

CHAPTER 3: INDEX CONSTRUCTION

3.1 INTRODUCTION

This focus considers the characteristics of an index and the typical steps followed in the construction of such a variable. From the literature, selective approaches to index construction are more fully described, with particular emphasis on the steps and methods used during the processes. These results in the formulation of some key considerations that can be regarded highly relevant in the construction of a commercial farming sophistication index.

3.2 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 off' and lower values 'less off', 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.

3.3 STEPS IN INDEX CONSTRUCTION

Babbie (2011:169) notes that the task of index construction is not a simple undertaking; while Spector (1992:v) described the process as being seldom easy. As in the case of the market segmentation process, comprising 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. On the other hand, research conducted by African Response (2006), the South African Advertising Research Foundation (2009), and Jensen, Spittal, Chrichton, Sathiyandra and Krishnan (2002) provides specific pragmatic and empirical reference in identifying the typical reasons for constructing an index, as well as consideration and common steps relevant in the process. These studies are reviewed in more detail in Section 3.4.

Three steps in index construction can commonly be distinguished, namely: (1) Item/variable selection; (2) examining the empirical relationships of variables and combining of these items into an index; and (3) validating the index.

More specifically with regard to this study, the aim was to construct a measure of commercial farming sophistication in the form of an index that is one-dimensional, can discriminate across the full spectrum of commercial farming businesses in South Africa, and is both valid and reliable.

The index is constructed through the assignment of scores, recognising that some variables included in the index will reflect a relatively low level of sophistication, while others reflect something higher. Thus, the index takes advantage of any intensity structure that may exist among variables.

3.3.1 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. For example, the selection of items to measure the various sophistication constructs listed in Table 4 was guided by the formulation of specific definitions. These definitions provided relevant points of reference for the researchers to identify variables related to the construct under consideration. For instance, logistical sophistication was defined as a composite of three dimensions: the degree of organisational formalisation, the use of information technology, and the use of indicators to monitor performance (Wanke *et al.*, 2007:545). Based on this definition, the researchers identified 19 possible variables related to the sophistication of the logistics function. Similarly 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 that would be provided by the items. If an item provides no variation, it would not be very useful for the construction of an index.

3.3.2 Combining of variables into an index

During the second step of the index construction, the relationships among items should be considered, with the anticipation of combining items into a single and one-dimensional construct variable. 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. Alternatively, multivariate statistical techniques, such as exploratory factor analysis and principal component analysis could be considered in the construction of the index. Exploratory factor analysis and principal component analysis use the multi-variability between items to derive a new single construct measure. In addition, exploratory factor analysis and principal component analysis provide 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.

3.3.3 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 which 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 appear to also be sophisticated in relation to other relevant items measured in the study.

Tonks (2009:349) provides additional views on validation, noting that it is important to assess index variables as to their extent in meeting the different 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, which are easily “observable”, such as type of legal form or turnover, do not present any formidable difficulties in establishing construct validity. For example, the index of logistics sophistication that was constructed by Wanke *et al.* (2007:542) were derived from activities and functions used in the business, such as vehicle tracking, routing, radio frequency and bar codes. These activities are typically easily observed or accounted for in the business based on them being either used or not used.

However, an index measure that is derived from less observable items, such as subjective evaluations or perceptions could be more challenging. For example, the study of Phillips (2000:541) constructed an index of business and strategic planning sophistication based on the extent of importance placed within the business on conducting a range of strategic analyses. A seven-point importance rating scale was used, with the index constituting an average overall evaluation. In this instance, the importance placed on the items is less observable than the actual conducting of these analyses within the business.

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 there exists a positive correlation 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; 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 judgments have to be made.

Content validity concerns 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, it is criterion validity that is likely to be seen as immediately pragmatic, and which

determines 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 may be considered in two ways, namely: test-retest reliability and internal-consistency reliability (Leedy & Ormrod, 201:93). 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, does note 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 alpha coefficient, which provides a means for measuring the internal reliability consistency of the newly created scale or index (Pallant, 2010:97).

3.4 SELECTED APPROACHES TO INDEX CONSTRUCTION

This study concerns the measurement of commercial farming sophistication in South Africa and serves as illustration of the process of index construction and applying it as a method of market segmentation. Despite index construction being widely used by marketing researchers, the availability of empirical studies

to illustrate the process of index construction as a method of segmentation in a business context is scarce.

This section presents three selected approaches that were followed in the construction of index variables and more specifically, applying it as methods of market segmentation. The focus of discussion falls on (1) the aims that were associated with the construction of an index and applying it as a method of segmentation; (2) steps followed in the index construction process; and (3) outcomes evident from the processes. The target markets considered in the various studies are therefore not of particular relevance, but are regarded incidental for the purpose of reviewing these approaches and in the context of this discussion.

3.4.1 The South African Advertising Research Foundation Living Standards Measure (SAARF LSM)

3.4.1.1 Background

The Living Standards Measure (LSM) was developed by the South African Advertising Research Foundation (SAARF) during 1988/89 – with the aim of providing a measure – using a combination of variables that could distinguish living standards better than could any single demographic variable (South African Advertising Research Foundation, 2009:92). According to SAARF, it provides a unique means of segmenting the South African market, as it cuts across race and other outmoded techniques of categorising people, and instead groups people, according to their living standards by using criteria, such as degree of urbanisation and ownership of cars and major appliances.

The construction of the SAARF LSM was based on a multi-level approach involving various steps in the process. Initial requirements stipulated that the index should have broad application across the total South African market. In addition, it should be simple to use and also important; it should be easy to link

to other surveys being conducted in the market. Lastly, it should also be stable over time, but sensitive enough to register changes.

3.4.1.2 Steps in the index construction

Firstly, a large number of possible variables were selected on the basis of criteria that were believed could contribute towards explaining or measuring levels of living standards. In other words, items were selected on face value. The variables were selected from a pre-developed questionnaire that was used as part of SAARF's All Media and Products Surveys (AMPS). The questionnaire was thus therefore not originally designed with the primary aim of developing an index of living standard, but was incidental in the context of the study. The variables included the possession of a range of durable household articles, access to reticulated water and electricity supplies, use of the various media, and a wide range of demographics, including population group, income, education and others. Some 20 variables were coded into 71 classes. This meant that out of 20 variables, 71 dummy variables were derived (each coded as 1 or 0), serving as indicators of possession, access and usage.

Secondly, using principal component analysis, an index score was calculated for each respondent. The variables used were the 71 indicator variables, because an interval scale cannot be assigned to these variables (South African Advertising Research Foundation, 2009:92). The principal component analysis technique identified a number of emerging factors that accounted for the variability found in the original classes. It was found that the first factor provided for the largest proportion of the variation in the data, with the other factors catering for smaller proportions.

For each case in the AMPS database, an index score was derived based on the loadings of the first factor only. Using the total population frequency distribution as guidance, the index scores were divided into a number of unique, non-overlapping categories. Category groups were, henceforth, cross-tabulated

against aspects, such as the consumption of goods, services and media to obtain an indication of whether the category groups provided adequate segmentation capabilities of the population.

Due to the large number of variables used, the third step focused on reducing the number of explanatory variables. This was done by identifying those variables, which had the greatest discriminatory power, and then weighting the remaining variables optimally. Part of the analysis again involved a principal component analysis to examine the spread of the data points of the variables, with the aim of establishing the combination of variables along which the largest proportion of the spread occurred.

Using stepwise regression analysis, the sub-set of variables was identified that most accurately predicted the scores of the respondents on the factor that catered for the largest proportion of the variation in the data. A total number of 13 variables were used, to measure a respondent's living standard and indicate access to services and durables of an individual in a household. The specific variables were:

- Polisher/vacuum cleaner
- Fridge/freezer
- TV set
- Water/electricity
- Washing machine
- No car in household
- Hi-Fi/music centre
- Sewing machine
- Non-supermarket shopper
- Rural dweller (Outside Pretoria, Vereeniging and Western Cape)
- No domestic worker
- No VCR set
- No tumble drier

Each variable also carried a different weight, positive or negative, which was derived from the stepwise regression analysis. A respondent's position on the SAARF LSM scale could then be derived by adding together the weights of the variables that s/he possessed. A constant was also added to the total score to eliminate any negative total scores.

The next step involved index validation, namely, to examine the association of LSM scores against other variables that could be expected to be associated with the living standards. These included, for example, personal and household income, educational level of respondents, demographic group and urban/rural area.

Having validated the LSM scores, SAARF henceforth used the scores to form a number of equal sized groups. The groups were investigated in terms of mean index scores as well their properties relating to the items that formed the basis of the index scores. Where adjacent groups were viewed to be similar, they were combined. A final set of eight LSM segments were formed. These LSM segments represented homogeneous groups in terms of living standards. This, in essence, constituted the tool provided for marketing research practitioners.

3.4.1.3 Outcomes of original analysis and further development

Since the original development of the LSM in 1988/89, and the specifications of the 13 variables, SAARF has to date initiated various reviews of the measurements. Initial reviews were largely focused on addressing some of the unforeseen difficulties, challenges and biases that were experienced through the early developmental phases of the LSM. For example, from 1989 to 1992 SAARF adjusted the LSM weights and changed the variables where necessary to provide for the best fit to the data.

This, however, meant that a year-on-year comparison of the results was not possible. In 1993, a decision was made not to adjust the variables annually,

unless large changes were required. This resulted in a rework of the statistical process and model to ensure that LSM variables could be updated continuously without breaking the trend (South African Advertising Research Foundation, 2008:94).

A review of LSM was again done in the late 1990s. The list of variables was expanded to include 20 indicator variables. In 2001, SAARF introduced another review, resulting in the expansion of the original eight segments groups to 10 groups, as well as increasing the predictor variables to 29.

Table 5 lists the most recent variables used for the calculation of the LSM scores (South African Advertising Research Foundation, 2012:36). The list consists of 29 variables. The table also shows the squared multiple correlation, indicating the extent of correlation between the variable and the LSM score. The last column shows the weight that was derived from the stepwise regression analysis, and used to calculate a respondent's LSM score.

Table 5: SAARF LSM list of variables 2012 (South African Advertising Research Foundation, 2012:36)

Variable number	Attribute	Squared Multiple Correlation	Weight
1	Hot running water from a geyser	0.6167	0.185224
2	Computer –Desktop/Laptop	0.7203	0.311118
3	Electric stove	0.8031	0.16322
4	No domestic workers or household helpers in household	0.8437	-0.30133
5	0 or 1 radio set in household	0.8696	-0.245
6	Flush toilet in/outside house	0.8933	0.113306
7	Motor vehicle in household	0.9105	0.16731
8	Washing machine	0.9228	0.149009
9	Refrigerator or combined fridge/freezer	0.9339	0.134133
10	Vacuum cleaner/floor polisher	0.9411	0.164736
11	Pay TV (M-Net/DStv/TopTV) subscription	0.9470	0.12736
12	Dishwashing machine	0.9513	0.212562
13	3 or more cell-phones in household	0.9553	0.184676
14	2 cell-phones in household	0.9588	0.124007
15	Home security service	0.9620	0.151623

Variable number	Attribute	Squared Multiple Correlation	Weight
16	Deep freezer – free standing	0.9651	0.116673
17	Microwave oven	0.9679	0.126409
18	Rural resident (excluding Western Cape and Gauteng rural)	0.9703	-0.12936
19	House/cluster house/town house	0.9732	0.113907
20	DVD player/Blue Ray Player	0.9753	0.09607
21	Tumble drier	0.9771	0.166056
22	Home theatre system	0.9790	0.096072
23	Home telephone (excluding cell-phone)	0.9804	0.104531
24	Swimming pool	0.9816	0.166031
25	Tap water in house/on plot	0.9829	0.123015
26	Built-in kitchen sink	0.9842	0.132822
27	TV set	0.9852	0.120814
28	Air conditioner (excluding fans)	0.9861	0.178044
29	Metropolitan dweller (250 000+)	0.9871	0.079321

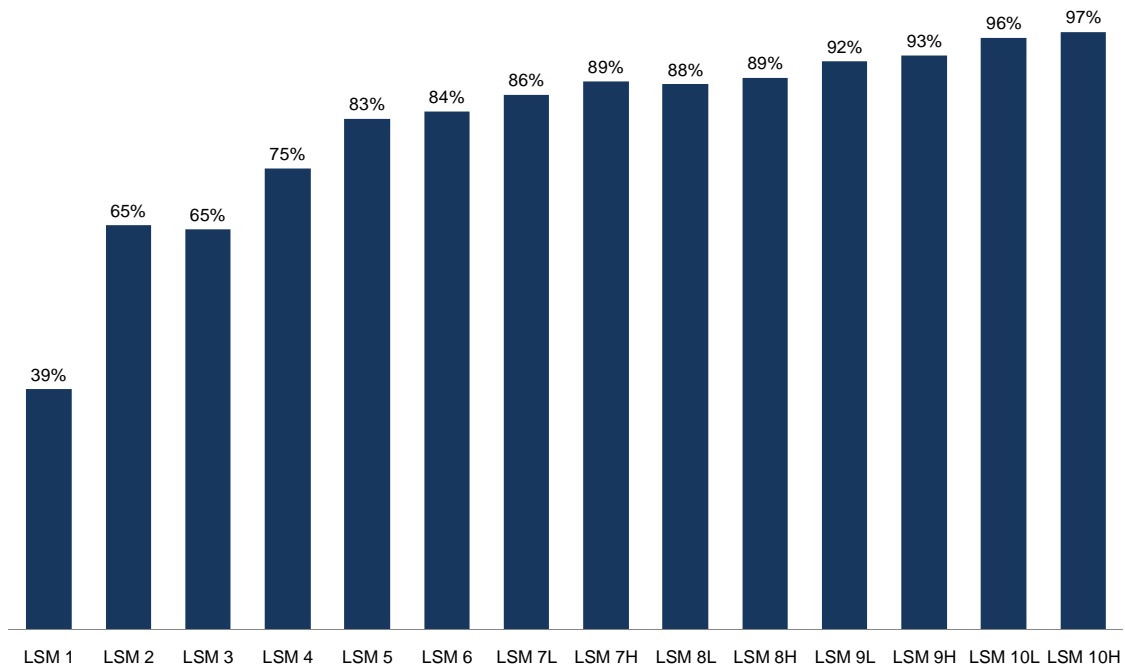
Table 6 shows the calculation of LSM segments. Weights are summated for those variables with which the respondent complies. A constant of -0.81052 is added, and based on the total summated weights; a respondent is then grouped into one of the ten LSM segments, depending on the defined ranges.

Table 6: Calculation of LSM (South African Advertising Research Foundation, 2012:36)

LSM Group	Total weight
1	Less than -1.390140
2	-1.390139 to -1.242000
3	-1.242001 to -1.011800
4	-1.011801 to -0.691000
5	-0.691001 to -0.278000
6	-0.278001 to 0.382000
7	0.381999 to 0.801000
8	0.800999 to 1.169000
9	1.168999 to 1.745000
10	More than 1.744999

In addition to homogenising the market in terms of living standards, the application of the LSM index as segmentation tool facilitates an improved understanding of the market for marketing practitioners, and could lead to the identification of new opportunities or better allocation of resources. In fact, the SAARF LSM is considered to be one of the most widely used marketing research tools in South Africa (Haupt, 2006:1). While a detailed description of the application of the LSM segmentation tool goes beyond the scope of this study, some examples of how the tool is used to describe and understand behaviour in the market is provided as illustration. The LSM tool has, for example, been used as explanatory variable for cell-phone penetration in South Africa. Figure 6 shows the proportion of the South African population, 16 years and older, that owned, rented or used a cell-phone in 2011 within the various LSM segments. The higher the measured living standard of a respondent, the more likely s/he is to own, rent or use a cell-phone.

Figure 6: Percentage cell-phone penetration in South Africa December 2011 (South African Advertising Research Foundation, 2012:47)



A profile of each segment has also been developed by SAARF, which assist researchers and marketing practitioners' in understanding market behaviour. The profile also provides information on aspects such as demographics, media consumption, educational background, average monthly household earnings, radio listenership and access to banking products. For example, the first LSM segment constitutes an approximate 1.9% of the South African population. These segment members tend to be older than 50 years, have completed primary schooling, live in small urban/rural areas, and earn a household income on average of R1 369 per month; with radio as a major channel of media communication, with Wenene FM and Ukhozi FM attracting significant listenership. They typically have minimal access to services.

Similar profiles exist for the other LSM groups and are summarised in Table 7.

Table 7: A profile of LSM segments (South African Advertising Research Foundation, 2012:53)

LSM 1 (1.9%)	LSM 2 (5.1%)
<p><u>Demographics</u> Gender: Male and female Age: 50+ Schooling: Primary completed Living: Small urban/Rural area Structure: Traditional hut Household income: R1 369 (average)</p> <p><u>Media</u> Radio a major channel of media communication; mainly African Language Stations (ALS) – Umhlobo Wenene FM, Ukhozi FM; community radio</p> <p><u>General</u> Minimal access to services Minimal ownership of durables, except radio sets Mzansi bank account Activities: Minimal participation in activities; singing</p>	<p><u>Demographics</u> Gender: Female Age: 15 – 24 and 50+ Schooling: Some high school Living: Small urban/Rural area Structure: Squatter hut shack; matchbox; traditional hut Household income: R1 952 (average)</p> <p><u>Media</u> Radio: Commercial, mainly ALS – Umhlobo Wenene FM; Ukhozi FM</p> <p><u>General</u> Communal access to water Minimal ownership of durables, except radio sets; stoves Mzansi bank account Activities: Minimal participation in activities; singing; attend burial society meetings and traditional gatherings</p>



<p>LSM 3 (6.1%)</p> <p><u>Demographics</u> Gender: Female Age: 15 - 34 Schooling: Some high school Living: Small urban/Rural area Structure: Squatter hut shack; traditional hut Household income: R2 545 (average)</p> <p><u>Media</u> Radio: Mainly ALS – Umhlobo Wenene FM; Ukhozi FM</p> <p><u>General</u> Water on plot or communal Minimal ownership of durables, except radio sets; stoves Mzansi bank account Activities: Singing</p>	<p>LSM 4 (12.2%)</p> <p><u>Demographics</u> Gender: Male Age: 15 – 34 and 50+ Schooling: Some high school Living: Small urban/Rural area Structure: Squatter hut shack; matchbox; traditional hut Household income: R3 141 (average)</p> <p><u>Media</u> Radio: Mainly ALS – Gagasi, Motsweding FM, Umhlobo Wenene FM, Ukhozi FM; community radio</p> <p><u>General</u> Electricity; water on plot or communal; non-flush toilet TV sets; electric hotplates Mzansi bank account Activities: Attend gatherings; go to night clubs</p>
<p>LSM 5 (17.4%)</p> <p><u>Demographics</u> Gender: Male and female Age: 25 - 34 Schooling: Some high school Living: Small urban/Rural area Structure: House; matchbox; matchbox improved Household income: R4 200 (average)</p> <p><u>Media</u> Radio: Commercial mainly ALS – Lesedi FM; Motsweding FM; Ukhozi FM; community radio TV: SABC 1, 2, 3; etv; TopTV</p> <p><u>General</u> Electricity; water on plot; flush toilet outside TV sets; hi-fi/radio set; stove; fridge Mzansi bank account Activities: Singing; bake for pleasure; go to night clubs; attend gatherings; buy lottery tickets</p>	<p>LSM 6 (22.4%)</p> <p><u>Demographics</u> Gender: Male Age: 25 - 49 Schooling: Matric Living: Large urban Structure: House; townhouse; cluster house Household income: R6 454 (average)</p> <p><u>Media</u> Radio: Wide range of commercial and community radio TV: SABC 1, 2, 3; etv; TopTV; community TV Any SAARF All Media & Products Survey (AMPS) newspaper Outdoor</p> <p><u>General</u> Electricity; water in home; flush toilet in home TV set; fridge/freezer; microwave oven Savings and Mzansi bank account Activities: Hire DVDs; go to night clubs; take away in the past 4 weeks; attend gatherings; buy lottery tickets; go to gym</p>



<p>LSM 7 low (4.9%)</p> <p><u>Demographics</u> Gender: Female Age: 35+ Schooling: Matric and higher Living: Urban Household income: R9 768 (average)</p> <p><u>Media</u> Radio: Wide range of commercial and community radio TV: SABC 1, 2, 3; etv; DStv; TopTV; community TV All print Accessed Internet past 7 days Outdoor</p> <p><u>General</u> Full access to services Savings accounts Increased ownership of durables plus DVD and motor vehicle Participation in all activities</p>	<p>LSM 7 high (5.8%)</p> <p><u>Demographics</u> Gender: Male Age: 35+ Schooling: Matric and higher Living: Urban Household income: R12 311 (average)</p> <p><u>Media</u> Radio: Wide range of commercial and community radio TV: SABC 1, 2, 3, etv; M-Net; DStv; TopTV, community TV All print Accessed Internet past 7 days Cinema; outdoor</p> <p><u>General</u> Full access to services, including cheque and savings account Increased ownership of durables plus DVD and motor vehicle Participation in all activities</p>
<p>LSM 8 low (4.2%)</p> <p><u>Demographics</u> Gender: Male Age: 35+ Schooling: Matric and higher Living: Urban Household income: R14 275 (average)</p> <p><u>Media</u> Radio: Wide range of commercial and community radio TV: SABC 1, 2, 3; etv; M-Net; DStv; TopTV, community TV All print Accessed Internet past 7 days Cinema; outdoor</p> <p><u>General</u> Full access to services and bank accounts Full ownership of durables, including PC Increased participation in activities</p>	<p>LSM 8 high (4.1%)</p> <p><u>Demographics</u> Gender: Male Age: 35+ Schooling: Matric and higher Living: Urban Household income: R15 499 (average)</p> <p><u>Media</u> Radio: Wide range of commercial and community radio TV: SABC 1, 2, 3, etv, M-Net; DStv; TopTV, community TV All print Accessed Internet past 7 days Cinema; outdoor</p> <p><u>General</u> Full access to services and bank accounts Full ownership of durables, including PC Increased participation in activities</p>



<p>LSM 9 low (4.6%)</p> <p><u>Demographics</u> Gender: Male Age: 50+ Schooling: Matric and higher Living: Urban Household income: R18 444 (average)</p> <p><u>Media</u> Radio: Wide range of commercial and community radio TV: SABC 2, 3; etv; M-Net; DStv; TopTV, community TV All print Accessed Internet past 7 days Cinema; outdoor</p> <p><u>General</u> Full access to services and bank accounts Full ownership of durables Increased participation in activities, excluding stokvel meetings</p>	<p>LSM 9 high (4.6%)</p> <p><u>Demographics</u> Gender: Male Age: 35+ Schooling: Matric and higher Living: Urban Household income: R22 887 (average)</p> <p><u>Media</u> Radio: Wide range of commercial TV: SABC 2, 3; etv; M-Net; DStv; TopTV, community TV All print Accessed Internet past 7 days Cinema; outdoor</p> <p><u>General</u> Full access to services and bank accounts Full ownership of durables Increased participation in activities, excluding stokvel meetings</p>
<p>LSM 10 low (3.3%)</p> <p><u>Demographics</u> Gender: Male Age: 35+ Schooling: Matric and higher Living: Urban Household income: R27 807 (average)</p> <p><u>Media</u> Radio: Wide range of commercial TV: SABC 3; M-Net; DStv; TopTV, community TV All print Accessed Internet past 7 days Cinema; outdoor</p> <p><u>General</u> Full access to services and bank accounts Full ownership of durables Increased participation in activities, excluding stokvel meetings</p>	<p>LSM 10 high (3.3%)</p> <p><u>Demographics</u> Gender: Male Age: 35+ Schooling: Matric and higher Living: Urban Household income: R33 590 (average)</p> <p><u>Media</u> Radio: Wide range of commercial TV: M-Net; DStv; TopTV, community TV All print Accessed Internet past 7 days Cinema; outdoor</p> <p><u>General</u> Full access to services and bank accounts Full ownership of durables Increased participation in activities, excluding stokvel meetings</p>

3.4.2 The New Zealand Economic Living Standard Index (ELSI scale)

3.4.2.1 Background

The objective of the development was to construct a broad-spectrum scale suitable for measuring the living standards of New Zealanders (Jensen *et al.*, 2002:17). The model that formed the basis of the development postulates that “variations in living standards can be validly specified on a single underlying dimension, that is the source of the associations between a number of observable variables.” In addition, the key assumption is made that individuals included in the model can be ranked along a continuum reflecting their living standard.

The aim was to construct an index that:

- Could discriminate across the full continuum;
- Was a direct measure, which could be used over a wide range of non-monetary descriptive indicators;
- Was one-dimensional;
- Was continuous;
- Was valid and reliable;
- Provided valid comparisons between sub-populations;
- Provided scores, which were readily interpretable; and
- Permitted monitoring over time.

The New Zealand ELSI scale, therefore, consolidates a large amount of information about different aspects of individual economic wellbeing into a single index (Jensen *et al.*, 2003:72).

3.4.2.2 Steps in the index construction

The data used for the construction of the scale were based on responses obtained from individuals who had participated in a national household survey (Jensen *et al.*, 2003:73). A questionnaire served as a data-gathering instrument, which included questions about the respondent and his/her economic family unit. According to Jensen *et al.* (2003:73), an economic family unit refers to “a person who is financially independent, or a group of people who usually reside together, and are financially interdependent, according to current social norms.”

The development of the ELSI scale consisted of two inter-linking processes or phases. The first phase involved the development of a generic scale of living standard for New Zealanders, and being grounded strongly in the theory. However, the scale was derived using confirmatory factor analysis (CFA), and as such, restricted the replication of the scale in future studies. The second phase, therefore, considered the derivation of a general use form of the scale that could be easily calculated by other researchers and survey practitioners without depending on using CFA. This was in line with the original aims, namely, to develop an index that could be calculated and applied in other surveys, and be readily interpretable. This general use form of the standard of living scale would be referred to as the Economic Living Standard Index or ELSI.

The development of the generic living standard scale consisted of three steps. The first step in the process involved the identification of indicator variables that could be used to measure the living standards of New Zealanders. A total of five such indicators were identified, namely: (1) Ownership restrictions; (2) social participation restrictions; (3) economic behaviour; and ratings of (4) adequacy of income; and (5) standard of living.

The first three indicators were represented by sets of items, while the last two indicators were self-rating items. The items representing ownership restriction

measured the possession of household items of the respondent. Social participation restrictions focused on a respondent's engagement in various forms of recreation and social participation. Economising behaviour took into account the things that the respondent consumes.

The focus of measurement, therefore, fell on various activities and ownership, rather than focusing on the resources that would enable them to do or to acquire these things, addressing the objective of developing an index based on non-monetary dimensions.

Next, a structural equation-modelling approach was adopted, with confirmatory factor analysis (CFA) as the main statistical technique in the development of the generic living standard scale. For the CFA, the living standard was conceptualised as a latent variable. According to this approach, the latent variable existed independently of the particular set of indicators (Jensen *et al.*, 2003:73). In other words, the same latent variable should be able to be observed in the properties of a different set of indicators.

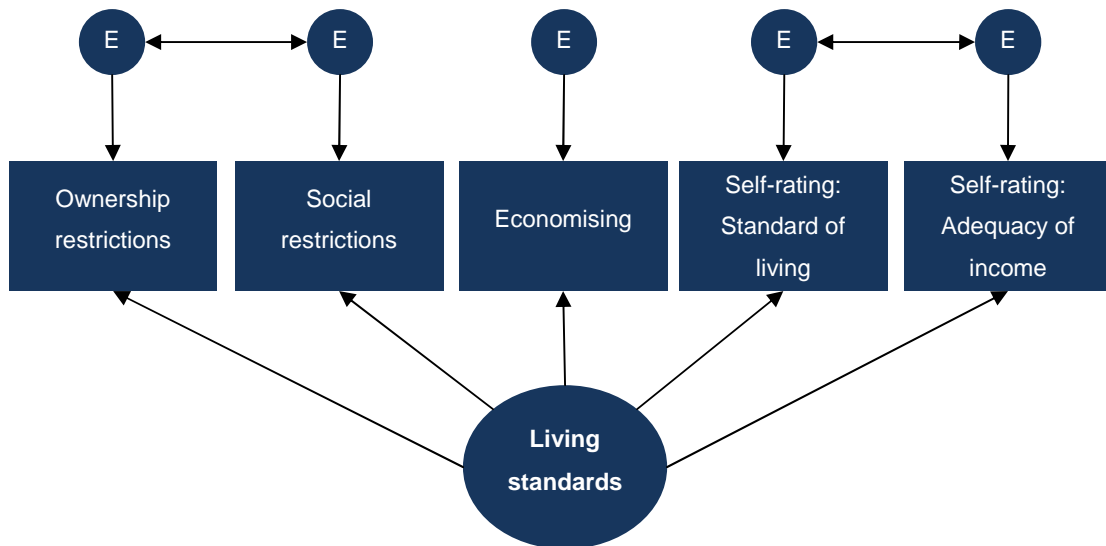
Jensen *et al.* (2003:74) also summarised the latent variable by describing it as follows:

- It cannot be observed directly;
- It is inferred from the pattern of statistical associations between the indicator variables;
- It has been specified by using the method of CFA;
- It is hypothesised as being a single, one-dimensional construct;
- It is hypothesised as being able to account for the associations between the indicator variables; and
- It is only accepted as existing if the data can be shown to fit the CFA model based on the indicator variables.

The CFA yielded a regression equation that estimates the values of the latent variable from the observed indicators. These values represent the generic scale of living standard.

Refer to Figure 7, which presents the structural equation model that was defined for the development of the generic living standard scale.

Figure 7: Conceptual model of generic living standards scale for New Zealand (Jensen *et al.*, 2002:61)



The third and last step involved validation of the scale. Jensen *et al.* (2002:75) postulate that encapsulated within the various definitions of validation lies “the idea that a test must be evaluated against some criteria, to determine whether it measures what it was intended to measure.” This process was achieved by examining the association between the generic scale and a number of variables that were expected to be associated with living standards.

Having derived and validated the generic living standard scale, the researcher set out to derive a more simplistic and general-use version of the scale. According to Jensen *et al.* (2003:80), the development was guided by the following criteria:

- The measure should be robust, replicable, and useful in future surveys from which separate samples are drawn.
- The measure should have a simple procedure for computing total scores to enable its easy use by a wide range of researchers and survey practitioners.
- The measure should be suitable for sub-group analysis, including the examination of individual groups and comparisons between groups. It was considered important that the given item set would not unduly bias the results of any one sub-group or another.
- Finally, the measure should still maintain the properties of the CFA generic scale.

In essence, the process should produce a new set of values that closely approximated those obtained by the regression equation.

The first step involved the choice of items to be used for the construction of the scale. Consideration was given to identify a set of items seen as desirable equally across the sample. This was deemed important, as failure to do so could have resulted in the inclusion of items, which were, for example, only desired by those who could afford them. At the same time, it was also critical to identify items where the probability of participants endorsing how important they perceived a given item to be across the different levels of standard of living and sub-groups.

Using items that were only regarded as important by some groups would have introduced skewness into the measurement of the construct as judgements of importance would surely have impacted upon item attainment. A desired item that is expensive is more likely to attract an individual's scarce resources if it is important to them, potentially causing them to forego the attainment of several

other items that are less expensive, or less important. By contrast, if it is desired but unimportant, it may be foregone in favour of a number of other items.

Jensen *et al.* (2002:83) further noted that a second aspect considered during item selection involved the capacity of the item to offer discriminating power between people with a low standard of living and those with a higher standard of living.

The final list of items identified by the researchers to be used for the calculation of the ELSI scale is reported in Table 8.

Table 8: Items used for the development of a generic scale measuring living of standard of New Zealanders (Jensen *et al.*, 2003:75)

Economising items	Ownership restrictions (did not own because of cost)	Social participation restrictions (did not do because of cost)	Self-assessment of standard of living
Less/cheaper meat	Telephone	Give presents to family/friends on special occasions	Standard of living (self-rating)
Less fresh fruit/vegetables	Secure locks	Visit hairdresser once every 3 months	Adequacy of income (self-rating)
Bought second-hand clothes	Washing machine	Holiday away from home every year	Satisfaction with standard of living (self-rating)
Worn old clothes	Heating in main rooms	Overseas holidays once every 3 years	
Put off buying new clothes	Good bed	Night out once a fortnight	
Relied on gifts of clothes	Warm bedding	Have family or friends over for a meal at least once a month	
Worn-out shoes	Winter coat	Space for family to stay the night	
Put up with cold	Good shoes		
Stayed in bed for warmth	Best clothes		
Postponed doctor's visits	Pay TV		
Gone without glasses	Personal computer		
Not picked up prescription	Internet		

Economising items	Ownership restrictions (did not own because of cost)	Social participation restrictions (did not do because of cost)	Self-assessment of standard of living
Cut back on visits to family/friends	Contents insurance		
Cut back on shopping	Electricity		
Less time on hobbies			
Not gone to funeral			

The specification of a score procedure followed the identification of the items. The challenge was to develop a procedure that would be easy to describe and apply in future survey research studies, yet would not result in a significant loss of information or measurement precision. Various approaches were investigated. Jensen *et al.* (2003:89) noted that a critical consideration was the requirement of a very high correlation ($r > 0.95$) between ELSI and the generic scale, and that ELSI should preserve the shape of the distribution of the generic scale.

Having taking these issues into account, a specific coding system was formulated. Items were coded as follows:

Ownership restrictions:

Enforced lack = 0

Ownership or not wanting = 1

Social participation restrictions

Enforced lack = 0

Participation or not wanting = 1

Economising behaviours:

A lot = 0

A little = 1

Not at all = 2

Self-rating: Standard of living:

Low = 0

Fairly low = 1

Medium = 2

Fairly high = 3

High = 4

Self-rating: Satisfaction with standard of living:

Very dissatisfied = 0

Dissatisfied = 1

Neither dissatisfied nor satisfied = 2

Satisfied = 3

Very satisfied = 4

Self-rating: Adequacy of income:

Not enough = 0

Just enough = 1

Enough = 2

More than enough = 3

Responses to the items were combined into a single score using the following formula:

$$\begin{aligned} & (\Sigma \text{ Ownership restrictions}) + (2 \times \Sigma \text{ Social participation restrictions}) + \\ & (\Sigma \text{ Economising behaviours}) + (2 \times \Sigma \text{ Self-rating standard of living}) + \\ & (2 \times \Sigma \text{ Self-rating: satisfaction with standard of living}) + (2 \times \Sigma \text{ self-rating:} \\ & \text{adequacy of income}) \end{aligned}$$

Based on this procedure scores could theoretically range from 0 to 82. However, it was argued that such a range is not necessarily useful as it produces a very long tail in the distribution without any significant gain in precision. A minimum score of 22 was set, with all responses less than this coded as 22. The majority of responses in this category were regarded as outliers.

To obtain a final score, the range was 're-zeroed' by subtracting 22 from each score, so that the minimum was 0 instead of 22. The maximum was now 60 instead of 82. The reason for this recalculation was purely for presentational purposes, so that a respondent with the lowest possible standard of living had a score of zero. This resulted in the general ELSI scale.

The scores were, henceforth, divided into seven standard score intervals. These intervals represented homogeneous segments of the New Zealand population, based on similar standards of living. The following criteria were used to guide the process (Jensen *et al.*, 2002:92):

- not sacrificing useful discriminating power at the high living standard end of the scale;
- not getting undue bunching into the bottom couple of intervals for sub-populations with low overall living standards;
- having a fairly compact set of ranges, for example, 10 to 15 intervals for the primary set;
- having a secondary set of ranges that is more compact, for example, less than 10 intervals;
- having enough categories in the lower living standard region to permit debates and choices about where poverty thresholds might be specified; and
- a bottom category (the low living standard end) that contains only a small proportion of the population (less than 10 percent).

3.4.2.3 Outcomes of original analysis and further development

An example of the application of ELSI as a segmentation tool is illustrated in Table 9. The results presented indicate the propensity for children in various ELSI segments or categories to experience a constraint in their consumption of the item examined (Jensen *et al.*, 2003:89). For example, 31% of children in the “restricted” category were in families where there was no suitable wet weather clothing for each child because of cost: This in comparison with approximately 7% of children in the “somewhat-restricted” category; 3% in the “comfortable” category; and no children in the “good” living standards category. Constraints on the consumption of child-specific goods and services are experienced by a greater proportion of children with ELSI scores that place them at the lower end of the scale. The ELSI segmentation tool therefore serves as a variable for explaining variation in the data.

Table 9: Constraints in consumption experienced by New Zealand children by ELSI segments – Items not obtained or cut back because of cost (Jensen *et al.*, 2003:75)

Items	“Restricted” living standards (levels 1 & 2)	“Somewhat restricted” living standards (level 3)	“Comfortable” living standards (levels 4 & 5)	“Good” living standards (levels 6 & 7)
Suitable wet weather clothing for each child	31%	7%	3%	0%
A pair of shoes in good condition	17%	3%	1%	0%
Child’s bike	24%	9%	4%	0%
Playstation	29%	23%	9%	1%
Personal computer	59%	29%	20%	2%
Internet access	59%	30%	19%	3%
Not gone on school outings	51%	23%	7%	1%
Not bought school books/supplies	38%	18%	5%	1%
Not bought books for home	58%	38%	17%	3%
Postponed child’s visit to the doctor	31%	13%	3%	0%

3.4.3 The African Response Business Sophistication Measure

3.4.3.1 Background

The development of the African Response Business Sophistication Measure (BSM) emanated from a growing need to provide a more relevant segmentation solution of the various types of entrepreneurs in South Africa (African Response, 2006:9). The measure was to provide an assessment of the degree of sophistication of small businesses. It was also considered a more applicable reference to the condition of a small business than simply referring to 'informal' or 'registered'.

In addition, the BSM was to be used as indicator whether a business was likely to grow or be a user of financial services. This could assist in the effective targeting of policies and services, according to the different needs of South African small businesses.

3.4.3.2 Steps in the index construction

The development of the BSM was carried out in several steps. Survey data obtained from a small business survey conducted in 2006 in Gauteng by Finscope were used by African Response for the development of the measure. The BSM was developed from a wide range of variables measured in the survey. The questionnaire was originally designed as part of the Finscope study, and not with the primary aim of developing an index of sophistication. It was therefore incidental in the context of the African Response study.

The first step, therefore, involved the identification of questions from the Finscope Small Business Survey 2006 questionnaire, which related to the degree of development and sophistication of a small business. The questions chosen were (Galpin, 2006:1):

- What type of business is it?

- Do you sell the goods as you buy them, or do you add value, or both?
- Do you have a written employment contract for your employees?
- What type of premises do you operate your business from?
- Do you own, rent or just use the place where you trade/run your business?
- Services and equipment?
- Partners or shareholders?
- Do you have a written shareholders/partnership/ members' agreement?
- Do you keep financial records or accounts?
- Do you keep these financial records yourself/internally or does someone from outside help you?
- Are your financial records audited?
- Is this business a franchise?
- Is your company/business a subsidiary/part of another company?
- Do you have any affiliations with international companies?
- Do you do any business/trade with anyone outside South Africa?
- Do you import/export/both?
- Do you offer goods or services on credit?
- Type of credit offered?
- Payment of taxes?
- Compliance with Acts?
- Professional services handled by staff?
- Any bank used for the business?
- Type of banking services?
- Do you have any loans for your business?
- From where did you get the loan?
- Types of insurance paid for by the business?

Having identified the questions that could relate to business sophistication, the second step of the development involved the recoding of the questions and subcategories into 126 possible variables, each coded as 1 or 0, depending on whether the respondent responded yes or no. In other words, business

sophistication was gauged by a set of empirical variables that a small business enterprise may or may not have.

The third step of the development involved the subjection of the 126 variables identified to a principal component analysis. The binary coding used placed all the 126 variables on the same scale, making principal component analysis the appropriate technique to be used for index construction (Galpin, 2006:1). The scores obtained from the first principal component analysis formed the initial BSM index scores.

In the fourth step, 10 approximately equally sized BSM groups were derived from the initial index scores, with the size of the groups being in terms of the weighted sample, in other words the population. The means for the variables by groups were henceforth inspected. The analyst found that the number of 'less sophisticated' groups was large. In comparison, there were only one or two groups that were somewhat sophisticated. The scores were then split into 20 groups, and the means again inspected. This investigation revealed that for a number of options, very few respondents stated 'yes'. All with five or fewer respondents were flagged, and considered for omission or combination with other options. In addition, the multi-mentioned options were examined to see which were correlated. For example, the very similar options for the business, namely 'own house/room(s) in own house', 'garage' and 'backyard' were combined into 'own house/room(s) in own house/garage/backyard'. The separate list of banks used was converted to Banked and Unbanked. The loadings on the first factor were also used to group some of the options.

Using the transformed data, a new and final set of index scores was created as part of the fifth step, again using the first principal component initial BSM scores. The scores were categorised into 20 approximately equal-sized groups, with group 1 being the least sophisticated, and group 20 the most sophisticated. As in the case of LSM, the groups were compared in terms of mean index scores as well the proportional distribution of items that formed the basis of the

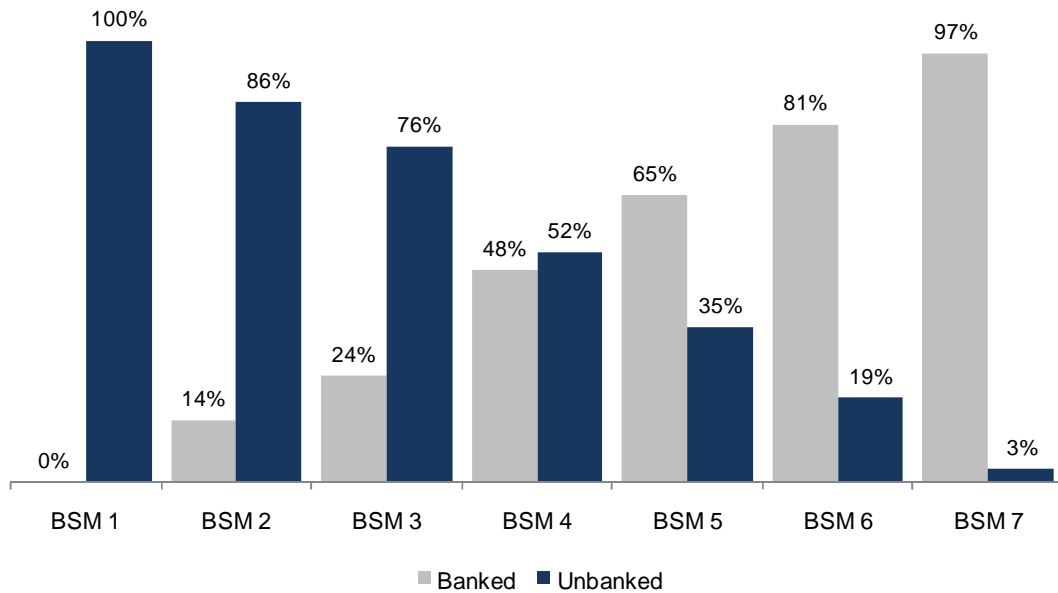
index. Where adjacent groups were viewed to be similar, groups were combined. A final set of seven BSM segments were formed. The cut-off points used for identifying the seven groups were (Galpin, 2006:2):

- Group 1: Lowest through -0.5086
- Group 2: -0.5086 through -0.4472
- Group 3: -0.4472 through -0.357
- Group 4: 0.357 through -0.196
- Group 5: 0.196 through 0.0392
- Group 6: 0.0392 through 0.8917
- Group 7: 0.8917 through highest

3.4.3.3 Outcomes of original analysis and further development

The application of the BSM index as a segmentation tool is illustrated in Figure 8, which shows the estimated proportion of small businesses in Gauteng that have a separate and specific business bank account (African Response, 2006:64). Business bank account penetration in BSM 1 is 0%; while in BSM 4, it is 48%; and in BSM 7 it is 97%. The more sophisticated the business, the higher the banking penetration. This improved an understanding of the behaviour of the market.

Figure 8: Business bank account penetration in South African small businesses – FinScope Study 2006 (African Response, 2006:64)



As in the case of LSM, the BSM groups represent homogenised segments in terms of business sophistication. The application of the BSM index as a segmentation tool, therefore, facilitates an improved understanding of market behaviour, which can lead to the identifying of new opportunities, or result in better allocation of the resources.

Having identified and used the seven groups as segmentation base in the 2006 study, the researchers at African Response expressed a need to reduce the number of variables required to accurately predict the index scores that were obtained from the principal component analysis (African Response, 2006:141), thus making it more practical for researchers to reconstruct the index in future studies. The aim was to identify those variables that explained the largest proportion of the variation in the final index scores that were derived from the last principal component analysis. In addition, it was deemed necessary to derive weights that could be added together, giving an indication of where a business was in terms of its level of business sophistication. The outcome

would hence be an instrument for measuring business sophistication in future surveys.

Of the original 126 variables that were used in the construction of the index scores, a subset of 20 variables was identified that played a major role in the equation. These variables were subjected to a stepwise regression that produced a set of estimated BSM scores. It was, however, found that the 20 variables did not correlate sufficiently well with the full BSM index. Further analysis was thus required.

Subsequent stepwise regressions were performed to investigate the performance of subsets consisting of 30, 40 and 50 variables, respectively. The correlations with the full index were: 30 questions ($r = 0.9929$); 40 questions ($r = 0.9957$); and 50 questions ($r = 0.9974$).

The results indicated that although the 40 and 50 variable shortlists seemed to be highly correlated with the full BSM index, the improvement was deemed inadequate to balance the number of questions asked.

The study concluded by presenting a shortlist of 30 questions, from which a 10 group index could be derived. However, no indication of weights was given. The following variables were included on the shortlist:

- Registered for income tax
- Have/use a fax machine
- Marketing and sales
- Compliance with the Employment Equity Act
- Have motor vehicle insurance
- Comply with Pay-as-you-earn (PAYE)
- Have a vision or mission statement
- Have hot running water/geyser
- Have an executive dining room
- Have a photostat/copying machine

- Have an email address
- Internet banking
- Banking – none
- Have a formal training programme
- Workman's compensation
- Have electricity
- Have written agreement
- Audited
- Storeroom/Access to storeroom
- Have a canteen or dining room
- Have Human Resources/Personnel/Payroll
- Comply with Labour Relations Act
- Have a written marketing plan
- Have current or cheque account
- Have pension/provident fund
- Make use of accountant/bookkeeper
- Have a website
- Have contracts for full-time/part-time employees
- Classified as informal/street/market/stall trader (small)
- Have vehicle finance

3.4.4 Key considerations in the construction of a commercial farming sophistication index and applying it as a method of segmentation

The three selective approaches reviewed in the preceding sections provide valid reference and key considerations that are appropriate for index construction in general. More specifically, they serve as reference where the index construction was used as a method of market segmentation. The underlying processes followed are therefore applicable to the construction of a commercial farming sophistication index and applying it as a method of market segmentation.

The considerations pertain, firstly, to the broad aims envisaged for the construction of a specific index that could measure a particular construct. In other words, to measure a variable that cannot be directly observed, but is assumed to exist, based on some pattern of behaviour or combination of characteristics. Secondly, in terms of the assumptions underlying the model adopted that would guide the index construction process. Thirdly, in terms of the steps, processes and advanced statistical methods that could be employed for the calculation of original index scores. Fourthly, in terms of deriving a general use form of the index that could be easily calculated by other researchers and survey practitioners without depending on advanced statistical analysis. Fifthly, to present a standard set of index score intervals that segments the market. Lastly, in terms of the potential value that the index as segmentation variable offers to marketing practitioners in understanding the behaviour of the market. These aspects are discussed next.

3.4.4.1 *Broad aims and objectives envisaged for the construction of a specific index*

It is evident from the review that the construction of the three selective indices all originated from very similar aims and objectives that were envisaged by the various researchers during conceptualisation. Nine specific aims can be identified; and these are listed below. These aims could equally well guide that which was envisaged for the construction of other indices, and more specifically that of a commercial farming sophistication index.

Aim one: To construct an index that is a measure of a specific construct. In other words, to present an index that is one-dimensional. In the case of the SAARF LSM (South Africa) and New Zealand ELSI (New Zealand), this pertained to living standard, while in the case of African Response BSM (South Africa) to that of business sophistication. In the case of this study, the specific construct measured would be that of commercial farming sophistication.

Aim two: To construct an index using a combination of variables that could measure the construct better than any single variable. The aim of the construction of a commercial farming sophistication index is, therefore, to provide a measure using a combination of variables that could distinguish between the levels of commercial farming sophistication better than any single variable.

Aim three: To construct an index that is a direct measure of the construct, based on non-monetary descriptive indicators. For this study, it would need to relate to measuring commercial farming sophistication without including turnover, profitability or any other monetary-related item as a base for measurement. This aim was adhered to in all three of the reviewed indices. This, however, does not mean that no relationship should exist between the new construct and any monetary-related variable.

Aim four: Items identified for the construction of the index should, on face value, relate to the construct being measured. This suggests that secondary data can be utilised as source for the construction of the index, given that the data is evaluated to be valid in the context of the study.

Aim five: To present an index that is reliable and valid. In other words, the commercial farming sophistication index should measure what it is supposed to measure. This relates to construct validity, which can be decomposed into the assessments of convergent, discriminant and nomological validity. In addition, it should provide scores that are consistent across repeated measures. This relates to the reliability of measurement.

Aim six: To construct an index that has broad application value across the full spectrum of the market, allowing for sub-group analysis, including examination of individual groups and comparisons between groups. A similar aim was

envisaged for this study, namely, to construct an index that could discriminate across the full continuum of commercial farming businesses in South Africa.

Aim seven: To present a measurement process that is useful in future surveys from which separate samples are drawn. In other words, the calculation of index scores should be a simple procedure, and easily replicated by a wide range of researchers and survey practitioners across other surveys conducted in the market. Scores should be readily interpretable.

Aim eight: To construct an index that is stable over time, but sensitive enough to register changes. In other words, to provide scores that would make trend analysis possible. This is, however, only achieved through continuous revision and refinement of the index over time, which was reported as being part of the processes in the reviewed indices, in particular that of the SAARF LSM and New Zealand ELSI scales.

Aim nine: To present a standard set of index score intervals that segments the market. These intervals will provide a practical and standardised procedure that other researchers can follow in future to segment the market.

3.4.4.2 *Assumptions and model*

In order to achieve the stated aims, three key assumptions underlie the index construction process, namely, that the measured construct can be:

- Presented by a single underlying continuous dimension that is the source of the associations between a number of observable variables;
- Could be ranked along a continuum, reflecting levels of the measured construct; and
- Used as base of descriptor variable in market segmentation studies.

3.4.4.3 Steps, processes and methods employed for calculation of original index scores

The stepwise process followed in the construction of all three of the measures, namely, the SAARF LSM, New Zealand ELSI scale and the African Response BSM correspond to the multi-level approach proposed by both Babbie (2011:171) and Spector (1992:7) in index construction. The steps can broadly be specified as: (1) Item selection and the defining of variables for further analysis; (2) combining variables into an index; and (3) segmentation and validating the index.

Drawing from the review, the selection of items of variables included in the calculation of the original index scores is evaluated in terms of their contribution to measuring and explaining the construct under consideration. It is, therefore, considered critical to assess an item's capacity to offer discriminating power across the continuum. This is typically done in part through the determining of the face validity of items.

Next, it is evident that the use of multivariate statistical techniques, such as principal component analysis and confirmatory factor analysis (CFA) provide powerful tools that could aid in the calculation of original index scores. In fact, when a binary coding system is used to indicate the presence of selected items as part of construct measurement, it places all variables on the same scale, making principal component analysis the appropriate technique to be used for index construction (Galpin, 2006:1). Both techniques, however, reduce the often large number of variables into fewer and more meaningful constructs or factors that can be interpreted.

Lastly, index validation should take place. This involved, in the case of the three reviewed indices, examining the association of the derived index scores against those variables and items that comprise it, as well as other variables that could be expected to be associated with the construct.

3.4.4.4 *Derivation of a general use form of the index scale*

Resulting from the above three steps, index scores are produced that might not necessarily be easily replicable in future studies. Due to the typically large number of variables that are used in the original index construction, a reduction of the number of explanatory variables is sought. This is achieved by identifying those variables that have the greatest discriminatory power, and then weighing them optimally. This produces a general-use form of the index that could be easily calculated by other researchers and survey practitioners without depending on using advanced multivariate statistical techniques.

Weighting is done in such a way that each variable carries a different weight, positive or negative. An element's position on the index scale could then be derived by adding together the calculated weights of the variables. In some instances, a constant is also added to the total score to remove negative total scores.

3.4.4.5 *Applying the index as a method of market segmentation*

This relates to specifying standard intervals of the index scores, which then represents homogeneous segments of the market. In all of the cases, the process of establishing cut-points for the intervals was informed by the calculation of some basic descriptive statistics, as well as adhering to criteria specified by the researchers. The forming of groups was thus not based on an advanced statistical clustering method of index scores.

3.4.4.6 *Application value of index*

It is evident from the review that the three derived indices offered extensive value to practitioners, in particular as a method of market segmentation. The antecedents of market segmentation were extensively discussed in Section 2.5,

and apply to these three approaches also. These include aspects, such as a better understanding of the market, assisting in the design of more suitable marketing strategies and programmes, helping businesses focus on those buyers that have the greatest chance of being satisfied, as well as identifying new marketing opportunities, and the more effective allocation of financial and other resources.

In support of this, it was noted that the SAARF LSM is considered to be one of the most widely used marketing research tools in Southern Africa (Haupt, 2006:1).

3.5 CHAPTER SUMMARY

In this chapter, the construction of an index was described by drawing on a sequential three-step process, which was also adopted for this study. The steps involved: firstly, item/variable selection; secondly, examining the empirical relationships between variables and the combining of items into an index; and thirdly, validating the index. When applying the index as segmentation variable it forms part of the last step. The chapter also considered a number of selective studies, in particular due to the fact that these studies followed a process of index construction and applying it as a method of market segmentation. From the review some key considerations could be drawn that were deemed highly relevant in the construction of a commercial farming sophistication index and subsequent segmenting of the market.

The next chapter will provide a discussion of the research design and methods employed in this study.