Constructing a sophistication index as a method of market segmentation of commercial farming businesses in South Africa

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A B S T R A C T

This study investigates the process of index construction as a means of measuring a hypothetical construct that can typically not be measured by a single question or item and applying it as a method of market segmentation. The availability of incidental secondary data provided a relevant quantitative basis to illustrate this process by constructing a commercial farming sophistication index for South Africa. It was evident that this approach offers an appropriate and useful means of segmenting a market. Several factors contribute to the appeal of this approach. Among others, it addresses important priorities in the area of future segmentation research. By offering classification rules based on characteristics that can easily be observed or elicited through asking a few key questions, new or potential buyers can be grouped by buying behaviour segment. Furthermore, the multi-step process that was employed provides a systematic and structured multivariate approach to segmentation. It also facilitates replication of the process when conducting future studies. Lastly, the outcome of this type of segmentation method offers researchers and marketing practitioners a procedure, in the form of an equation, to calculate index scores and provide rules to segment the market based on predefined intervals. Hence, the challenge to replicate segment formation across independent future studies is addressed.

Key words: agribusiness, commercial farming, index construction, segmentation, sophistication

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Market segmentation is regarded as essential by marketing practitioners among others for targeting, proposition development, price formulation and developing mass communication (Bailey, Baines, Wilson & Clark 2009). However, tension exists between theory and practice in the field of market segmentation, with many marketers expressing concern about implementation and the integration of segmentation into marketing strategy (Dibb & Simkin 2009). To address this, priorities in the area of future segmentation research include the selection and incorporation of new variables into segmentation models, as well as developing new and innovative segmentation strategies (Dibb & Simkin 2009).

A specific area of segmentation development that holds particular pragmatic relevance for marketing practitioners is the process of index construction as a method of market segmentation. Among marketing research practitioners, the South African Audience Research Foundation's Living Standards Measure (LSM) is a well-known example of an index measure. The LSM places South African adults on a continuum of living standards and is used not only in marketing research, but also in social, business, economic, education and other fields of research. The value of the index measure, however, lies in its application as a segmentation tool, serving both as base and descriptor variable.

While the use of index variables in research studies might be common, the process of index construction and subsequent application in segmentation studies seems a neglected area of coverage in academic literature and is often noted only in passing. The focus of this paper is on a typical process of index construction that is often followed within a survey research methodological framework. To illustrate the process, an index of commercial farming sophistication is constructed from secondary survey data that were originally gathered among a sample of commercial farming units in South Africa. Commercial farming sophistication is conceptualised for the purpose of this study as the relative degree of complexity of structures, systems, strategies and practices employed across various functional areas in a commercial farming business. It should be noted that lower levels of sophistication, however, do not suggest units being regarded as unsophisticated, but merely falling on a lower relative level of sophistication. Furthermore, in the context of this study, the availability of the secondary data is regarded as incidental. It nonetheless provides a relevant and recent quantitative basis to illustrate the process of index construction. Further to this, the application of this newly created index as a base variable for market segmentation is explored.

The research objective is firstly to identify and define variables that can be used for the construction of a commercial farming sophistication index for South Africa; secondly, to construct a commercial farming sophistication index for South Africa to

use as base or descriptor variable in market segmentation studies; thirdly, to segment and profile the South African commercial farming market based on the new index; and lastly, throughout all of the above, to assess the use of index construction as a market segmentation method.

This study contributes to the academic literature by addressing important priorities in the area of future segmentation research, namely that of investigating the application of new variables into segmentation models, as well as investigating new segmentation strategies. Incorporating innovative segmentation approaches, processes and methods that can improve one's understanding of the market is valued by marketing practitioners. This contributes towards realising the advantages of market segmentation, which are promoted extensively in the literature (Dibb, Stern & Wensley 2002: 113; Ferrell & Hartline 2005: 134; Freathy & O'Connell 2000: 102; Goller, Hogg & Kalafatis 2002: 263; McDonald & Dunbar 2004: 34). These include homogenising market heterogeneity, improving the understanding of buyers, identifying new market opportunities, better allocation of business resources and skills, and improved performance and competitive advantage.

From a practical perspective, understanding how such a method of segmentation might apply holds significant value for researchers and marketing practitioners that will be engaging in future segmentation studies. It also contributes towards applying a new and creative segmentation base that offers more discriminating power in explaining market behaviour than the often very limited explanatory value offered by traditional external variables. In addition, offering rules to construct such a new and creative segmentation base that is founded on characteristics that can easily be observed or elicited by asking a few key questions, holds significant value for conducting future segmentation studies.

Lastly, illustrating the process also has wider application value in other business-to-business markets, locally and internationally, where index variables are constructed from both primary and secondary sources and used as a method of segmentation following a similar multi-step approach to that proposed in this study.

Literature review

Marketing researchers often make use of index construction as a means of measuring some hypothetical construct. There are several reasons for this. Firstly, despite the efforts of researchers to design studies that can provide valid and reliable quantitative measurements of variables, it is seldom possible to develop single indicators of complex concepts in advance. Considering several data items as a composite measure might therefore provide a more comprehensive and accurate indication

of the construct being studied, contributing towards the validity and reliability of measurement (Babbie 2011). Secondly, data items that form the basis of an index are typically scaled or ordinal in nature. As such, an index variable takes advantage of any intensity structure that may exist among attributes. Thirdly, indexes are efficient at reducing data, as several inter-related items may be summarised in a single numerical score.

Characteristics of an index

Both Babbie (2011: 169) and Spector (1992: 1) make reference to various characteristics of index variables. Firstly, an index is derived from multiple items. This means that the items are summated or combined, thereby converting a specific procedure into a single measurement or scale. Secondly, the individual items that form the basis of the index measure something that is underlying, quantitative and on a measurement continuum. Index variables are therefore typically ordinal in nature. Thirdly, an answer or response to an item cannot be classified in terms of 'right' or 'wrong'. An index variable therefore constitutes a scale measurement that is indicative of some hypothetical construct that can typically not be measured by a single question or item. Higher index values might indicate 'more of' and lower values 'less of', with neither being 'right' or 'wrong'. Lastly, a good index is evaluated in terms of its reliability and validity. Both these aspects are considered as part of the last step in index construction.

Steps in index construction

Babbie (2011: 169) notes that the task of index construction is not a simple undertaking; while Spector (1992: v) describes the process as seldom being easy. As in the case of the market segmentation process, which comprised a number of logical and inter-linking steps, index construction also follows a stepwise process. In fact, the process of index construction, when applied as a method of segmentation, forms sub-steps in the segmentation process.

The work of Babbie (2011) and Spector (1992), in particular, provides academic and theoretical reference in the process of index construction, while research conducted by African Response (2006), the South African Advertising Research Foundation (2009), and Jensen, Spittal, Crichton, Sathiyandra and Krishnan (2002) provides specific pragmatic and empirical reference in identifying the typical reasons for constructing an index, as well as considerations and common steps relevant in the process.

Three steps in index construction are commonly distinguished, namely: (1) item selection; (2) examining the empirical relationships of items and combining these into an index; and (3) validating the index. These steps are briefly reviewed.

Item selection

In the first step, Babbie (2011: 172) notes that when a composite index is created in order to measure some variable or construct, an important criterion to consider is the face validity of items. The selection of items should be guided by a clear and precise definition of the construct itself (Spector 1992: 7). An index cannot be developed until it is clear exactly what that index is intended to measure. In the context of this study, items included in measuring commercial farming sophistication should, therefore, appear at face value to indicate business sophistication. Lastly, an important aspect to consider in item selection is the degree of variation provided by the items. If an item provides no variation, it would not be very useful for the construction of an index.

Combining of items into an index

During the second step of the index construction, the relationships among items are considered, with the anticipation of combining some of the items into a single and one-dimensional construct variable. Borrowing from Jensen et al. (2002), additional outcomes associated with this step include that the index should discriminate across the full continuum; be a direct measure used over a wide range of non-monetary descriptive indicators; be continuous; be valid and reliable; provide valid comparisons between sub-populations; provide scores that are readily interpretable; and lastly, be stable but sensitive enough to register changes over time.

By assigning scores for particular responses on an item, a single composite index can be created through the basic summation of items. In these instances, each item score is weighted equally. However, researchers are often faced with a multitude of possible variables to include in the index, and a reduction of the number of explanatory variables is therefore sought. A potential solution to this is the use of multivariate statistical techniques, such as exploratory factor analysis, confirmatory factor analysis and principal component analysis. These techniques use the multi-variability between items to identify those variables that have the greatest discriminatory power and weigh them optimally in order to derive a new single construct measure. In other words, it offers solutions for assigning different weights to items through the calculation of factor scores. The weights typically present an indication of the relative 'importance' or extent of contribution of specific items towards the final index scores.

Lastly, an important outcome of this step should be to derive a general use form of the index scale. While techniques such as factor analysis and principal component analysis produce weighted scores, these might not necessarily be easily replicable in future studies. The aim is therefore to produce a general-use form of the index that could easily be calculated by other researchers and survey practitioners without depending on using advanced multivariate statistical techniques. Another important aspect is to provide guidance on cut-off points for the index scale so as to guide researchers in applying the newly created index as a method of market segmentation. Alexander, Wilson and Foley (2005) rightfully argue that while an understanding of particular consumer behaviour is valuable through the interpretation of the index scores, this information becomes much more valuable if new or potential consumers, buyers or members of the market can be classified using a derived formula, particularly if they are segmented into homogeneous groups. Furthermore, the index is useful if it is based on characteristics that can easily be observed or elicited by asking only a few key questions.

Index validation

The last step involves index validation. Item analysis provides a means of testing for internal validation. In other words, the index is examined across the item responses that comprise it. It is also advisable to test for external validation. Commercial farming businesses that are, for example, classified as having high levels of sophistication should also appear to be sophisticated in relation to other relevant items measured in the study. Similarly, individuals with high living standard levels should, for example, be associated with other items indicative of living standard but not included in the make-up of the index.

Tonks (2009: 349) provides additional views on validation, noting that it is important to assess the extent to which index variables address the various approaches to establishing validity, namely: those of construct, content and criterion validity. Construct validity is probably the most difficult to establish, as it is concerned with what the construct is ultimately measuring. Many variables that are easily 'observable', such as type of legal form or turnover, do not present any formidable difficulties to establishing construct validity. However, an index measure that is derived from less observable items, such as subjective evaluations or perceptions, could be more challenging. Tonks (2009: 349) proposes a multitrait-multimethod matrix approach for establishing construct validity. This approach provides a means of decomposing construct validity into the assessments of convergent, discriminant and nomological validity. The first step is to identify the extent to which a positive correlation exists

between the construct and other similar constructs. This would also suggest that the inter-correlation between items within a factor is typically high. Secondly, it is important to confirm that no correlation exists with other theoretically unrelated constructs; and thirdly, it is necessary to establish the consistency with respect to different but associated constructs. However, Tonks (2009: 349) warns that such procedures are complex and require abundant data. Nonetheless, whether or not they are used, some subjective judgements have to be made.

Content validity involves determining the suitability of the segmentation variable for a clearly specified domain of interest. This is usually done by referring to the literature, or by trusting the judgement of a well-informed professional or panel of experts. Despite the scholarly debates concerning construct and content validity, Tonks (2009: 349) remarks that the role of subjectivity in establishing these types of validity may be considered irrelevant if a given general segmentation variable has adequate criterion validity. Of the three types of validity identified here, criterion validity is most likely to be regarded as immediately pragmatic, and to determine some of the criteria for segment qualification and segment attraction.

Tonks (2009: 349) states: "In the case of a basic segmentation theory or model, criterion validity concerns the extent to which the available 'independent' segmentation variables are associated with the 'dependent' criterion of interest – which is usually some aspect of behaviour. That association may or may not be casual, but the essential requirement is that the 'independent' descriptor variable discriminates the 'dependent' criterion variable in a useful way; and the general rule is that homogeneity is required within segments, and heterogeneity between segments."

As part of the validation, aspects relating to the reliability of the scale should also be considered. Reliability is typically considered in two ways, namely: test-retest reliability and internal-consistency reliability (Leedy & Ormrod 2010: 93). The aforementioned relates to a scale or index yielding consistent measurement over time. The latter means that multiple items, which are designed to measure the same construct, would consistently show high levels of inter-correlation with one another. Spector (1992: 6), however, notes that it is possible that a scale demonstrates only one of these types of reliability. Various methods and strategies exist to test for reliability. These, for example, include the calculation of the Cronbach's alpha coefficient, which provides a means of measuring the internal reliability consistency of the newly created scale or index (Pallant 2010: 97).

Key considerations in the construction of an index

The literature reveals some key considerations that are believed to contribute towards the successful construction of an index, namely:

- The process originating from similar aims and objectives that are envisaged by the various researchers during conceptualisation
- The general and specific assumptions underlying the model adopted that would guide the index construction process
- The steps, processes and advanced statistical methods that are employed for the calculation of original index scores
- Deriving a general use form of the index that could easily be calculated by other researchers and survey practitioners without depending on advanced statistical analysis
- Presenting a standard set of index score intervals that segment the market and allow researchers to classify potential members of the market into the relevant segment.

Research design

Survey data gathered from commercial farming units in South Africa were identified by the researchers as suitable for the construction of a commercial farming sophistication index. In the context of this study therefore, the availability of the secondary data was regarded as incidental and served the primary purpose of illustrating the process of index construction. Another aim of the study was to apply the index as a method of market segmentation.

The original data were gathered by means of a structured questionnaire and a postal survey. A final sample realisation of 876 farming units was derived and used in the subsequent index development process.

The plan for index construction followed a multi-step approach, namely: (1) selecting questions from the original survey instrument and defining variables that were most likely to be indicators of commercial farming sophistication; (2) combining variables into an index using principal component analysis and stepwise regression; and (3) forming market segments and index validation.

This study had several delimitations relating to its context, constructs and theoretical perspectives. Firstly, it was limited to the context of commercial farming businesses located in South Africa, defined as any farming unit within the boundaries of South Africa that produced agricultural products intended for the market. Secondly, the study focused on measuring the degree of sophistication

among commercial farming businesses in South Africa. It was therefore limited to identifying and defining the variables needed for such measurement; and it was not concerned with measuring the relationship – whether direct, or as a moderating influence – between the levels of business sophistication and business performance, although this relationship is hypothesised in the literature (Hahn 1999). Thirdly, a pre-designed questionnaire used as part of the original study formed the reference point for the identification of variables that could contribute to the development of an index measuring commercial farming sophistication.

Results

The first step in the process involved defining variables that could be used as indicators of commercial farming sophistication. The original question responses were hence re-coded so that the categories were presented by dichotomous variables indicating the presence or absence of a specific item in a commercial farming business. This, firstly, standardises the scale across all items; and secondly, it meets the measurement requirements for principal component analysis, which was used as part of the index construction.

Following the identification and definition of items, one-way frequency tables were produced. Only variables that showed sufficient variation were used in the subsequent steps of the index construction. These variables are listed in Table 1.

The next step was to examine the empirical relationships between the variables. This was done by firstly subjecting the variables identified in the first step to a principal component analysis. A Kaiser-Meyer-Olkin measure of sampling adequacy of 0.82 was also reported, suggesting that one could continue with the analysis. Pallant (2010) recommends a minimum value of 0.6 for a good analysis. This value was considered to be a positive indication of the potential for index development. The scores on the factor that explained the largest proportion of variation in the data (21.0%) formed the initial scores for the index. The square loadings are shown in Table 2.

Table 3 shows that when considering the results from the rotated component matrix, seven variables subjected to the analysis were more closely related to the first component than to any of the other components.

Table 1: Frequency distribution of initial set of variables (n = 600)

Variables	No (%)	Yes (%)
Primary farming operation: Stock farmer	33.0	67.0
Have any secondary branches of farming operations	24.0	76.0
Operate other farming-related business	78.7	21.3
Primary farming operation administrated: Sole ownership	33.8	66.2
Registered for VAT	3.2	96.8
Have cash-flow budget	27.0	73.0
Make use of accountant (external)	71.7	28.3
Use a cell-phone as part of farming operations	8.7	91.3
Use PC as part of farming business/farm management	27.2	72.8
Use PC for business management	68.5	31.5
Use PC for animal/irrigation management	75.2	24.8
Use PC for financial management	57.5	42.5
Use PC for VAT/tax management	60.7	39.3
Have internet access	38.8	61.2
Pay wages via internet	71.0	29.0
Have short-term insurance for farming business	12.3	87.7

Table 2: Results from first principal component analysis: Variance explained

	Rotation sums of squared loadings		
Factor	**Total**	**% of variance**	**Cumulative %**
1	3.368	21.0	21.0
2	1.351	8.4	29.5
3	1.291	8.1	37.6
4	1.171	7.3	44.9
5	1.108	6.9	51.8

Table 3: Results from first principal component analysis: Variables loading on first factor

Variables	Factor loadings
Use PC as part of farming business/farm management	0.786
Have internet access	0.734
Use PC for financial management	0.734
Use PC for VAT/tax management	0.651
Use PC for business management	0.634
Pay wages via internet	0.611
Use PC for animal/irrigation management	0.550

The scores were then categorised into ten equal-sized groups. Inspection of frequency distributions and correlation analysis provided insight into the extent of association among the variables and the initial index scores. Variables that showed little or no correlation were excluded from the subsequent analysis.

A second exploratory factor analysis was performed using the reduced list of variables as input. The scores on the factor that again explained the largest proportion of variation in the data formed the scores for the index. These scores were subsequently included in a stepwise regression to identify a set of variables that would help explain any variation in the index scores. As expected, the new set of scores produced by the stepwise regression correlated highly with the scores from the second principal component analysis, with an adjusted R-square of 0.995, as shown in Table 4.

Table 4: Results from stepwise regression: Model summary

R	R Square	Adjusted R Square	Standard error of the estimate
0.997	0.995	0.995	0.07021459

An analysis of variance (ANOVA) was used to test the hypothesis that the coefficients included in the final model were significantly different from zero. The results, as reported in Table 5, show that the null hypothesis cannot be accepted ($p = 0.000$), therefore suggesting that all the coefficients are significantly different from zero.

Table 5: Results from stepwise regression: ANOVA

	Sum of squares	Degrees of freedom	Mean square	F	Sig.
Regression	38 254.734	10	3 825.473	775 944.167	0.000
Residual	192.219	38 989	0.005		
Total	38 446.953	38 999			

The predicted scores calculated from the stepwise regression also formed the values for the final index. It should be noted that the variables included in the final stepwise regression model were not necessarily the same as those identified from the second principal component analysis. The variables that best predicted the index scores associated with commercial farming sophistication are reported in Table 6.

Table 6: Results from stepwise regression: Coefficients

	Unstandardised coefficients		Standardised coefficients		
	B	Standard error	Beta	t	Sig.
Constant	-2.148	0.002		-906.173	0.000
Use PC as part of farming business/farm management	0.586	0.001	0.263	472.160	0.000
Use PC for financial management	0.400	0.001	0.200	422.913	0.000
Pay wages via internet	0.369	0.001	0.165	390.553	0.000
Use PC for VAT/tax management	0.515	0.001	0.254	590.748	0.000
Use PC for animal/irrigation management	0.470	0.001	0.207	525.594	0.000
Have internet access	0.431	0.001	0.212	397.098	0.000
Primary farming operation: Stock farmer	0.300	0.001	0.145	390.479	0.000
Use PC for business management	0.277	0.001	0.129	301.476	0.000
Use a cell-phone as part of farming business	0.303	0.001	0.085	230.231	0.000
Registered for VAT	0.305	0.002	0.055	151.241	0.000

These coefficients could hence be used to calculate the index scores. The index scores thus provide a continuous scale that indicates the levels of commercial farming sophistication. Higher scores are associated with higher levels of sophistication.

The next phase in the study concerned the formation and profiling of meaningful segments in order to present homogeneous groups of farming operations. To form a final set of commercial farming sophistication segments, the scores obtained from the stepwise regression were categorised into a number of approximately equally sized

groups, based on the weighted sample. Twenty-five groups were initially formed, which allowed adequate group size to be retained and variability in the data to be examined. Next, the proportional distribution of variables that formed the basis of the sophistication index was examined across the 25 groups. Where adjacent groups revealed similar proportional characteristics, they were collapsed to form a new reduced set of segment groups. The proportional distribution of groups was again inspected and the same process repeated. This process of evaluating adjacent groups was repeated until a final set of segments emerged. Five segments were eventually formed. This process is presented in Figure 1. Lower and upper cut-off points were identified for each segment, providing segmentation rules for researchers and practitioners alike.

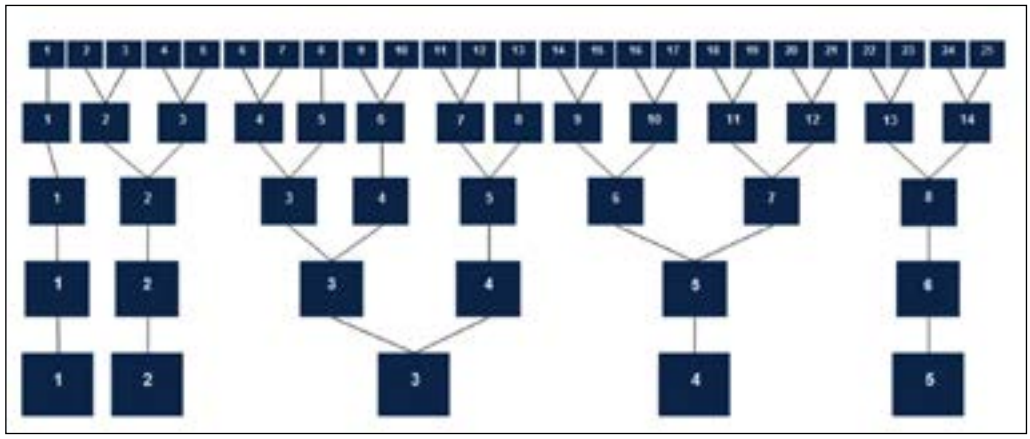

Figure 1: Process showing the collapsing of 25 groups to form a final set of five market segments

In the last step, the relationships between segments across those variables that formed the basis of the construction of the sophistication index, as well as among other variables that were expected to be correlated with levels of sophistication, were inspected. This also allowed for the profiling of segments.

The results showed that commercial farming units in South Africa that formed part of the first segment (an estimated 6.5% of the total market) were characterised as having the lowest levels of commercial farming sophistication, and these were predominantly stock farmers (81.8%). As noted earlier, while these proportions provide a means of profiling segments, stock farmers are not classified as unsophisticated, but merely lying at the lower levels of sophistication. An estimated quarter of operations (25.7%) makes use of a cell-phone as part of the daily operational and farm-management activities. However, the use of a personal computer and having

internet access seemed largely non-existent. About 71.8% of farming operations were registered for tax.

The number of commercial farming units that formed part of the second segment (an estimated 25.5% of the total market) and were farming primarily with stock, was proportionally lower (69.2% compared to 81.8%), with a sizable proportion of farmers in this segment (30.8%) being regarded as crop farmers. Whereas only an estimated one in four operations (25.7%) in the first segment made use of a cell-phone, slightly more than 95% of the farming operations in the second segment did so. Despite the high proportion of cell-phone users, only one in five farming operations in this segment (19.3%) used a personal computer to assist with their operational and farm-management activities.

The market penetration of internet connectivity was also relatively low (15.1%), with only a few farmers (1.8%) using this channel to pay wages electronically. As expected, a large percentage of farming operations in this segment (97.2%) was registered for tax.

Of those farming units in the third segment (an estimated 26.9% of the total market), an estimated 63.5% were farming primarily with livestock, with 36.5% farming with crops. About 97% of farming operations in this segment made use of a cell-phone. The use of a PC as part of the daily farm operational and management activities was evident among nearly all of them (99.3%). The use of a personal computer for various operational and farm-management activities emerged within this segment, with 22.4% using one for general farm and business management, 22.2% for animal/irrigation management, 31.4% for financial management, and 33.3% for tax management.

Almost 66% had internet connectivity, with one in ten (10.5%) paying wages via the internet. Ninety-seven per cent (96.9%) of farming operations were registered for tax.

Among farming units in the fourth segment (an estimated 29.0% of the total market), a much more equal distribution of livestock and crop farming operations was evident (53.8% and 46.2% respectively). About 95% of farming operations in this segment made use of a cell-phone. The use of a personal computer as part of daily farm operational and management activities was evident among all units (100.0%).

The use of a personal computer for various operational and farm-management activities was more established within this segment, with 48.4% using one for general farm and business management, 30.5% for animal/irrigation management, 79.9% for financial management, and 67.0% for tax management. Almost 95% had internet connectivity, with 53.4% paying wages via the internet. All the farming operations within this segment are registered for tax.

Of those farming units in the fifth and last segment (an estimated 12.2% of the total market), a significant proportion of farming operations are characterised as livestock farmers (70.2%). About 98% of farming operations in this segment make use of a cell-phone. The use of a personal computer as part of daily farm operational and management activities is evident among all (100.0%). The use of a personal computer for various operational and farm-management activities was well established in this segment, with 88.1% using a PC for general farm and business management, 87.3% for animal/irrigation management, 98.0% for financial management, and 92.7% for tax management.

All the farming operations in this segment had internet connectivity, with 69.1% paying wages via the internet. All the farming operations in this segment were registered for tax.

The study also considered the relationship between selective firmographic characteristics of commercial farming operations in South Africa and the five segments. The following characteristics had a significant relationship with segments:

- Operate other farming-related businesses
- Primary farming operation administered: Sole ownership
- Primary farming operation administered: Company
- Annual turnover: More than R3 million
- Have cash flow budget
- Make use of an independent financial advisor
- Use 3G cellular service
- Have short-term insurance for farming operations.

There was also a relationship between the legal structure of commercial farming operation and the segments, with higher levels of sophistication being associated less with sole ownership (48.3% in segment 5 compared with 90.6% in segment 1), and increasingly with a company (4.3% in segment 1 compared with 19.7% in segment 5). Segments with higher levels of sophistication also showed higher levels of turnover. No farming operations in segment 1 reported an annual turnover of more than R3 million, compared with 5.2% in segment 2, 9.8% in segment 3, 22.6% in segment 4, and 32.7% in segment 5.

Commercial farming operations with higher levels of sophistication were more likely to have a cash-flow budget. About 50.2% of farming operations in the first segment reported having a cash-flow budget, compared with 65.1% in segment 2, 71.2% in segment 3, 81.0% in segment 4, and 88.7% in segment 5.

The adoption and use of technologies such as 3G cellular services were also more prevalent among segments with higher levels of sophistication, with about 53.6% of

farming operations in segment 1 having 3G, compared with 67.5% in segment 2, 76.4% in segment 3, 80.8% in segment 4, and 85.1% in segment 5.

Conclusion and practical implications

This study focused on the process of index construction as a means of measuring a hypothetical construct, namely that of commercial farming sophistication. In addition, this study considered the subsequent use of the newly developed index as a base variable for segmenting the South African commercial farming market. Lastly, throughout all of the above, the study assessed the use of index construction as a method for market segmentation.

Following the process, the conclusion is drawn that this approach offers an appropriate and useful means of segmenting a market. Several factors contribute to the appeal of this approach. From an academic perspective, it contributes towards addressing important priorities in the area of future segmentation research, namely that of investigating the application of new variables into segmentation models, as well as investigating new segmentation strategies. Incorporating innovative segmentation approaches, processes and methods that can improve one's understanding of the market is valued by marketing practitioners.

From a practical perspective, the approach is creative in combining several base variables into a single measure, namely that of an index variable. This allows for a reduction of the complexity in the often unstructured data that researchers and marketing practitioners have to deal with.

It also contributes towards offering a segmentation variable that provides more discriminating power in explaining market behaviour than the often very limited explanatory value provided by traditional external variables. For instance, the study found levels of sophistication to be a significant explanatory variable for the adoption of information and communication technology product and service usage, such as a personal computer, a cell-phone and the internet as part of farming operations. The findings of this study also revealed that farming operations along the sophistication continuum tended to adopt the use of a personal computer firstly for financial management purposes, rather than using a computer in other functional management areas.

The process contributes towards homogenising the market heterogeneity in terms of a single construct. The segmenting of the market could also facilitate a more homogeneous response to marketing programmes.

Using an index takes advantage of any intensity structure that may exist among attributes. This has the advantage of placing members of the market on a continuum

that can lead to tracking members' development paths as they progress towards higher levels, for example, farming sophistication.

Furthermore, the process has wider application value in other business-to-business markets, locally and internationally, where index variables can be constructed from both primary and secondary sources and used as a method of segmentation following a similar multi-step approach to that proposed in this study.

The outcome of this type of segmentation method offers researchers and marketing practitioners a procedure, in the form of an equation, for calculating index scores and providing rules to segment the market based on predefined intervals. This ensures consistency in the rules and criteria used to calculate index values and apply these as a method of market segmentation. Hence, the challenge to replicate segment formation across independent future studies is addressed.

This thesis is the result of an investigation into the process of index construction as a method of market segmentation. Specific limitations were formulated in the literature review and during the empirical part of this study, which focused on illustrating the process by constructing a commercial farming sophistication index as a method of segmentation.

Various limitations are cited following the completion of the research and reporting of the results. Firstly, the illustration of the process was limited to the commercial farming business market. Secondly, due to the fact that secondary data were used as an incidental source for index construction and segmentation, the researcher was restricted to a limited set of pre-developed questions (variables) that could serve as a potential measure of commercial farming sophistication and profiling of segments. Thirdly, the combination of variables to derive index scores was limited to the use of one specific multivariate statistical technique, namely principal component analysis.

Imperatives for future research

With regard to the specific construction of the commercial farming sophistication index, the following recommendations for future research are made:

- That primary research be conducted in order to expand the potential list of questions and variables that can contribute towards constructing a commercial farming index, and using this to profile the segments.
- That further analysis be conducted in order to explore the relevance of expanding the current number of segments and the value that this expansion holds for marketing practitioners.
- That research be conducted to establish the validity of the construct of commercial farming sophistication.

- That an index of farming sophistication be constructed in the context of emerging and subsistence farming markets. This will require redefining the construct of sophistication for these markets, and identifying different sets of variables that could measure the constructs. Understanding the behaviour of these markets on the basis of sophistication and how they progress towards higher levels is of value for an entity such as government, given the agenda of business development.
- That future research studies explore and confirm the relationship between information and communications technology (ICT) product and service usage and levels of sophistication. The findings of the study revealed that levels of sophistication are positively associated with increasing incidents of ICT product and service usage such as a personal computer, a cell-phone and the internet as part of the farming business. However, the focus was only on incidents of ICT usage, and not on aspects relating to early product or service adoption.
- That a periodic review of the items used to measure sophistication be conducted, given the rapid change and introduction of new products, services and technologies to the market, as well as evolving farming production practices. This might also result in either the merging or the splitting of segments.

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