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Strategic perspectives on quitting or remaining in commercial agriculture in South Africa and why it matters

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ABSTRACT

This paper explores reasons why some commercial producers in South Africa are expecting to quit and sell their farms, and others are not. Of 450 respondents to a voluntary survey, distinctly different groups of producers emerged concerning their longer-term strategic planning and how they experience and absorb current threats and challenges. Unsupervised learning on the dataset is imposed using a cluster analysis to explore the commonalities and the underlying factors why producers would expect to exit or not. Factors that we hypothesised might play a role included a producer's age and financial position, rural safety concerns, labor problems, industry-related problems, and opportunities for off-farm earnings. The factors the potentially exiting producers had in common were financial difficulty, which was uncorrelated to turnover, problems with access to dependable labor, uncertainty regarding land reform policy, and rural safety concerns. Intention to retire also played a role, although to a lesser extent. It is more often a combination of factors, rather than a single factor, that makes a producer more likely to decide to quit and sell in the future. With the exclusion of farm safety concerns and labor problems, the identified factors in this study are in step with those found internationally.

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Farm size; farm exiting; commercial agriculture; principal component analysis; k means clustering

1. Introduction

From the perspective of the agricultural economist, structural change involves the long-term evolution of farm structure and organisation (Chavas 2001). This process is evidenced by changes in farm size, land use, extent of mechanisation, labor use and value chain structure. Of these, farm size is the most easily comparable international metric, influenced by the amount of farmland available and the number of producers.

Some countries, such as Japan, New Zealand and India, have experienced a decrease in the total amount of farmed land with agricultural zoning. Where farm size has increased, for example in Belgium, Germany, Denmark, Canada, Argentina and South Africa, the increase has been driven mostly by a decrease in the number of producers. Internationally, changes in farm size do not show a universal trend. Between 1960 and 2000, farm sizes increased in Europe, with Belgium (251%), Germany (233%), Denmark (212%), the Netherlands (149%) and France (139%) showing the largest increases; in other developed countries, with Canada (88%), Australia (76%) and the USA (46%) showing the largest increases; and in some developing countries, such as South Africa

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(125%), Argentina (57%) and Uruguay (47%) (Liebenberg 2012; Lowder, Skoet, and Raney 2016). However, during the same period, farm sizes decreased in several upper-middle- and lower-middle-income countries, such as India (−51%), Jamaica (−50%), Indonesia (−34%), Chile (−29%) and Venezuela (−26%). By excluding factors associated with rezoning agricultural land, farm size changes are driven by changes in producer numbers. In general, the average farm size decreased in most low-income and lower-middle-income countries but increased in some upper-middle-income countries and in nearly all high-income countries (Lowder, Skoet, and Raney 2016).

Several reasons have been suggested for the increase in farm sizes in high-income and upper-middle-income countries. Recurring themes in the literature can broadly be categorised as personal, financial and policy-related.

On the personal front, education and alternative opportunities for generating income are highlighted. Examples of personal drivers of farm size include part-time farming (Antman et al. 2015), supplementing on-farm income with off-farm sources (Martini and Kimura 2009; NFU 2011; Ramsey, Ghosh, and Sonoda 2019; RIRDC 2007), or the next generation pursuing a non-farm career or lifestyle (Gale 2003). Part-time farming enables producers to continue to farm on a smaller production unit (Chen et al. 2019). Producers who earn off-farm income are less dependent on the returns from primary agriculture, thus these trends can slow down the rate of farm consolidation. The pursuing of a non-farm career by the next generation because of lifestyle choice or opportunity cost considerations tends to accelerate consolidation because fewer new entrants take up the land which becomes available. These observed trends contribute to the increase in producers' average age (European Commission 2017; Shimizu 2017). More ageing producers means more exits in the immediate future and it also means the exit process will accelerate. Where exiting occurs without concurrent succession or entering, more land is owned by the older, decreasing number of producers (Katchova and Ahearn 2014; European Commission 2017). A distinction between "exiting without succession" and "exiting with transfer to next of kin" will be explored in this analysis.

Regarding finances, increased exiting without new entrants taking up the opportunity is associated with two main factors: viability to continue or opportunity cost. Farm viability, measured in real returns per unit area, will decrease over time if there is a decrease in real output value in conjunction with an increase in real input cost, a phenomenon broadly referred to as the "farm problem" (Babian 1956). The opportunity cost of farming increases when there is an increase in the producer's level of education and an increase in the producer's actual and potential non-farming income.

Babian (1956) investigated the type of efficiency increase that is required to overcome the farm problem. It is not sufficient to increase production to the extent that the decline in real output prices is countered to maintain a specific gross income. This would result in a decrease in net income if not combined with a reduction in total production cost. Failing to address these input and output pressures erodes the farm's ability to compensate the owner for the opportunity cost of their labor, thereby forcing small and medium producers out of operations (Chen et al. 2019; Gale 2003; Gras 2009). This can be attributed to several factors, such as inability to justify acquiring expensive technology-based productivity improvements that are dependent on critical mass to be worth adopting and repaying the expense (MacLeod and Moller 2006; Pedersen and Møllenberg 2017), or inability to enact the value chain integration required to offset declining real income at the primary production level (Castro-Fontoura 2016; Productivity Commission 2005). These factors – production income and cost and technology adoption – will feature in this study and be extracted through the analysis process.

Policy, the third theme in the literature, is seen as having an effect, and it can hinder or support growth in producer numbers. Policies that target specific parts of the agricultural industry, such as production quotas or price support measures, can obstruct farm size growth in the industry, with producers boxed in even if they would like to expand their operations (Bokusheva and Kimura 2016). Direct or indirect transfer payments that artificially increase farm income and revenue can

hinder farm consolidation, but they may not be sufficient to keep all small and medium-sized growers in production (Brady et al. 2017; DG AGRI 2012; Severini and Tantari 2015; Volkov et al. 2019). The removal of policy distortions, the liberalisation of markets and the dismantling of control boards have compelled producers to run profitable operations in an open market to stay in business, accelerating exiting beyond a rate of replacement by new entrants, which resulted in fewer producers (Lambie 2005; Mulet-Marquis and Fairweather 2008). In the EU, the common agricultural policy (CAP) aims to bolster the sector through income support measures, as well as to enhance the development of rural areas, whilst also aiming to improve agricultural productivity (European Commission 2018). Counter measures, such as quotas, have been introduced to support producers without causing an oversupply in the market. These measures inevitably impact production unit size and the total number of producers.

As defined and captured in the 2017 Census of commercial agriculture, farm size and producer numbers in commercial agriculture have yet to receive attention in the South African literature regarding farm size, specifically in terms of existing and potential producer decisions. The exception in this regard is from the study by Liebenberg (2012), documenting the trend in commercial farm sizes in South Africa. Most studies that touch on the issue refer to changes only in the context of policy reforms (for example, Greyling, Vink, and Mabaya 2015; Greyling, Vink, and van der Merwe 2018; Vink 1993). In this paper, we begin to fill the gap by using an unsupervised learning algorithm to investigate the groups that emerge from such an analysis and understand the characteristics behind the groupings. In addition, information on potential exiters' specific characteristics can be derived by imposing data concerning potential exiting in the future onto the clusters. This information on commercial producers in South Africa can then be compared with that in the international literature.

From the international literature and observations in South Africa, we hypothesised that age, subsector, financial position, rural safety concerns, labor problems and opportunities for off-farm earnings would feature prominently in the commonalities from the cluster analysis. To test this hypothesis, we surveyed 450 commercial producers who owned one or more farms between 2017 and 2019 in all nine provinces of South Africa.

2. Data collection and methods

2.1 Data collection

The data for this study was collected over an 18-month period through a voluntary participation survey, starting at the end of 2017. The questionnaire, distributed via email or by students, was designed to elicit the respondents' background and geographic location, strategic planning and aspirations, employment of skilled and unskilled labor, capital and turnover, production mix, changes in land use, and view on the impact of exogenous factors on their business. The respondents were asked to rank statements on a five-point Likert scale (from one, strong disagreement/not at all, to five, strong agreement/most definitely) to indicate the perceived level of constraint or threat to their business of the following factors: social aspects (labor availability and quality, stock theft and farm attacks), policy aspects (land reform, labor laws, environmental laws and market access), natural environmental aspects (climate change and predators), and economic aspects (input cost and decreasing commodity prices). The results serve as the basis for the cluster analysis described below.

Of the approximately 1 370 distributed, 658 questionnaires were returned, of which 541 were completed in full. Of these, 450 were completed by farm owners and thus form the sample of interest for this study, with the complement completed by farm managers. The latter's decision to remain within primary agriculture or exiting will not affect producer numbers.

Although the survey sample was not representative of the number of producers by province, many other factors align with the 2017 Census.

The respondents' ages ranged from 20 to 90, with an average of 51. Categorically, the age profile is well aligned to the Census: 11% under 35 years of age in the survey, compared to the 12% of the Census. Similarly, 38% of the survey respondents were over 55, comparable to the 40% of the Census. With 2% unspecified in the Census, that leaves 45% between the ages of 35 and 55, compared to the survey's 51%. Calculating the average age in the Census using the midpoint of the different age categories, the average age of producers in the Census is also 51 (Statistics South Africa [StatsSA], 2020).

Most respondents had between 16 and 30 years of experience, and 26% had over 30, which should also be comparable considering the age alignment with the Census. As expected, respondents were almost all male (95%), although slightly overrepresented in the survey compared to the Census (91%). Formal education levels were fairly high: 70% said they had completed an undergraduate tertiary qualification, and 12% said they had completed a postgraduate degree (StatsSA, 2020).

Furthermore, 28% of farms in the Census experienced losses because of stock theft, input and produce theft, and violent and other crimes. In the survey, 27% of respondents indicated that theft is a major threat to their operations. Also, natural disasters were considered by 31% of the respondents as most definitely a threat to sustaining their operation, which is comparable to the 29% of producers in the Census recording losses as a result of natural disasters (StatsSA, 2020).

2.2 Principal component analysis

We considered a total of 37 variables for inclusion in the cluster analysis described below and therefore used in the principal component analysis (PCA) in their standardised form to reduce the impact of units of measurements, for example number of employes and annual turnover (in rand). We found that 43% of the total variance in the dataset was explained by the first three unrelated variables (PC variables), predominantly featuring constraint, threat and exiting decision variables (see Appendix A). The first nine PC variables explained 77% of the variance. By doing the PCA before the cluster analysis we could determine which variables in the initial setup would not make a meaningful contribution to the analysis. The variables that contributed the least significant variability to the first nine independent variables (see factor loadings in Appendix A) were omitted from the subsequent cluster analysis (viz. occupation, education, labor variables, gender and province). We hypothesised that financial difficulty is associated particularly with one or more of the subsectors in agricultural production. We, therefore, decided to keep the categorical breakdown of the sub-sectors (field crop, livestock, horticulture, forestry and mixed production) in the dataset for the cluster analysis.

The results from the PCA confirmed that the strategic decision at the farm level was affected by producers' perspectives on financial difficulty, intention to retire or rural safety concerns, as well as the constraints and threats to the farming operations, as these factors explained the bulk of the variance in the first three PCA variables.

After doing the PCA, we included 23 of the initial 37 variables in the final clustering analysis and solution. These included the producer's age and experience; decision to exit within the next ten years; type of production; turnover of the farm; and the constraints and threats, or lack thereof, they perceived.

2.3 k means clustering

We used *k* means clustering (Sayad 2020) to identify the commonalities in the producers' strategic decisions: whether to expand, exit, or contract their farming operations.

We randomly assign a respondent to any of the initial clusters' center locations. For every record, we find the nearest cluster center that partitions the dataset, after which we update the location of each cluster center until a logical outcome is achieved. Through the movement of the cluster centers

until convergence or termination, the objective of *k* means clustering, i.e., to minimise the intra-cluster variance, is achieved, as per objective function *J*:

$$J = \sum_{j=1}^{k} \sum_{i=1}^{n} \| x_i^{(j)} - c_j \|^2 , \tag{1}$$

where *k* is the number of clusters, *n* is the number of cases, and in the distance function case *l* is denoted by and the centroid for cluster *j* by From *J*, it is clear that the Euclidean distance function was applied where each data point is assigned to the closest centroid, which is central to that specific cluster.

We chose *k* means clustering as our clustering algorithm rather than an agglomerative hierarchical clustering algorithm because of the non-hierarchical nature of our dataset, and rather than mixture modeling because of the non-normal distribution of our dataset. In addition, we also thought a *k* means-type solution provided the best fit for our problem statement.

The number of clusters, *k*, for the analysis is informed by the number of clusters. We used the information of where the within-group sum of squares tapers off or no longer significantly decreases incrementally to select the number of clusters to include. In this study, the steep decline in the within-group sum of squares turned into a more gradual decline at four clusters (see Figure 1). In order to find a good factor solution, we performed successive steps to identify an interpretable solution with a reasonable number of homogeneous clusters (Suhr 2018). We found a well-interpretable solution with four homogeneous clusters rather than five or six.

With unsupervised learning, where an algorithm learns patterns from untagged data, it is important to select the correct variables for inclusion in the analysis, and these must be scaled correctly to prevent bias. If we include data that confuses the algorithm, the result could be weak or nonsensical. Our selection of variables for inclusion in the cluster analysis was informed by applying our principal component analysis to the initial set of variables.

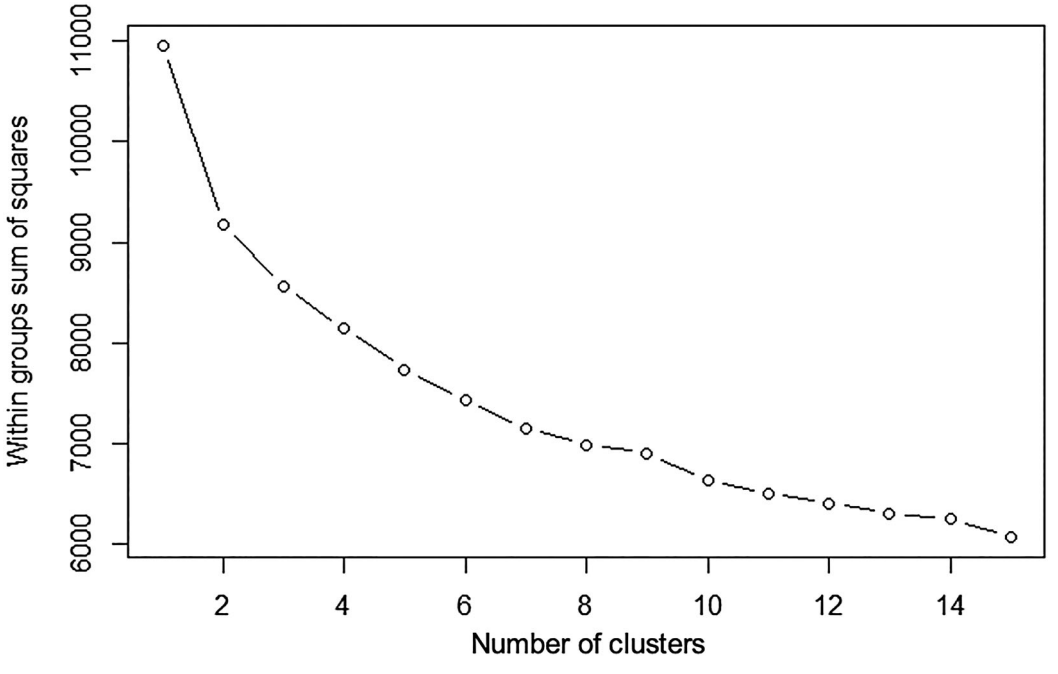

Figure 1. Within-group sum of squares for cluster determination.

Table 1. Number of observations per cluster.

	Cluster 1	Cluster 2	Cluster 3	Cluster 4
No. of responses per cluster	135	119	61	135
Share of respondents per cluster	**30%**	**26%**	**14%**	**30%**

The *k* means algorithm converged to the four clusters (Table 1). Of the total variation in the dataset, 25% was explained by the cluster solution. Our analysis aimed to find commonalities in the producers' strategic decisions regarding land and land use – whether to expand, exit, or contract their farming operations over a decade. Therefore, even though our groupings explain a small percentage of the variation, the results yielded a cluster that predominantly contains producers who expect to exit. This "exit cluster" enabled us to identify the common factors that can play a role, ex-ante, in the exit decision, whilst the other clusters enabled us to identify the common factors shared by three different groups who have the intention to remain in agriculture.

3. Discussion of results

3.1 Exploring the clusters

The cluster analysis provided four distinct groups of producers with small within-group variation and large between-group variation. Categorically, the cluster analysis can be discussed in three parts: general themes, the intention of succession or exiting, and perceptions of and attitudes towards challenges and threats. A high-level overview is provided first to define each cluster and easily differentiate between the clusters.

By considering some general themes – experience, turnover, education and age (Figure 2), it appears that there were some differences between the different clusters concerning experience (less than or more than 15 years), turnover (below or above R10 million per annum) and age (ranges between 48 and 55 on average), but no notable differences in education levels (graduate vs non-graduates). In cluster 1, the average age is 51, with 60% of respondents having more than 15 years of farming experience and 64% generating turnover of more than R10 million per annum. For clusters 2, 3 and 4, the average age is 55, 51, and 48 respectively, with 90%, 75% and

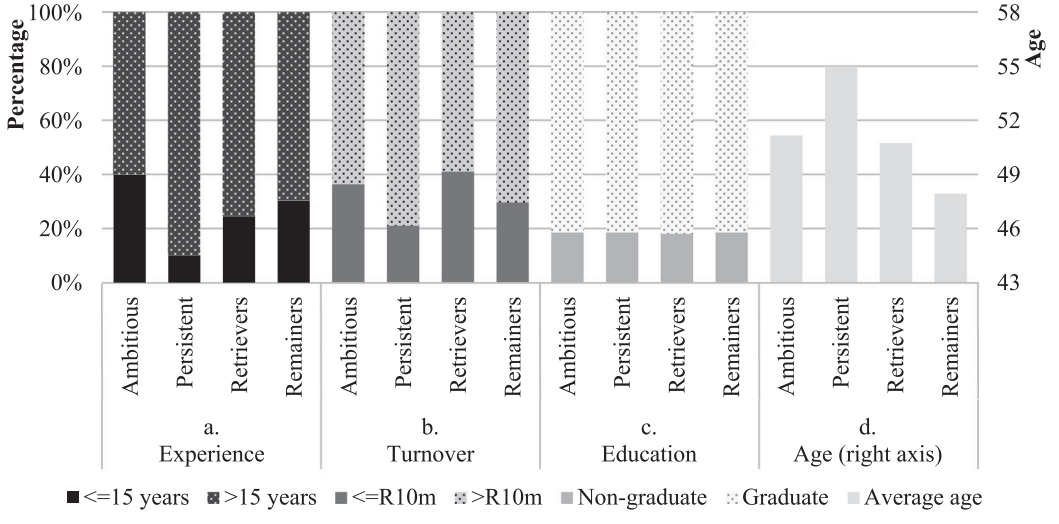

Figure 2. Comparing general themes between clusters.

70% having more than 15 years of experience and 79%, 59% and 70% generating turnover of more than R10 million per annum respectively.

By cluster, the intention of succession, where own children or family continue with operations when the current producer exits, or exiting, where the land will be sold once the current producer exits, provided interesting results. Both clusters 1 and 2 revealed that 13% of respondents planned to exit and sell, with 23% of the cluster 1 respondents indicating an intention of succession, compared to the 35% of cluster 2. In clusters 3 and 4, observations revealed that 85% and 4%, respectively, had an intention to exit and sell, with 5% and 31% indicating an intention of succession.

A first glance at the perceptions of and attitudes towards challenges and threats by cluster revealed that the range of responses varied substantially between the clusters on certain variables. In some instances, the variance was much lower. Clusters 3 and 4 showed very consistent trends for the perceptions and attitudes towards challenges and threats to operations, averaging concern levels of 74% across the different variables. In comparison, clusters 1 and 2 revealed 24% and 52%, respectively.

Hence, two groups of fairly similar clusters emerged, with the large between-group variation driven by a small number of variables for which large variances were observed between the groups.

The respondents in cluster 1 collectively appeared to be driven by constant risk mitigation to continue growing their businesses. Hence, we shall call respondents in this cluster "ambitious" – optimistic and unwavering in their pursuit. Several traits in cluster 2 coincide with observations from cluster 1. However, they are warier about the impact of challenges and threats on their operations. As such, the respondents in this cluster are deemed "persisters" – continuing firmly despite the difficulty.

The respondents in cluster 3 collectively appeared to be very concerned about the various challenges and threats to operations. Concerning longer-term decisions regarding farm ownership, the majority showed an intent to exit, and very few indicated that succession by own children or family was part of future plans. Hence, we'll call respondents in this cluster "retrievers" – forced or strategic withdrawal from the action. Several traits in cluster 4 coincide with observations from cluster 3; however, they show minimal intent to exit despite perceiving the environment in which they operate as challenging and a threat to their operations. The respondents in this cluster are deemed "remainers" – remain, despite the negativity.

The ambitious, and the persisters to a lesser extent, appear to be able to keep mitigating their risks and adjusting their strategy to continue growing their businesses. A Likert scale, where one is "not at all" and five is "most definitely", is used to display the level of challenge and threat perceived by producers in the two clusters for several variables in Figure 3. The ambitious cluster tends to be more resilient than the persistent cluster. Whilst both seem undeterred by the potential of challenges posed by financial constraint (panel a) and servicing loans (panel b), the persisters consistently perceived the exogenous factors to be more threatening to their operations than the ambitious producers (panels c to j). The highest level of threat perceived by the ambitious cluster was from natural disasters (see panel f of Figure 3), with 47% rating this threat four or five on the Likert scale. These threats are followed by rising input costs (panel h). The persisters were most concerned about the uncertainty around land reform policy (panel e), and they were also seriously concerned about rising input costs (panel h) and farm attacks (panel j).

Sixty-seven per cent of the total sample of producers with a turnover above R100 million belonged to either the ambitious or persistent clusters. Also, 11% of respondents in these two clusters have a turnover below R1 million per annum. They formed part of these clusters through the commonalities they share with the large-scale producers, such as not being deterred by the constraints and threats of the environment in which they operate.

Conversely to the difference in perception regarding challenges and threats to operations observed between the ambitious and persistent clusters, the retriever and remainer clusters tended to display substantial similarities. However, there was one major difference: 85% of the retrievers also indicated that they planned to exit and sell their farms, compared to the 4% of the remainers, which makes the substantial similarities in the challenges and threats surprising.

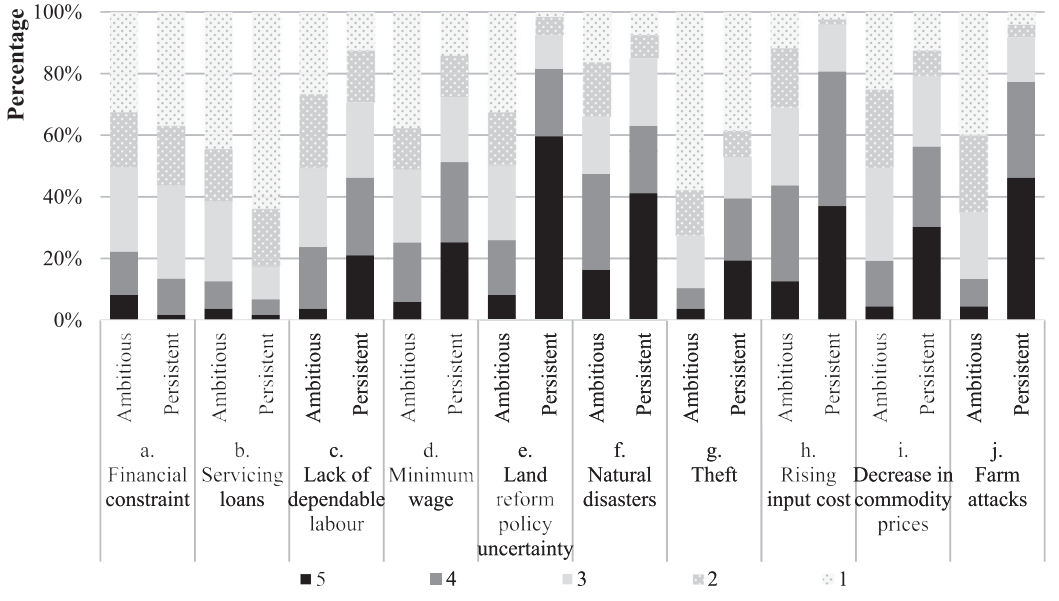

Figure 3. Comparing the perception of the ambitious and persister clusters.

We found that 75% or more of the retrievers and remainers scored the challenge of financial constraint and the threat of land reform policy uncertainty, natural disasters, rising input cost, and farm attacks a four or five on the Likert scale, substantiating the view that they perceive these factors as serious threats to operations (see Figure 4). The views of both these clusters contrast strikingly with those of the ambitious and persistent clusters. Apart from panels a, e, f, h and j highlighted above, a lack of dependable labor, minimum wage and decreasing commodity prices were also concerning for these clusters.

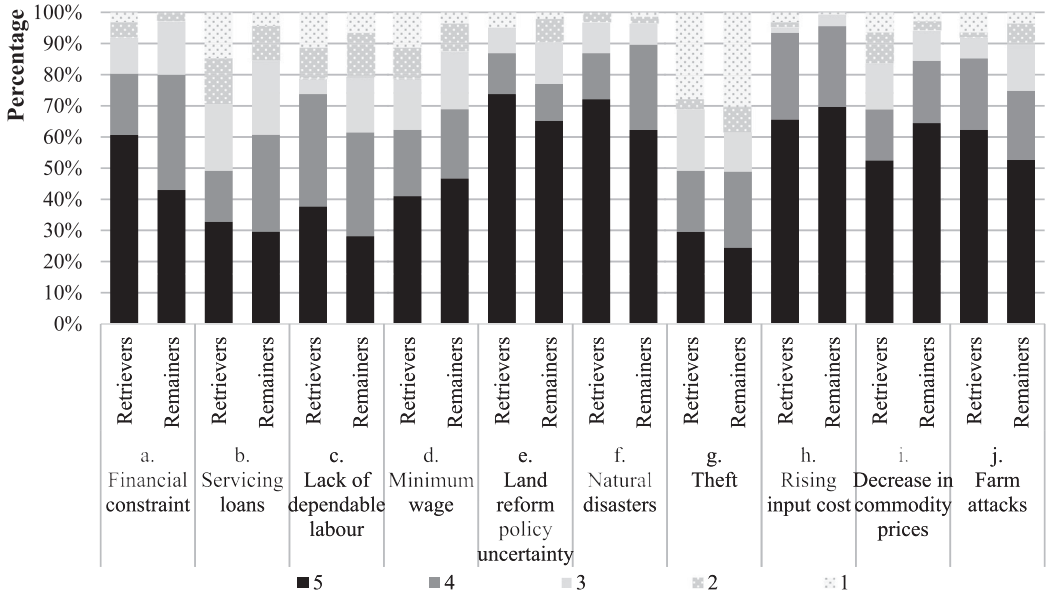

Figure 4. Comparing the perceptions of the retriever and remainer clusters.

Other differences observed between the retrievers and remainers include that the retrievers are slightly older (51 vs 48 years of age), run smaller operations in terms of turnover (41% vs 30% generate a turnover of less than R10 million per annum), with a much smaller window for succession by family after exiting (5% vs 31%) and slightly higher postgraduate education levels (15% vs 9%). If the perception of challenges and threats is quite negative, succession planning and education (therefore alternative job opportunities) seem to play a large role in the decision to exit or not.

3.2 Commercial producers who have a strategic intent to stay in agriculture

Clustering into four groups resulted in most producers with the strategic intent to exit over ten years being bundled into cluster 3, the retriever cluster. This sub-section of the study will focus on the complement – the three clusters primarily concerned with continuing farming. The discussion that follows, focused on these three groups of producers whose strategic intent is to remain operational.

The ambitious producer is, on average, 51 years of age, with 23% having a succession plan and 13% planning to exit. This cluster also features the highest share of postgraduate studies (16% of the cluster). Retirement is the most prevalent reason for planning to exit from this cluster and appears only in producers older than 46. For at least 33% of this cluster, it appears that farming is a second career. This was calculated by aligning farming experience with the producer's age. In terms of perceptions and attitudes towards challenges and threats to operations, this cluster averages concern levels of 24% across the different variables – the lowest of all the clusters in the study.

Conclusions drawn from this information is that, firstly, and at least to a certain extent, there has been an influx of new entrants to primary production in the ambitious cluster from other industries. These producers developed skills outside of primary agriculture and are now applying these skills to mitigate the risks they experience in farming. Secondly, whilst collectively appearing to have a strong appetite to grab the bull by the horns, some are driven to deal with the challenges as best they can while they can in order to add value – on the income and balance sheets – but who will eventually retire and sell their farms because no other viable solution is available.

The persistent producer is, on average, 55 years old, with 35% of them having a succession plan and 13% planning to exit. Retirement is also the most prevalent reason for planning to exit from this cluster, but with some concern for financial difficulty and physical danger. For only 16% of this cluster, it appears that farming is a second career, hence the highest average years of experience (90% of the cluster has over 15 years), which potentially could also be linked to the highest share of producers with a turnover over R10 million per annum (79% of the cluster). In terms of perceptions and attitudes towards challenges and threats to operations, this cluster averages concern levels of 52% across the different variables, the second-lowest of all the clusters in the study.

Conclusions drawn from this information are that, firstly, the persistent producer, to a large extent, started farming early in their career, with the strongest inclination towards succession. While the determination to continue the family tradition is noticeable, it is also somewhat alarming. The threats most concerning this cluster are land reform policy uncertainty, natural disasters, rising input costs, decreasing commodity prices, and farm attacks, which the next generation will also have to deal with.

The remainers, on average, are 48 years of age, with 31% having a succession plan and 4% planning to exit. Financial challenges are the most prevalent reason for few producers expecting to exit from this cluster and appears primarily in producers under the age of 54. In terms of perceptions and attitudes towards challenges and threats to operations, this cluster averages concern levels of 74% across the different variables, equaling the threat to operation perception levels of the retriever cluster.

Conclusions drawn from this information on the remainers are that, firstly, retirement as an exit strategy does not feature in this cluster at all. This could be attributed partly to the lowest average age of all the clusters and the questionnaire's ten-year outlook. Secondly, despite perceiving similar

levels of constraints and threats to their businesses, the vast majority of this cluster (96%) are planning to remain in primary agriculture. Delving into the specifics of the underlying factors contributing to the high levels of challenges and threats to operations experienced by this cluster, the findings concerning farm-level efficiency – whether these producers can reduce the cost of production more than the decrease in revenue from sales – is not only alarming for their sustainability but also those family members who have been identified as forming part of the succession plans. In addition, 80% of this cluster experiences financial constraints, and 60% find the servicing of loans challenging, yet only 4% think they might exit because of financial difficulty. Whilst some may interpret this result as a show of character, our interpretation leans more towards the existence of barriers to exit.

3.3 Exiting commercial producers

Most producers who indicated that they were likely to exit over ten years form part of the retriever cluster. Those outside of this cluster were described in the preceding section. For those who form part of this cluster but have not indicated that they plan to exit, we will explain why they are clustered with producers who have indicated a strategic exit decision.

To fall into the category of exiters, respondents had to have a high score for one or more of three responses on why they intended to quit farming: to retire, because of safety concerns, or financial difficulty. Whilst retirement was considered the primary reason for planning to exit from the ambitious and persistent clusters, and financial difficulty prevalent in the remainer cluster, in the retriever cluster, not only did 85% of the producers in the retriever cluster indicate their intention to quit, but, in most instances, they gave more than one reason for their intention to exit and sell the farm.

The retrieving producer was, on average, 51 years of age, with 5% having a succession plan and 85% planning to exit. This cluster also features the second-highest share of postgraduate studies (15% of the cluster). Safety concerns were the single most prevalent reason for planning to exit from this cluster. It appeared consistently across different age brackets and featured prominently (46%) as a part of a combination of factors driving the exit decision in the future. This was followed by financial difficulty as a reason to exit, and retirement, featuring in combination with each other and/or safety concerns 44% and 40%, respectively. Whilst the financial difficulty is especially pertinent for producers between 35 and 54, retirement was more concentrated among producers older than 55. For 23%, a combination of all three factors was the driving force behind the strategic exit decision. In terms of perceptions and attitudes towards challenges and threats to operations, this cluster averaged concern levels of 74% across the different variables, with perceptions concerning the level of threat posed by land reform policy uncertainty, natural disasters, rising input cost, and farm attacks to farm operations being especially high.

The non-exiting portion of the retriever cluster, of which 89% is under the age of 54, formed part of this cluster through the commonalities they share with producers who plan to exit. However, they are not currently at the same level of determination to exit over a decade. Still, the signs are there when considering the levels of threat they perceive from the various factors analysed.

The literature (for example, Chen et al. 2019; Gale 2003; Gras 2009) and the popular press often cite an inability to run a farm profitably as a reason for producers exiting. As profitability cannot be elicited through an anonymous and voluntary survey, we used farm turnover as a proxy to establish whether smaller producers are more likely to plan to exit. From the analysis (and shown in Figure 2), observations include that the retriever cluster had a higher-than-average share of respondents with annual revenue below R10 million (41% compared to 29% for the other clusters). However, by taking a step back, we could delve further into the relationship between turnover and the reasons for planning to exit, testing the hypothesis of whether smaller producers were more likely to exit because of financial difficulty.

Figure 5 shows the shares of reasons for the intent to exit or stay. Financial difficulty as the sole reason to exit and turnover were not closely correlated, hence the result disproving the hypothesis that it is predominantly the smaller producers who exit because of financial difficulty. When the

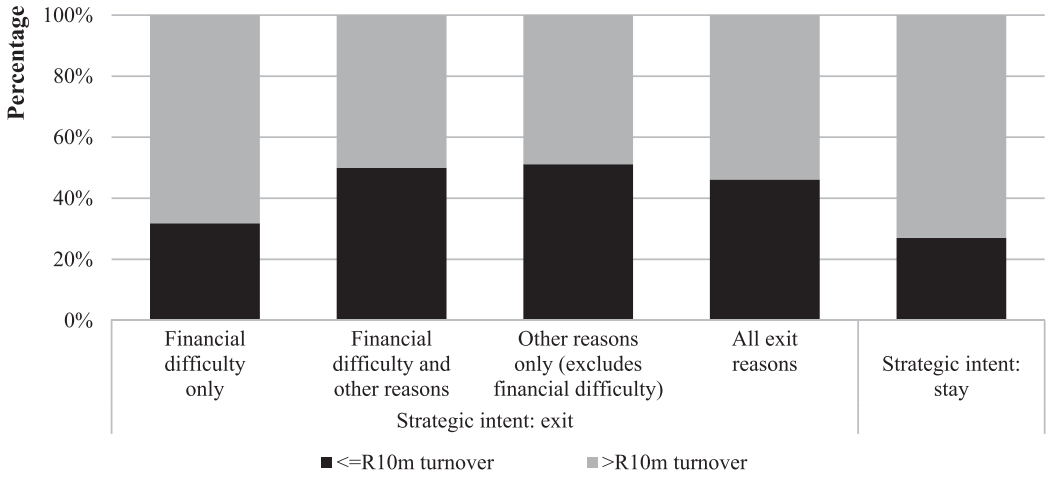

Figure 5. Financial difficulty as an exit reason compared to turnover.

other reasons, viz. retirement and safety concerns, are included, the split between producers with a turnover below and above R10 million per annum becomes much more equal. However, what is clear, is that the sample is much more skewed towards producers with a turnover above R10 million per annum where there is a strategic intent to stay.

Conclusions drawn from this information include that it is often a combination of factors, rather than a single factor, that contributes to the intent to exit, with turnover not so much a determining factor in exiting, but indeed in the intention to stay.

4. Conclusion

Four distinct groups of respondents were identified through our cluster analysis, which included 23 variables. Commonalities and differences between clusters provided valuable insights into the characteristics of the different groups of producers in the study – those who intend to exit farming within the next ten years, excluding producers who said the next generation would take over the farm, and those who intend to stay.

Cluster 1, the ambitious producers, constituted 30% of the sample. Their average age was 51 years, with 60% having more than 15 years of experience. Sixty-five per cent had an undergraduate and 16% a postgraduate qualification; 36% had revenues of less than R10 million a year and 64% of more than R10 million. Thirteen per cent said they planned to exit within the next ten years, with 23% indicating that a succession plan for their own children or other family was applicable.

Cluster 2, the persistent producers, constituted 26% of the sample. Their average age was 55 years, with 90% having more than 15 years of experience. Seventy-three per cent had an undergraduate and 8% a postgraduate qualification; 21% had revenues of less than R10 million a year, and 79% had more than R10 million. Thirteen per cent said they planned to exit within the next ten years, with 35% indicating that a succession plan for their own children or other family was applicable.

Cluster 3, the retrieving producers, constituted 14% of the sample. Their average age was 51 years, with 75% having more than 15 years of experience. Sixty-seven per cent had an undergraduate and 15% a postgraduate qualification; 41% had revenues of less than R10 million a year, and 59% had more than R10 million. Eighty-five per cent said they planned to exit within the next ten years, with 5% indicating that a succession plan for their children or other family was applicable.

Cluster 4, the remainer cluster, constituted 30% of the sample. Their average age was 48 years, with 70% of them having more than 15 years of experience. Seventy-three per cent had an

undergraduate and 9% a postgraduate qualification; 30% had revenues of less than R10 million a year, and 70% had more than R10 million. Four per cent said they planned to exit within the next ten years, with 31% indicating that a succession plan for their own children or other family was applicable.

Collectively, a 20% share of respondents (91 respondents) said they planned to stop farming, excluding producers who said the next generation would take over the farm, as the indication was towards selling their property within the next ten years. If a constant exit rate per year is assumed, using simple arithmetic, this could potentially result in an average annual exit rate of 2%. If exiting producers do not sell their farms to new entrants, this will result in a 2% per annum consolidation of ownership, slightly lower than the average annual exit rate of 2.6% for South Africa from 1991 to 2010 (Liebenberg 2012). In contrast, the average worldwide consolidation of farms ownership increased by 22% (or 1.1% annual average) from 1990 to 2010, somewhat concealing the increasing concentration of land in the hands of a smaller group of larger producers in a mass of 560 million producers worldwide (Lowder, Sánchez, and Bertini 2019).

The retriever cluster warranted further attention since most of the producers who planned to exit were in this cluster. These producers had two distinguishing features. They were relatively small producers, with 41% of them realising an annual revenue of less than R10 million, whereas this was the case for only 29% of respondents in the other clusters. They gave higher ratings to the problems of accessing dependable labor (74% vs 44% in the other three clusters), uncertainty regarding land reform policy (87% vs 61%) and rural safety (85% vs 54%). Although only 4% of the producers in the remainer cluster indicated an intent to exit, these producers gave similar ratings to labor, land reform policy and rural safety as those in the retriever cluster, and higher ratings to some other problems. The higher recorded ratings for the remainers than for the retrievers concerning the effects of minimum wage laws on labor cost (69% vs 62%), servicing loans (61% vs 49%), natural disasters (90% vs 87%), rising input costs (96% vs 93%) and decreasing commodity prices (84% vs 69%).

While all the clusters gave high ratings to the exogenous threats of natural disasters, uncertainty about land reform, and rising input costs, the retrievers and remainers gave these factors particularly high ratings. However, the ambitious and persistent clusters were possibly better positioned to absorb, avoid or mitigate these threats since 67% of the producers in our sample with annual revenue of more than R100 million a year were in these clusters, which is a clear concentration of mega producers.

Our findings support our hypothesis that farm exit decisions in commercial agriculture in South Africa are affected by retirement without succession, financial problems, access to dependable labor, uncertainty regarding land reform policy and concerns about rural safety. To a lesser extent, the producer's level of education may also play a role, even though it was not significant in the PCA. The other factor we hypothesised would affect the decision to exit, namely the type of production, was not substantiated by the analysis. Furthermore, more than one factor, or a combination of factors, plays a vital role in quitting farming and selling the property. Although a link between planning to exit and turnover could not be established when splitting the turnover at R10 million per annum, it appears that larger turnover could indeed play a role in the intent to stay.

Among the conclusions drawn from this information is that the biggest share of producers with postgraduate degrees form part of the ambitious or retriever clusters, suggesting that education and off-farm earning potential may play a role in the producer's initial occupation before entering primary agriculture and can also play a role in the decision to exit or stay. This could also be true for the next generation since studies have shown that children typically reach the same or higher levels of education as their parents (Narayan and van der Weide 2018; Piraino 2015). Education levels and the resulting ability to generate an off-farm income might contribute to South Africa's situation, as found in studies in the US, Canada, and Europe.

In the ambitious cluster, it appears that producers are building up to bigger revenues after coming into primary agriculture as a second career after working elsewhere first. In contrast, in the retriever cluster, the lack of critical mass – a bigger revenue offering better profitability prospects

– experienced by these respondents has also been responsible for reducing producer numbers in other countries, such as New Zealand, Argentina, and Uruguay. This issue could further entrench the dualistic nature of production, with primarily the larger producers being able to continue and the smaller ones deciding to exit, as is the case in Brazil. Lastly, we cannot exclude, or necessarily accurately quantify, the effect of the perceptions and realities of land reform policy and practices in South African commercial agriculture. Similarities can be found between the effect of reforms in Chile and Venezuela and South Africa.

From a land reform policy perspective, our study suggests that a substantial number of producers are planning to exit over the next decade. Additional research is required to help structure policy if an increase in the rate of land supply to aid transformation is required. Also, understanding the different producer groups, what they have in common and how they envision their future is pertinent information to write and apply policy effectively to drive sustainable transformation.

One of the recommendations of this study for future research would be to broaden the scope of the survey pool to determine whether factors such as province and climatic conditions might play an important role in the strategic decision-making process of producers, as this has been a limitation in this study. Further studies should also be conducted to identify and quantify the driving factors of the differences in perception of the environment producers operate and how these differences affect their decision to exit or continue could inform policy. Perhaps the biggest issue is not the loss of the 20% of producers who, according to our study, will exit over the next ten years, but rather the fact that we have not lost the ones who should have an exit strategy but do not have one. A related issue for research is the social and economic costs to the country if struggling producers remain in the business of farming when their farms are no longer productive.

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Appendix

Appendix A: Output from the PCA and variables included in the final cluster analysis

Proportion of variance explained	PC1 24%	PC2 10%	PC3 9%	PC4 8%	PC5 7%	PC6 6%	PC7 5%	PC8 5%	PC9 4%	
educ	0%	0%	0%	0%	0%	0%	0%	0%	0%	
occ_code	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Exiting	0%	0%	3%	0%	0%	0%	0%	0%	0%	Incl.
Exit_Retire	0%	6%	31%	1%	0%	0%	0%	1%	0%	Incl.
Exit_Danger	1%	6%	21%	2%	0%	1%	1%	1%	0%	Incl.
Exit_Finance	1%	0%	19%	2%	0%	0%	0%	3%	0%	Incl.
Prov_EC	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Prov_FS	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Prov_GP	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Prov_KZN	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Prov_LP	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Prov_MP	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Prov_NW	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Prov_NC	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Prov_WC	0%	0%	0%	0%	0%	0%	1%	0%	0%	
Gender_male	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Gender_female	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Industry_mixed	0%	0%	0%	1%	0%	0%	0%	0%	0%	Incl.
Industry_livestock	0%	0%	0%	0%	0%	0%	0%	0%	0%	Incl.
Industry_fieldcrops	0%	0%	0%	0%	0%	0%	0%	0%	0%	Incl.
Industry_horticulture	0%	0%	0%	1%	1%	0%	0%	0%	0%	Incl.
Industry_forest	0%	0%	0%	0%	0%	0%	0%	0%	0%	Incl.
born_rescaled	0%	1%	1%	0%	6%	3%	1%	2%	0%	Incl.
exp_rescaled	0%	4%	0%	0%	50%	18%	0%	8%	2%	Incl.
turnover_rescaled	0%	0%	3%	1%	4%	6%	29%	15%	32%	Incl.
Emp_Perm_Num_rescaled	0%	0%	0%	0%	0%	0%	0%	0%	1%	
Emp_Seas_Num_rescaled	0%	0%	0%	0%	0%	0%	0%	0%	0%	
const_fin_chal_rescaled	12%	19%	2%	3%	1%	0%	1%	5%	0%	Incl.
const_serv_borrow_rescaled	9%	24%	1%	4%	0%	3%	15%	6%	0%	Incl.
threat_dep_labour_rescaled	5%	0%	0%	4%	4%	5%	2%	5%	16%	Incl.
threat_min_wage_rescaled	11%	0%	1%	4%	5%	36%	1%	13%	0%	Incl.
threat_land_ref_rescaled	11%	14%	1%	5%	7%	2%	0%	27%	4%	Incl.
threat_drought_flood_rescaled	7%	0%	0%	0%	0%	9%	24%	2%	15%	Incl.
threat_ls_theft_rescaled	6%	9%	14%	63%	0%	0%	0%	2%	0%	Incl.
threat_input_cost_rescaled	9%	1%	0%	1%	3%	0%	3%	2%	2%	Incl.
threat_comm_price_down_rescaled	13%	1%	0%	3%	18%	14%	2%	7%	11%	Incl.
threat_farm_att_rescaled	13%	14%	1%	4%	1%	1%	18%	0%	13%	Incl.