_DMY | Household participating in cropping activities | 383 | 95.8 |
| P_GRANT_DMY | Household member receiving social grants from the government | 365 | 91.3 |
| P_LVSTK_DMY | Household member participating in livestock activities | 281 | 70.3 |
| P_NONAGRWAGE_DMY | Household participating in non-agricultural activities | 110 | 27.5 |
| P_REMITNC_DMY | Household receiving remittances. Remittances represents the income received from friends and relatives not presently living in the household. | 68 | 17.0 |
| P_SELF_EMP_DMY | Household participating in self-employment activities | 48 | 12.0 |
| P_MIGRAT_DMY | Household participating in migratory activities. Migratory wage involves formal and informal employment in nearby or distant rural, peri-urban or urban communities on a seasonal or permanent basis. | 43 | 10.8 |
| P_AGRWAGE_DMY | Household member participating in agricultural wage activities | 35 | 8.8 |

Source: Survey data (2015).

Table 4. Principal component loading estimated scores for participation in livelihood activities.

| Component | PC-1 | PC-2 | PC-3 | PC-4 | PC-5 | PC-6 | PC-7 |
|-----------------------------------|--------|--------|--------|--------|--------|--------|--------|
| Eigenvalues | 1.27 | 1.19 | 1.14 | 1.06 | 0.94 | 0.91 | 0.83 |
| % of variance | 15.93 | 14.88 | 14.23 | 13.31 | 11.75 | 11.32 | 10.42 |
| Cumulative % | 15.93 | 30.80 | 45.03 | 58.34 | 70.08 | 81.41 | 91.82 |
| Household participation dummy in: | | | | | | | |
| Cropping | 0.013 | 0.019 | 0.044 | -0.074 | 0.061 | 0.976 | 0.029 |
| Livestock | 0.084 | 0.145 | 0.075 | 0.924 | 0.071 | -0.088 | 0.013 |
| Social Grant | -0.094 | 0.938 | -0.029 | 0.148 | -0.021 | 0.033 | -0.042 |
| Agricultural wage | -0.096 | -0.009 | -0.064 | 0.060 | 0.959 | 0.063 | -0.042 |
| Non-agricultural wage | -0.499 | -0.403 | -0.369 | 0.375 | -0.278 | 0.235 | -0.057 |
| Self-employment | -0.033 | -0.035 | 0.024 | 0.008 | -0.040 | 0.027 | 0.995 |
| Remittance | 0.896 | -0.127 | -0.134 | 0.120 | -0.143 | 0.047 | -0.047 |
| Migration | -0.093 | -0.024 | 0.951 | 0.072 | -0.073 | 0.054 | 0.021 |

Notes: Extraction method: Principal component analysis (PCA).

Rotation method: Varimax with Kaiser normalisation.

Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy = 0.443.

Bartlett's Test of Sphericity: df = 63.123; approx. Chi-Square = 8; Sig. = 0.000.

Source: Survey data (2015).

determined whether the dataset of 400 households could be factored in. The KMO measure was 0.443 while Bartlett's test was statistically significant at $p < .001$. This suggests that the variables were related and could be factored in. Varimax with the Kaiser normalisation rotation method was used to improve interpretation of the PCs.

The first principal component (PC-1) explains 15.93% of the variance in the rural households' participation in livelihood activities, with one of the estimated component loadings above 0.3 being positive and the other negative. PC-1 also shows rural households receiving more remittances and participating less in non-agricultural wage activities. Therefore, this PC was named "Remittance". PC-2 explains 14.88% of the variance and shows households that participate more in social grants and less in non-agricultural wage activities. Social grants are a common livelihood source of income among rural households in South Africa (Todes et al. 2010), resulting in this PC being called "Social grants". PC-3 accounts for 14.23% of the variance in the rural households that strongly participate in migration and participate less in non-agricultural wage activities. This PC was thus identified as "Migration". PC-4 reflects a strong participation in livestock and moderate non-agricultural wage participation and was, therefore, named "Livestock and non-agricultural wage". This PC explains 13.31% of the variance in rural household participation in livelihood activities. The fifth component, PC-5, explains 11.75% of the variance in constraint scores. This PC represents households that strongly participated in agricultural wage activities and was thus called "Agricultural wage". PC-6 is accounted for by 11.32% of the variation and represents the dimension of rural households that participate in cropping activity, therefore it was called "Cropping". The PC-7 displays the least amount of

Table 5. Participation of households in combination of livelihood activities across clusters.

| PC dimensions of livelihood activities | Cluster | | | |
|--|---|---|----------------------------------|-----------------------------|
| | 1 "Mixed farming/migration/ social grant reliant" | 2 "Agricultural wage/ cropping reliant" | 3 "Mixed activity reliant" | 4 "Livestock reliant" |
| Non agric and remittance | -0.36511 | -0.07388 | 0.74059 | -0.05952 |
| Social grants | 0.26030 | -1.44353 | 0.38989 | -0.08800 |
| Migration | 0.20484 | -0.05674 | -0.31925 | -0.20821 |
| Livestock | 0.39407 | -0.08796 | -0.74270 | 0.34882 |
| Agricultural wage | -0.35281 | 1.61645 | -0.26156 | -0.28718 |
| Cropping | 0.23381 | 0.12944 | 0.19722 | -4.62563 |
| Self-employment | -0.16846 | -0.12181 | 0.41106 | -0.13568 |
| Number | 207 | 66 | 110 | 17 |

Source: Survey data (2015).

variation (10.42%) in the rural household participation scores and represents self-employment activities. This PC was called “Self-employment”.

The K-means clustering was subsequently used on the PC scores to obtain a grouping of variables into distinct clusters. Table 5 shows PC dimensions of livelihood activities across the four clusters. The clusters were named based on the way in which they related to the PC dimensions of livelihood activities.

Cluster 1 represents the households whose dominant livelihood strategies were mixed farming (i.e., cropping and livestock), social grants and migration. This cluster was named “Mixed farming/migration/social grant reliant”. The households in Cluster 2 represents those that participated mainly in agricultural wage and cropping activities and was therefore named “Agricultural wage/cropping”. Cluster 3, named “Mixed activity reliant”, represents households with a livelihood choice that combined more activities compared to other household clusters. These households received social grants and undertook cropping, self-employment, and non-agricultural wage activities, and received remittances. Finally, Cluster 4 represents households whose main livelihood activity was livestock farming, therefore called “Livestock reliant”.

Table 6 presents the results of the K-means clustering, confirming that the method was suitable for classifying the retained PC clusters. The predetermined number of clusters was also found to be suitable.

4. Multinomial logistic model results

Table 7 presents MNL results on the factors influencing rural households’ choice of livelihood strategies. Cluster 1 (“Mixed farming/migration/social grant reliant” livelihood strategy) was used as the base strategy in the MNL regression. This cluster accounted for the most common livelihood strategy among respondents (i.e., 52%).

The coefficients of the explanatory variables measure the influence of the variables on the likelihood of a household selecting a given livelihood strategy, in comparison with choosing the base strategy. The estimated model shows that an increase in the households’ access to arable dryland areas reduces the likelihood of engaging in “Agricultural wage/cropping reliant” or “Mixed activity reliant” livelihood strategies. The estimated model shows that the higher the dependency ratios, the lower the likelihood of households engaging in the “Agricultural wage/cropping reliant” livelihood strategy, relative to the base strategy.

Households that rely on commodity organisations and extension workers as sources of farming information are associated with a higher likelihood of choosing the “Agricultural wage/cropping reliant” livelihood strategy than the base strategy.

As the rural households’ access to arable area increases, they are less likely to choose the “Mixed activity reliant” livelihood strategy, but the instead select the “Mixed farming/migration/social grant reliant” livelihood strategy. This is also observed with households that have no savings, rely on extension workers and community meetings for farming information. Households in Umzimkhulu are more

Table 6. ANOVA results for the K-mean clusters.

| PC dimensions of livelihood activities | Cluster | | Error | | F | Sig. |
|--|-------------|----|-------------|-----|----------|------|
| | Mean Square | df | Mean Square | df | | |
| Non agric and remittance | 29.449 | 3 | 0.784 | 396 | 37.540 | *** |
| Social grants | 56.136 | 3 | 0.582 | 396 | 96.403 | *** |
| Migration | 6.949 | 3 | 0.955 | 396 | 7.277 | *** |
| Livestock | 31.801 | 3 | 0.767 | 396 | 41.479 | *** |
| Agricultural wage | 69.048 | 3 | 0.484 | 396 | 142.520 | *** |
| Cropping | 126.814 | 3 | 0.047 | 396 | 2705.812 | *** |
| Self employment | 8.584 | 3 | 0.943 | 396 | 9.108 | *** |

Note: *** $p < .01$.

Source: Survey data (2015).

Table 7. Multinomial logistic (MNL) regression results (Cluster 1 is the base category).

| Independent variable | 2 "Agricultural wage/ cropping reliant" | | 3 "Mixed activity reliant" | | 4 "Livestock reliant" | |
|----------------------|---|---------|-------------------------------|---------|--------------------------|-----------------------|
| | B | Exp (B) | B | Exp (B) | B | Exp (B) |
| Intercept | **5.298 | | -0.351 | | ***-29.050 | |
| AGE_HEAD | -0.036 | 0.965 | 0.014 | 1.014 | 0.042 | 1.043 |
| EDUCATION_YEARS | -0.127 | 0.881 | -0.003 | 0.997 | ** -0.462 | 0.630 |
| HHL_D_SIZE | **0.111 | 1.118 | -0.094 | 0.910 | -0.130 | 0.878 |
| DPNDCY_RATIO | ***-0.070 | 0.933 | 0.019 | 1.019 | -0.008 | 0.992 |
| DRYLANDSIZE | ** -2.833 | 0.059 | *-0.685 | 0.504 | 0.785 | 2.192 |
| TOT_INCM | 0.000 | 1.000 | 0.000 | 1.000 | 0.000 | 1.000 |
| TOT_ASSETS | 0.000 | 1.000 | 0.000 | 1.000 | 0.000 | 1.000 |
| EXTWORK_EXT | **0.846 | 2.330 | ** -0.884 | 0.413 | 1.143 | 3.137 |
| COMMNTY_EXT | -0.072 | 0.930 | ** -0.629 | 0.533 | -2.455 | 0.086 |
| COMMODTY_EXT | *0.371 | 1.449 | 0.079 | 1.083 | 0.582 | 1.789 |
| AREA_DMY | 0.161 | 1.175 | **1.394 | 4.031 | **2.898 | 18.137 |
| GENDER | -0.681 | 0.506 | 0.477 | 1.611 | 0.433 | 1.543 |
| SAVING_DMY | -0.976 | 0.377 | ** -1.888 | 0.151 | 22.941 | 9.18 x10 ⁹ |

Notes: Likelihood ratio test: Chi-Square = 123.242; df = 39; *p*-value = .001.

*, ** and *** significant at 10, 5 and 1%, respectively.

Overall % households correctly classified = 70.1%.

Source: Survey data (2015).

likely to choose the "Mixed activity reliant" livelihood strategy than the base strategy. With regard to households in Umzimkhulu, the likelihood of choosing the "Livestock-reliant" livelihood strategy rather than the "Mixed farming/migration/social grant reliant" livelihood strategy is greater, whereas household heads in this area with more years of formal education are less likely to do so.

It may be concluded that the choice of a livelihood strategy made by rural households examined in this study is likely to be influenced by factors such as household size, dependency ratio and household head's years of formal education. In addition, the results indicate the size of arable dryland access, household location and source of agricultural information have a strong influence on the rural livelihood diversification. Finally, household savings also support rural households in diversifying their livelihood portfolios.

5. Discussion

The regression results reveal marked differences in the choice of livelihood strategies across rural households. Years of formal schooling, household size, dependency ratio, arable dryland cultivated, extension, household location and household savings were the main factors found to influence the choice of these livelihood strategies.

The study results show that rural household members with more years of formal learning were less likely to choose "Livestock reliant" as their dominant strategy, while those with less educated or uneducated household members adopt this as their main livelihood strategy. Rural household members with formal education were found to engage in activities such as mixed farming and migration, as well as the receipt of social grants in coming up with their livelihood strategy. Mutenje et al. (2010) show in their study that education is a significant factor in livelihood diversification among rural households. Results from a study by Khatun and Roy (2012) show that educated household members diversify into livelihood options such as salaried jobs and migration. In the present study, it is interesting to find that households with educated members include social grants from the government as part of their strategy. Arguably, these rural households' human capital could be an enabling factor for diversifying their livelihood portfolios with other strategies other than social grants. Jogo and Hassan (2010) emphasise that improved access to education is crucial for better employment opportunities in the non-farm sector. However, it is likely that such

members may seek different and easily accessible ways to support the other household members; accessing government social grants could be one such way.

Study results also show that rural households with less educated members were likely to select “Livestock reliant” as their dominant strategy. Khatun and Roy (2012) found that household members with low education levels and the illiterate ones were involved in wage-earning occupations. Jogo and Hassan (2010) also show that uneducated household members had a strong reliance on wetland resources and were unable to diversify their livelihood activities. These studies and the present one show that rural households that are characterised by members with little to no education have a limitation which prohibits them from pursuing potentially rewarding livelihood strategies. According to Twine (2013), livestock farming plays an essential role for rural households in managing and mitigating risks. In part, this highlights that livestock farming is an important livelihood strategy for some rural households.

The results show that households with a larger size are less likely to make a livelihood choice that depends on receiving social grants; and, use migration, cropping and livestock farming activities. Instead, larger households would rather choose agricultural wage employment and crop farming. However, research by Fabusoro et al. (2010) observed that members of large households do participate in livelihood strategies like migration. A large household size, therefore, may not necessarily ensure rural households’ easy access to such a livelihood strategy for inclusion in its livelihood portfolio. Therefore, the effects of larger household sizes on selecting a livelihood activity such as migration may not always be straightforward for rural households.

An increase in the dependency ratio was shown to be associated with a higher likelihood of rural households selecting the “Mixed farming/migration/social grant reliant” strategy, rather than choosing a livelihood made up of cropping and agricultural wage activities. Similarly, in a study by Mutenje et al. (2010), the dependency ratio was observed to significantly influence the choice of a livelihood strategy. Similarly, other research in South Africa has shown that smallholder households with a high dependency ratio frequently receive social grants (Todes et al. 2010). Several issues could be responsible for reducing the proportion of the working population on the in rural households, and these include fostering of grandchildren with their grandmothers (Thurlow, Gow, and George 2009), multiple conjugal units¹ and the effects of HIV/AIDS (Hosegood and Ford 2003). Also, circular migration, where both men and women leave rural areas in search of employment in urban areas, is a crucial way in which most rural households in South Africa survive (Todes et al. 2010). As a result, dependents who are mostly children remain in rural homes, thereby increasing the dependency ratio. A high dependency ratio in rural households indicates households with more members available to participate in non-farm activities, as well as having the remainder available at home to supply family labour required for subsistence agricultural production.

Rural households with limited access to agricultural land selected either “Agricultural wage/cropping reliant” or “Mixed activity reliant” a livelihood strategy. Access to arable land meant that rural households in the study areas were likely to choose the “Mixed farming/migration/social grant reliant” as their dominant strategy. The study by Khatun and Roy (2012) show that productive resources such as land are important determinants of livelihood diversification. According to the World Bank (2003), cited in Nagayets (2005), smallholder farmers have a low asset base and operate on less than two hectares of cropland. Study results show that several rural households can be categorised as having limited access to agricultural land. These results do not indicate that one livelihood strategy is superior to another but show that access to land plays a role in constructing a livelihood portfolio. Members of rural households with access to arable land, construct their livelihood portfolio from its members: migrating and participating in employment in neighbouring or distant communities and then remit part of their earnings to their rural households (Nagayets 2005; Fabusoro et al. 2010).

The adoption of different livelihood strategies by the households in the two study areas reveals the importance of location in constructing a livelihood portfolio. The households located in Umzimkhulu were more likely to choose either “Livestock reliant” or “Mixed activity reliant” rather than

“Mixed farming/migration/social grant reliant” as their dominant strategies. Similarly, the study by Khatun and Roy (2012) show that diversification can be significantly affected by location. They explain that this may be a result of one location having more diversified livelihood opportunities than another region. A recap of the “Mixed activity reliant” strategy shows that rural households in this cluster combine non-agricultural, remittance, self-employment and cropping activities. Also, some of the members receive social grants as part of this strategy.

The results show that households with savings were less likely to select the “Mixed activity reliant” livelihood strategy and more likely to select the “Mixed farming/migration/social grant reliant” livelihood strategy. Therefore, savings play an important part in determining livelihood strategy choices. No known published studies are readily available to show this connection establishing the influence of savings on the livelihood strategy choice. Rural households have limited access to financial services, such as savings (Chisasa and Makina 2012). This limited access to such financial services hinders livelihood diversification in the ways described above.

The indices representing extension workers (EXTWORK_EXT) and community meetings (COMMUNITY_EXT) as sources of agricultural information have the effect that households are more likely to make a livelihood strategy that combines both cropping and livestock farming (i.e., the “Mixed farming/migration/social grant reliant” livelihood strategy), compared with the “Agricultural wage/cropping reliant” livelihood strategy. Rural households that rely on agricultural information of PCA indices representing extension workers (EXTWORK_EXT) and commodity organisations (COMMODITY_EXT) are more likely to choose the livelihood strategy that emphasises crop production (i.e., the “Agricultural wage/cropping reliant”), rather than the “Mixed farming/migration/social grant reliant” livelihood strategy. In other words, the proxies for training and extension (i.e., EXTWORK_EXT, COMMUNITY_EXT and COMMODITY_EXT) seem to play a crucial role in rural households’ choice of livelihood strategies. In a study by Khatun and Roy (2012), the effects of training on livelihood diversification were found to be positive and statistically significant, supporting the findings from this study. Therefore, factors such as training and extension affect the diversity of livelihood strategies.

Overall, these results provide an understanding of the formulation of livelihood choices made by rural households. Different livelihood choices were affected by the varying levels of years of formal education, household size, dependency ratio, arable dryland area accessed by the household, and savings of household heads. There is also some evidence that choice of livelihood strategy for sample households was affected by the location and source of agricultural information.

6. Conclusion

The representative sample of 400 rural households in Ndwedwe and Umzimkhulu LMs of the KZN province in South Africa combine several livelihood activities rather than concentrating on only one. Rural households combined livelihood activities, such as household involvement in cropping, livestock, social grants, agricultural wages, non-agricultural wages, self-employment, remittance and migration, to obtain their livelihood strategy. PCA and K-means cluster analysis identified four distinct livelihood strategies among rural households.

MNL regression identifies household size, household head’s years of formal education, size of arable dryland access, household location and household savings as the main determinants influencing the choice of a livelihood strategy. The study did not identify superior or preferred strategies but showed that livelihoods comprise of groupings of activities, influenced by specific household characteristics. Policymakers can intervene by influencing households to gravitate their choice of livelihood strategies in desired directions to contribute to secure livelihood outcomes.

Findings in this study have policy implications for the government and other practitioners in the Ndwedwe and Umzimkhulu LMs, and possibly in other rural areas of South Africa. Policymakers need to be sensitive to the different livelihood strategies at the household level and use such information to create policy interventions that cater to diverse livelihoods. Based on these results, the study recommends that policy interventions allow households to attain the best mix of strategies to enhance

their livelihoods and support resilience and well-being. For example, providing information and training to household members (e.g., through extension services, community meetings, commodity organisations) may allow them the opportunity to diversify their livelihood activities. Also, this study suggests that policies should play a meaningful role in stimulating and promoting savings by rural households; in turn, savings of the household members could enable them to diversify their livelihood choices.

Livelihood strategy choices of rural households were limited especially if the members' formal education was for only a few years or less; accordingly, livestock farming was a common strategy adopted by such rural households. Similarly, households in Umzimkhulu are likely to benefit from policy interventions that promote livestock farming as a livelihood strategy since it is most likely that there are households in this location which rely exclusively on this kind of activity. Therefore, policy interventions that focus on making livestock farming as an accessible and sustainable livelihood strategy for such household members may achieve the rural development objectives that are sought after by several development programmes.

Note

1. Mokyr (2003) explains that two or more conjugal units may arise from family members of either the same generation (e.g., brothers and their spouses and children), or from different generations (e.g. parents with one or more married son).

Acknowledgements

Opinions expressed and conclusions arrived at, are those of the author and are not necessarily to be attributed to the NRF.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

The financial assistance of the National Research Foundation (NRF) grant number 86 893 towards this research is hereby acknowledged.

References

- Achia, T.N., A. Wangombe, and N. Khadioli. 2010. A logistic regression model to identify key determinants of poverty using demographic and health survey data. *European Journal of Social Sciences* 13, no. 1: 38–45.
- Alemu, Z.G. 2012. Livelihood strategies in rural South Africa: Implications for poverty reduction. Paper presented at the Paper read at the 2012 Conference, Foz do Iguacu, Brazil, August 18–24.
- Babatunde, R.O., and M. Qaim. 2010. Off-farm labor market participation in rural Nigeria: Driving forces and household access. Paper presented at the 5th IZA/World Bank Conference: Employment and Development, Cape Town, South Africa, May 3–4.
- Babulo, B., B. Muys, F. Nega, E. Tollens, J. Nyssen, J. Deckers, and E. Mathijs. 2008. Household livelihood strategies and forest dependence in the highlands of Tigray, Northern Ethiopia. *Agricultural Systems* 98, no. 2: 147–155.
- Chibanda, M., G.F. Ortmann, and M.C. Lyne. 2009. Institutional and governance factors influencing the performance of selected smallholder agricultural cooperatives in KwaZulu-Natal. *Agrekon* 48, no. 3: 293–315.
- Chisasa, J., and D. Makina. 2012. Trends in credit to smallholder farmers in South Africa. *The International Business & Economics Research Journal (Online)* 11, no. 7: 771–784.
- Cohen, J. E. 2003. Human population: The next half century. *science* 302, no. 5648: 1172–1175.
- Costello, A.B., and J.W. Osborne. 2005. Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical Assessment, Research & Evaluation* 10, no. 7: 1–9.
- DAFF. 2013. Strategic plan for smallholder support 2011–2014/15. In: Department of Agriculture, FaF (ed.). F. a. F Department of Agriculture, Forestry and Fisheries, Pretoria: Department of Agriculture, Forestry and Fisheries.

- De Cock, N., M. D'Haese, N. Vink, C.J. Van Rooyen, L. Staelens, H.C. Schönfeldt, and L. D'Haese. 2013. Food security in rural areas of Limpopo province, South Africa. *Food Security* 5, no. 2: 269–282.
- D'Haese, M., N. Vink, T. Nkunzimana, E. Van Damme, J. Van Rooyen, A.-M. Remaut, L. Staelens, and L. D'Haese. 2013. Improving food security in the rural areas of KwaZulu-Natal province, South Africa: Too little, too slow. *Development Southern Africa* 30, no. 4–5: 468–490.
- Diniz, F.H., M.A. Hoogstra-Klein, K. Kok, and B. Arts. 2013. Livelihood strategies in settlement projects in the Brazilian Amazon: Determining drivers and factors within the Agrarian Reform Program. *Journal of Rural Studies* 32, no. Supplement C: 196–207.
- Dossa, L.H., A. Abdulkadir, H. Amadou, S. Sangare, and E. Schlecht. 2011. Exploring the diversity of urban and peri-urban agricultural systems in Sudano-Sahelian West Africa: An attempt towards a regional typology. *Landscape and Urban Planning* 102, no. 3: 197–206.
- Ellis, F. 1998. Household strategies and rural livelihood diversification. *The Journal of Development Studies* 35, no. 1: 1–38.
- Fabusoro, E., A. Omotayo, S. Apantaku, and P. Okuneye. 2010. Forms and determinants of rural livelihoods diversification in Ogun State, Nigeria. *Journal of Sustainable Agriculture* 34, no. 4: 417–438.
- Garson, D. 2009. Reliability analysis. [Online]. Available at: <http://faculty.chass.ncsu.edu/garson/PA765/reliab.htm>. Accessed Sep 15, 2017.
- Hair, J.F., W.C. Black, B.J. Babin, R.E. Anderson, and R.L. Tatham. 2006. *Multivariate data analysis (Vol. 6)*. Upper Saddle River: Pearson Prentice Hall.
- Hosegood, V., and K. Ford. 2003. *The impact of HIV/AIDS on children's living arrangements and migration in rural South Africa*. Paper presented at the Paper read at the Conference on African migration in comparative perspective, Johannesburg, South Africa, June 4–7.
- Israel, G.D. 1992. *Determining sample size*. Florida: University of Florida Cooperative Extension Service, Institute of Food and Agriculture Sciences, EDIS.
- Jogo, W., and R. Hassan. 2010. Determinants of rural household labour allocation for wetland and other livelihood activities: The case of the Limpopo wetland in Southern Africa. *Agrekon* 49, no. 2: 195–216.
- Jolliffe, I.T. 2002. Principal component analysis and factor analysis. In *Principal component analysis* 150–166, New York, Springer.
- Kaur, M., and U. Kaur. 2013. Comparison between K-means and hierarchical algorithm using query redirection. *International Journal of Advanced Research in Computer Science and Software Engineering* 3, no. 7: 1454–1459.
- Khatun, D., and B. Roy. 2012. Rural livelihood diversification in West Bengal: Determinants and constraints. *Agricultural Economics Research Review* 25, no. 1: 115–124.
- Manly, B.F. 2005. Tests of significance with multivariate data. In *Multivariate statistical methods: A primer*, (3rd ed.), 105–124 Boca Raton, FL: Chapman & Hall.
- Mokyr, J. 2003. *The Oxford Encyclopedia of Economic History: Human capital-Mongolia*. Vol. 3. New York, USA: Oxford University Press.
- Motsholapheko, M., D. Kgathi, and C. Vanderpost. 2012. Rural livelihood diversification: A household adaptive strategy against flood variability in the Okavango Delta, Botswana. *Agrekon* 51, no. 4: 41–62.
- Mutenje, M., G. Ortman, S. Ferrer, and M. Darroch. 2010. Rural livelihood diversity to manage economic shocks: Evidence from south-east Zimbabwe. *Agrekon* 49, no. 3: 338–357.
- Nagayets, O. 2005. Small farms: current status and key trends. The future of small farms, 2005 proceedings of a research workshop, IFPRI, Wye: 355–367.
- Nainggolan, D., M. Termansen, M.S. Reed, E.D. Cebollero, and K. Hubacek. 2013. Farmer typology, future scenarios and the implications for ecosystem service provision: a case study from south-eastern Spain. *Regional Environmental Change* 13, no. 3: 601–614.
- NPC. 2013. National Development Plan Vision 2030. In NPC, ed. National Planning Commission: National Planning Commission.
- Puttergill, C., N. Bomela, J. Grobbelaar, and K. Moguerane. 2011. The limits of land restitution: Livelihoods in three rural communities in South Africa. *Development Southern Africa* 28, no. 5: 597–611.
- Scoones, I. 2009. Livelihoods perspectives and rural development. *The Journal of Peasant Studies* 36, no. 1: 171–196.
- Sikhweni, N., and R. Hassan. 2014. Opportunities and challenges facing small-scale cattle farmers living adjacent to Kruger National Park, Limpopo Province. *Journal of Emerging Trends in Economics and Management Sciences* 5, no. 1: 38–43.
- Stats, S. A. 2015. Statistics South Africa Statistics South Africa [Online]. http://www.statssa.gov.za/?page_id=993&id=ndwedwe-municipality (accessed May 15, 2015).
- Thurlow, J., J. Gow, and G. George. 2009. HIV/AIDS, growth and poverty in KwaZulu-Natal and South Africa: An integrated survey, demographic and economy-wide analysis. *Journal of the International AIDS Society* 12, no. 1: 18–30.
- Todes, A., P. Kok, M. Wentzel, J. Van Zyl, and C. Cross. 2010. *Contemporary South African urbanization dynamics*. Paper presented at the paper read at the Urban Forum, Rio de Janeiro, Brazil, March 22–26.
- Train, K.E. 2009. *Discrete choice methods with simulation*. Cambridge: Cambridge University Press.
- Twine, W. 2013. Multiple strategies for resilient livelihoods in communal areas of South Africa. *African Journal of Range & Forage Science* 30, no. 1–2: 39–43.

- Van Averbek, W., and T. Khosa. 2007. The contribution of smallholder agriculture to the nutrition of rural households in a semi-arid environment in South Africa. *Water South Africa* 33, no. 3: 413–418.
- Vyas, S., and L. Kumaranayake. 2006. Constructing socio-economic status indices: How to use principal components analysis. *Health Policy and Planning* 21, no. 6: 459–468.
- Walker, J., B. Mitchell, and S. Wismer. 2001. Livelihood strategy approach to community-based planning and assessment: A case study of Molas, Indonesia. *Impact Assessment and Project Appraisal* 19, no. 4: 297–309.
- World Bank. 2003. *Reaching the rural poor: A renewed strategy for rural development, Washington DC, USA*. Washington, DC: World Bank.