# Assessing Entrepreneurial Mindset: Results for a New Measure[1]

Kelly G. Shaver, Professor of Entrepreneurial Studies, College of Charleston, USA
Jan Wegelin, African Response, South Africa
Immanuel Commarmond, Allan Gray Orbis Foundation, South Africa

## Abstract

This research describes the results of a national survey of entrepreneurial mindset conducted with 3,194 randomly selected individuals in a representative national sample. Several other measures of entrepreneurial personal characteristics appear in the literature. These include the Entrepreneurial Attitude Orientation measure (cf. EAO, Robinson, Stimpson, Huefner, & Hunt, 1991), the General Enterprising Tendency (cf. GET2, Caird, 1990), the test of Entrepreneurial Self-efficacy (cf. Chen, Greene, & Crick, 1998), and the Entrepreneurial Mindset Profile (cf. EMP, Davis, Hall, & Mayer, 2016). Valuable as these measures are, each has important limitations. This comprehensive study successfully addressed nearly all of those limitations.

**Key words:** entrepreneurial mindset, entrepreneurship, personality traits, scale development, psychology

## Introduction

Briefly, the MindCette Entrepreneurial Test (mcet™) was developed by beginning with a comprehensive literature review (cf. Commarmond, 2017) supported by the Allan Gray Orbis Foundation (AGOF) of the Republic of South Africa. That literature review identified 76 separate concepts that have over the years been associated with entrepreneurial behavior. Because many of these 76 originated from disciplines other than psychology or entrepreneurship, there was understandably some overlap. For example, "need for achievement" is really the same thing as "achievement orientation;" "risk orientation" overlaps with "calculated risk-taking." Elimination of overlap resulted in a total of 37 constructs, some of which are enduring personality traits, some of which are behaviors, and still others are personal preferences. A total of 116 items was assembled to assess these 37 constructs, which were then tested on a pilot sample of 213 females and 187 males in the Republic of South Africa. The results of the pilot survey were factor analyzed (separately by sex of respondent), reducing the total of items to 72. A full description of the scale development was presented at the 2017 Research in ENTrepreneurship (RENT) conference held in Lund, Sweden (Shaver & Commarmond, 2017).

## The National Study

Following the pilot study, the 72-item version of the mindset test was administered to a grand total of 3,661 individuals in the Republic of South Africa, using the same careful procedures used in the pilot study. Of these individuals, 2,404 respondents were randomly selected to be a nationally representative group (the "omnibus" sample), an additional 791 respondents were randomly selected from locations designed to maximize the presence of business ownership (the "booster" sample), 193 respondents were a convenience sample of female business owners, and the last 273 individuals were AGOF program participants. Among the members of the national sample, one person failed to self-identify as female or male. Within the female-owned group one individual self-identified as male, and 7 others failed to self-identify as female. An additional 5 of the female-owned group failed to identify with any racial group. These 14 respondents were dropped from the analyses, leaving a total of 3,647.

The omnibus and booster samples had been selected from a panel based on nationally representative "enumeration areas." There were controls for province, race, sex, and age. Interviews were done in person by field workers who chose dwelling units on the basis of Kish grids, then obtained a list of all household residents and again used a version of the Kish grid to select the person to be the respondent. Though interviews were done in English, all field workers spoke the local dialect for their coverage area (there are 11 official languages in the Republic of South Africa). Questions were presented in a different random order for each respondent, answers were transcribed by the interviewers, all resulting data were then immediately stored in the cloud.

There are two tests normally used to determine whether a dataset is suitable for factor analysis. The Kaiser-Meyer-Olkin (KMO) test for sampling adequacy tests for the proportion of variance among items that might be common variance (more is better for factor analysis) and its values range between 0 and 1, with higher numbers indicating better results. The Bartlett's Test of Sphericity tests the null hypothesis that there are no differences among the variances of the individual items, $\sigma_1^2 = \sigma_2^2 = ... = \sigma_k^2$. If there were no differences in variance across items, each of the *p* items would be correlated only with itself, producing the identity matrix. The result of the Bartlett's test is given as a Chi-square value with degrees of freedom (*df*) computed for the dataset in as $(p*(p-1))/2$.

Regardless of the extraction method selected, the KMO value is the same for respondents of the same sex in the same sample. Thus, for females in the omnibus sample, the KMO value was .97; for males in the omnibus sample, the KMO value was .97. For females in the booster sample, the KMO value was .94; for males in the booster sample the KMO value was .90. Again, regardless of the extraction method, the Bartlett value is the same for respondents of the same sex in the same sample. For females in the omnibus sample the Bartlett Chi-square value was 49159.41. Because the degrees of freedom depend on the number of items, they are always 2556 (*p* items*(*p* – 1 items)/2. For males in the omnibus sample the Bartlett Chi-square value was 32992.59. For females in the booster sample the Bartlett Chi-square value was 16585.92. For males in the booster sample the Bartlett Chi-square value was 10089.58. So, by both the KMO and Bartlett criteria, factor analyses of the data were appropriate.

Once it is demonstrated that the data are suitable for factor analysis, the next choice is among the algorithms used to perform the analysis. SPSS offers six: principal components analysis (PC), unweighted least squares (ULS), general least squares (GLS), maximum likelihood (ML), principal axis factoring (PAF), alpha factoring (AF), and image factoring (IF). According to Youngblut (1993), PC assumes that all error is random, so it extracts "real" factors inherent in the data (a geometrically correct result), whether or not that result is related to the original constructs. This is one reason that PC is said to produce "components" rather than "factors" (Nunnally, 1978). The other methods do not assume that all error is random, but leave open the possibility that some error might be systematic. Because of differences in the assumptions about error, the conservative course of action is to compare the results of PC to the results of some other extraction technique. Because ULS "does not require any distributional assumptions. It can be used with small samples even when the number of variables is large…” (Jöreskog, 2003, p. 1), it was our choice for an alternative to PC.

In the simplest possible terms, the amount of variance explained by a factor is its *eigenvalue.* In any initial solution each variable is standardized to have a mean of 0.0 and a standard deviation of ± 1.0, producing a variance of 1.0. So, any factor with an eigenvalue < 1.0 explains less variability than does a single item. This is why most statistical programs cause a factor analysis to terminate with a minimum eigenvalue of 1.0. When we ran the chosen factor analyses with a minimum eigenvalue of 1, there were too many items on all of the first factors, and so many factors were identified that the solutions became uninterpretable. Consequently, what we report here are factor analyses in which the minimum eigenvalue is set to 1.1. We did, however, use the normal criteria for item loadings and cross-loadings. That is, items were considered part of a dimension if their primary loading on that dimension exceeded ± .40 and they did not have cross-loadings on other dimensions that exceeded ± .40.

Across the several analyses, for both sexes, there were 6 items that consistently failed the loading criteria, so the rest of the results reported here are on 66 items only. Moreover, across the several initial analyses, the PCA solutions for both men and women in both the omnibus sample and the booster sample (a) accounted for the largest percentage of the variance, (b) had the fewest number of items in the first extracted factor, and (c) had the fewest number of items with new cross-loadings. For these reasons, the PCA was the clear choice for analyzing the 66 items. The KMO and Bartlett’s tests were repeated with the 66 items (which reduced the *df* to 2145). For female respondents, KMO was .97 (omnibus) and .94 (booster); for male respondents it was .97 (omnibus) and .90 (booster). The respective Bartlett’s values were 45124.95 (female omnibus), 15041.73 (female booster), 30226.35 (male omnibus), and 9125.35 (male booster). Overall results of the PCA analyses for the 72 items and next for the 66 items are shown in Table 1.

*Table 1. Overall analysis results for 72 items and 66 items (PCA-Varimax rotation).*

| **Item set analyzed:** | **Original: 72 items** | | **Reduced: 66 items** | |
|---|---|---|---|---|
| **Respondent Subsample:** | **Omnibus** | **Booster** | **Omnibus** | **Booster** |
| **Female Respondents** | | | | |
| # factors extracted: | 9 | 12 | 8 | 12 |
| % variance accounted for: | 51.76 | 55.95 | 51.63 | 57.46 |
| Items in Factor I: | 16 | 9 | 16 | 8 |
| Items with cross-loadings: | 5 | 1 | 6 | 4 |
| Items that failed to load: | 10 | 9 | 8 | 12 |
| **Male Respondents** | | | | |
| # factors extracted: | 9 | 15 | 9 | 14 |
| % variance accounted for: | 51.77 | 58.16 | 53.15 | 58.45 |
| Items in Factor I: | 20 | 11 | 23 | 10 |
| Items with cross-loadings: | 6 | 5 | 5 | 4 |
| Items that failed to load: | 2 | 9 | 2 | 8 |

Even with the 66 items, however, for both the female respondents and the male respondents in the omnibus sample, the first extracted factor contained what would normally be considered too many items (16 for females, 23 for males). This is especially true when recognizing that these items did not all originate from a single source. One of the solutions to this problem is to factor analyze only the items extracted in each first factor, but instead of specifying an eigenvalue criterion, specify a number of factors to be obtained. This was done with both female and male respondents, specifying that the PCA should extract 3 separate factors.

Of course, the question is whether the 3-component structure is "better" than the original 1-component structure. This question can be answered by performing confirmatory factor analysis (CFA) that takes the "theory" (three separate components) and uses that theory to specify a statistical model. The CFA was performed using LISREL 9.30 (Jöreskog & Sörbom, 2017). In fact, two CFAs were done, one separating the 16 items into their three components, and one allowing them to remain as elements of one single component. Then each CFA was examined for its goodness of fit. According to Kenny (2015) the Root Mean Square for Error of Approximation (RMSEA) is "currently the most popular measure of goodness of fit" and is now "reported in virtually all papers that use CFA…" Because RMSEA is a measure of departure of the model from a good fit to the data, its desirable value is small. Although the values were close in an absolute sense, the three-factor solution was just a bit better in fitting the data. Additionally, Kenny (2015) has noted that the 90% confidence interval for RMSEA represents the precision with which the RMSEA has been estimated. For the three-factor solution this confidence interval was from 0.0625 - 0.0709, whereas for the one-factor solution the confidence interval was from 0.0736 – 0.0823. In short, there was no overlap between these two confidence intervals. Thus, for statistical reasons as well as conceptual reasons, the three-factor version of the first component obtained for females in the omnibus sample was preferable to the single-factor version. Among the male respondents in the omnibus sample, the three-factor confidence interval was 0.0627 – 0.0702, whereas the single component solution produced a RMSEA confidence interval of 0.0712 – 0.785. As in the case of the female respondents, there was no overlap between these two confidence intervals. It is fair to conclude that, again, the 3-factor solution was preferable.

For both female and male respondents, not only did the first extracted factor contain too many items, the same was true of the second extracted factor for each sex. For the females, the second factor had 14 items, 12 of which had loadings that exceeded ± .40. for the males, the second factor had 15 items, all of which had sufficiently high loadings. Inspection of the "second factor" for each sex suggested that the content was not entirely uniform. Consequently, each set of "second factor" items was first subjected to an EFA with designed to produce two factors (instead of a mineigen criterion). Next, the results of each of these EFAs were used in two different CFAs: one dividing the items into the two components produced in the EFA, one allowing all the items to remain as if they predicted a single conceptual variable. For each sex of respondent, the two-factor CFA produced "better" results than did the single-factor CFA.

On the basis of a number of additional comparisons, it was determined that the first two groups of respondents (for whom the data collection procedures were identical) could be combined into a total of 1,918 female and 1,276 male respondents (total of 3,194) whose answers could then be Random Iterative Method (RIM) weighted so that their results for the 66 items could be considered nationally representative.

As had been the case with the pilot sample, we factor analyzed the 66 items in the *combined* omnibus/booster sample separately for females and males, again splitting the first and second factors as noted above. Not surprisingly, the resulting factor structures for women and men were again clearly different (Principal Components, varimax rotation). Analyses of the answers by the 3,194 respondents produced 10 dimensions for males and 11 dimensions for females. Of these, nine dimensions were present in both men and women. We have adopted these 9 shared dimensions as the MindCette Entrepreneurial Test (mcet™). The nine dimensions are Confidence, Diligence, Entrepreneurial Desire, Innovation, Leadership, Motives, Permanence, Resilience, and Self-control. Sample items from each dimension are shown in Table 2 along with the number of items representing the dimension and the Cronbach Alpha value for each dimension.

Table 2. *Summary of dimensions in MindCette Entrepreneurial Test (mcet™).*

| | | **Females** | | **Males** | |
|---|---|---|---|---|---|
| **Dimension** | **Sample Item** | **Items** | **C.A.** | **Items** | **C.A.** |
| Confidence | I feel confident about my abilities | 3 | .803 | 5 | .825 |
| Diligence | I finish whatever I begin | 4 | .779 | 7 | .825 |
| Entr. Desire | I have seriously thought about starting my own business | 4 | .875 | 4 | .863 |
| Innovation | I would rather innovate than continue to do the same old thing | 6 | .793 | 6 | .736 |
| Leadership | Most people think I am a strong leader | 4 | .698 | 4 | .591 |
| Motives | I want to build great wealth or a very high income | 3 | 828 | 4 | .827 |
| Permanence | People have a certain amount of intelligence and they can't really do much to change it | 6 | .779 | 6 | .765 |
| Resilience | Life's challenges are opportunities for personal growth | 6 | .792 | 7 | .821 |
| Self-control | I want to control my own destiny | 2 | .708 | 5 | .828 |

Some of the 66 items (primarily on the two dimensions of Entrepreneurial Desire and Motives) had originated from the US Panel Studies of Entrepreneurial Dynamics (PSED). The PSED I and PSED II data are publicly available at http://www.psed.isr.umich.edu/psed/home. The two datasets are described, respectively, by Gartner, Shaver, Carter, and Reynolds (2004) and Reynolds and Curtin (2009). The critical point for present purposes is that for any items originally derived from the PSED, there is a second nationally representative sample consisting of a total of 2,475 individuals, for a grand total of 5,669 across two countries and multiple years.

## Entrepreneur Comparisons

Of course, the reason that people care about the possibility of measuring entrepreneurial mindset is the hope that the resulting measure will somehow distinguish between those who would be good candidates for starting a new venture and those who would likely not be so successful. To accomplish this long-term objective the assessment instrument must (a) contain subscales that represent concepts shown to matter in entrepreneurial performance, (b) reliably distinguish current entrepreneurs from people who are not currently running independent businesses. It would also be helpful if at least some of the dimensions were positively correlated with the success of an entrepreneurial venture being operated by a founder who has taken the assessment.

The first of the immediate goals was achieved when the factor analyses of items produced dimensions that were recognizable, internally consistent, and common across the two sexes. The 9 core dimensions together reflect attitudes, behaviors, and traits that are valuable in the creation of a new business. For example, innovation supports the creation of new opportunities, diligence is necessary to get the job done, and resilience is critical – no new venture goes exactly as planned. Without information on the revenue and employment produced by an entrepreneur in the sample, the third goal cannot be achieved by the current work. The second goal – differentiation of entrepreneurs from those who are not running businesses – can be examined using the data this project has collected.

As noted earlier, among the 3,661 individuals in the South African dataset, there are 3,647 who had complete data. Of these, 561 people (392 female, 169 male) answered affirmatively that they were self-employed. These individuals can be compared to the remaining 3,086 on each of the nine dimensions identified in the factor analyses. It is important, however, to note one aspect of such comparisons. Recall that the people in the omnibus and booster samples were obtained through random sampling. Because of that sampling, RIM weights representing (a) province, (b) race, (c) age, and (d) gender were iteratively applied to allow generalization to the nation as a whole. But for the targeted groups (female business owners, participants in the AGOF entrepreneurship development programs), no corresponding weights can be computed. As a result, to assess differences between entrepreneurs and non-entrepreneurs, the RIM weights must be omitted in the comparisons. In short, there can be generalizations to the nation from the weighted data, but comparisons between groups must use unweighted data. Mean scores on the mcet™ are shown in Table 3 for females and males who either self-identified as entrepreneurs or did not do so.

Table 3. *Mean mcet™ scores for entrepreneurs and non-entrepreneurs in South Africa.*

| | **Females** | | **Males** | | ***p* value** | |
|---|---|---|---|---|---|---|
| **Dimension** | **Entr.** | **Non-E** | **Entr.** | **Non-E** | **Employ** | **Sex** |
| Confidence | 5.21 | 5.06 | 5.24 | 5.06 | <.000 | n.s. |
| Diligence | 5.17 | 4.92 | 5.16 | 4.95 | <.000 | n.s. |
| Entrepreneurial Desire | 4.89 | 4.22 | 5.04 | 4.43 | <.000 | <.004 |
| Innovation | 4.98 | 4.82 | 5.02 | 4.84 | <.000 | n.s. |
| Leadership | 4.89 | 4.77 | 4.88 | 4.71 | <.001 | n.s. |
| Motives | 5.18 | 4.92 | 5.15 | 4.88 | <.000 | n.s. |
| Permanence | 4.16 | 4.25 | 4.05 | 4.29 | <.001 | n.s. |
| Resilience | 5.14 | 4.99 | 5.07 | 4.95 | <.000 | n.s. |
| Self-control | 5.36 | 5.22 | 5.21 | 5.08 | <.001 | <.000 |

We performed a series of nine analyses of variance (ANOVA), one per core dimension. Each of these anovas was a 2 x 2 design (Sex X Self-employment). The results of these analyses are shown in the rightmost two columns of Table 3. Respectively, these show the *p*-values for the self-employment status and respondent sex. The first conclusion is that entrepreneurs are different from non-entrepreneurs on every single one of the nine dimensions (given the items that are part of the Permanence dimension, that dimension should produce lower scores for the entrepreneurs). Thus, the second short-term goal has been achieved. It is certainly true that the absolute differences do not seem very large. However, with a total of 3,467 data points, those differences do not need to be large in order to be statistically significant. We are currently working on additional research that will assess the ability of the mcet™ to reflect differences in the revenue and employment performance of companies created by entrepreneurs.

In closing, it should be noted that in the analyses presented in Table 3, there are only two significant mean differences in the scores of women as compared to the scores of men. Recall that the data shown in Table 2, most of the dimensions contain different numbers of items for men and women. Entrepreneurial Desire and Permanence contain the identical items for women and men; Innovation contains the same number of items for both sexes, but the items are not identical. Despite the differences in factor structure, it is in some ways encouraging that most of dimensions do not show sex differences at the conceptual level. This suggests that despite variations in item sets within a dimension, the conceptual dimension scores appear to operate in a roughly comparable fashion for both women and men. The implication from a policy perspective is that programs designed to increase entrepreneurial behavior can afford to treat women and men similarly, but in a nuanced way. Specifically, entrepreneurship development programs could profit from (a) assessing the two sexes using measures specific to each, (b) enhancing the entrepreneurial desire of women, and (c) suggesting to men that they should think twice before acting.

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Correspondence relating this paper should be addressed to kelly@mindcette.com.

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