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How stable are farmers' risk perceptions? A follow-up study of one community in the Karoo

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ABSTRACT

Two cohorts of Likert scale risk data were subjected to rigorous principal component analysis to simplify the participants' risk rankings. This improves methodologically on the first Karoo risk analysis. More than 80% of the items and two-thirds of the participants overlap in these datasets, which made it possible to study the stability of these perceptions over the four years that elapsed between the surveys. Two-thirds of the items were factorable and the four common factors identified in the first cohort all persisted in the second cohort, which indicates stability. The four items added to the second survey created the opportunity to study how emerging structures differ when the lists change. The principal component analysis conducted on the longer list identified a new common concern about growing government control over private enterprise that came to light as a result of adding four extra items. Predation ranked as the number one risk in both surveys followed by drought. Labour and security were middling risks, market access a low risk and a lack of support from the local cooperative no risk at all.

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1. Introduction

There has been limited support for commercial agriculture in post-apartheid South Africa (Kirsten and Van Zyl 1996; Conradie 2016) and the small stock industry has had to cope with weakening terms of trade during the twentieth century (Nattrass and Conradie 2015). The Karoo has not experienced technical progress since 1952 (Conradie et al. 2009) which creates the temptation to overgraze to escape the cost-price squeeze. This is exacerbated by insecure land rights. Uranium exploration and hydraulic fracturing threaten production (Esterhuyse et al. 2018) and land ownership is contested everywhere (Jara 2019). Even the climate outlook is poor (Lumsden et al. 2009).

Conradie and Piesse (2016) ranked and modelled these risks.

The evidence reviewed in Meuwissen et al. (2001) suggests that risk perceptions vary by mode of production and geographic and institutional context but is potentially so idiosyncratic that it is not worth searching for a common structure to a group's risk perceptions. However, they identified a common structure to risk perceptions in Dutch agriculture that could be summarised as "operator health and wellbeing", "financial and institutional risk", "policy environment", "social and technological constraints on production" and "family labour risks" (different labels were used). This illustrates one of the main difficulties with factor analysis, which is to choose useful labels for the factors that emerge from the principal component analysis. The second difficulty is to ensure that the correct factors are extracted systematically. In the process mean sampling adequacy, eigenvalues, cross- and non-loading item scores and communalities must be considered (Hair et al. 2014). Meuwissen et al. (2001) failed on most of these counts.

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This lack of rigour is common in studies that apply principal component analysis to agriculture. Flaten et al. (2005) only reported raw item scores and the variance explained by each factor but ignored low factor scores and cross loading items. Akcaoz and Ozkan (2005) implemented eigenvalues (>1), reported the cumulative variance explained by successive factors and avoided cross loading problems but paid little attention to mean sampling adequacy or communalities. The cursory factor analysis presented in Morales et al. (2008) reported none of the requisite statistics. Kisaka-Lwayo and Obi (2012) resorted to three-point Likert scales and factored the covariance matrix instead of the correlation matrix, which they claimed explains their low factor loadings, although varimax rotation might have improved matters by redistributing items across factors. Cross loading was a problem too. Gebreegziabher and Tadesse (2014) factored 16 items of which at least 1 was not factorable because mean sampling adequacy was not considered, and they might have excluded more items if a higher cut-off loading was used. Asravor's (2018) study is more rigorous. It evaluated factorability upfront with mean sampling adequacy (>0.7), restricted items on a given factor to those with meaningful associations (>0.4) and ensured that their model extracts enough information from each item (communality >0.55), but factor validation might still be a problem as Cronbach's alpha was applied per by item rather than by factor.

Our goal with this study is threefold, to (1) improve the rigour of the first Karoo risk analysis, (2) check for the stability of perceptions over time and (3) investigate if risk structures are affected when more items are added to the list. Another round of risk data gathered in 2016 made points 2 and 3 possible.

The dataset is described in Section 2, including changes over time in item scores and the correlation matrices of the various data cohorts. Section 3 delves into the factorability of the panel dataset of items administered in both waves. A split-level analysis by year provides validation and the basis for the 2012 ranking. Section 4 factors the longer list administered in 2016 and Section 5 discusses the stability of the rankings over time. Items were replaced with scales where appropriate in this section.

2. Description of the risk perception datasets

The risk perception data were gathered as part of the Karoo Farm Management Survey[1], a four-wave panel study initiated in the Central Karoo Municipality in 2012. The lack of reliable sampling frame required snowball sampling. By wave 4 it covered 16,194 km^2, the response rate was 71% and cumulative attrition had gone up to 16%. All except one of the wave 4 (2016) respondents completed the risk perceptions module, which was filled in by 79% of participants in wave 1 (2012). The respondents are sheep farmers (Conradie and Landman 2015; Conradie and Piesse 2015).

The same 5-point Likert scale was used in both surveys with 1 = no threat, 2 = slight threat, 3 = threat, 4 = serious threat and 5 = severe threat. Regulatory concerns were represented by questions relating to labour laws in general, environmental laws in general, predator control regulations, minimum wage regulations for agriculture and the Extension of the Security of Tenure Act (Act 62 of 1997) also known by its acronym ESTA, which protects farm workers' rights and land reform. Other labour market concerns were captured in questions about the reliability of farm labour and unemployment in the wider economy. Various aspects of price risk were surveyed through questions about market access, rising input prices, falling output prices, variability in output prices and unstable exchange rates. Stock theft and farm attacks measured crime and environmental concerns were captured in observations for drought, climate change and predation. A significant feature of wave 4 (2016) was the inclusion of four new risks making headlines across the Karoo. These were hydraulic fracturing, minerals prospecting (uranium), politics and weather weirding (as defined in Hulme 2015). Other item descriptions are in Table 1 and the correlation matrices of the two datasets are in Appendix 1 and 2. Analysis was conducted in Stata 15.1.

The mean scores on most items did not vary between cohorts. The exceptions were higher scores assigned to other environmental laws (x5) and the statutory minimum wage for agriculture (x7) and lower risks attributed to falling output prices (x14). Real mutton and wool prices were 20% higher in

Table 1. Item scores by wave on a 5-point Likert scale.

		Wave 1 (2012) $n = 57$		Wave 4 (2016) $n = 55$		Difference in means	
	Risk item	Mean	Std dev	Mean	Std dev	t-stat	p-value
x1	Unreliable farm labour	3.491	1.351	3.255	1.308	0.9413	0.3486
x2	Labour laws general	3.561	1.268	3.545	1.199	0.0683	0.9456
x3	Predation	4.228	1.053	4.400	0.974	−0.8965	0.3719
x4	Restrictive predator control regulations	3.982	1.261	3.764	1.247	0.9234	0.3758
x5	Other environmental laws	2.702	1.336	3.291	1.242	−2.4148	0.0174
x6	Extension of Security of Tenure Act	3.386	1.497	3.491	1.345	−0.3897	0.6975
x7	The statutory minimum wage for agriculture	2.737	1.316	3.436	1.288	−2.8417	0.0053
x8	Stock theft	2.930	1.462	2.927	1.345	0.0096	0.9924
x9	Drought	3.930	1.116	4.182	1.124	−1.1907	0.2363
x10	Inadequate drought relief	2.895	1.160	3.818	1.073	−4.369	0.0000
x11	Lack of support from local cooperative	1.667	0.988	1.491	0.920	0.9733	0.3326
x12	Lack of market access	2.035	1.133	1.709	0.956	1.6426	0.1033
x13	Rising input costs	4.018	1.077	3.909	0.888	0.5803	0.5629
x14	Falling commodity prices	3.316	1.242	2.818	0.983	2.3462	0.0208
x15	Commodity price instability	3.053	1.329	3.018	1.027	0.1531	0.8786
x16	Currency instability	2.719	1.360	3.091	1.309	−1.4727	0.1437
x17	Land reform	3.035	1.523	3.291	1.436	−0.9139	0.3628
x18	Farm attacks	2.895	1.532	3.036	1.539	−0.488	0.6265
x19	Unemployment in the wider economy	3.140	1.469	3.600	1.486	−1.6461	0.1026
x20	Climate change	3.140	1.260	3.655	1.126	−2.2748	0.0249
x21	Weather weirding			3.582	1.150		
x22	Hydraulic fracturing (gas)			3.836	1.437		
x23	Uranium prospecting			3.764	1.490		
x24	Politics			4.255	0.985		

2016 than in 2012 while the minimum wage rose by 51% in 2013. Karoo farmers encounter environmental regulations mainly as restrictions on predator control methods and other environmental laws when they apply to plough virgin land to grow vegetable seed, an activity for which demand rose between 2012 and 2016. Although rainfall records indicate above normal rainfall for 2016, this year was drier than 2012 in parts of the study area. It shows that farmers worry about drought even when it is not dry and strongly prioritise drought relief when it is. There might also be a link to rising climate change awareness (x20), a programme of the Department of Agriculture.

The initial assessment of data's factorability was based on the correlation coefficients and mean sample adequacy scores reported in the appendices. The indicators were Bartlett's test of sphericity, which tests for the presence of some correlation, and the Kaiser–Meyer–Olkin test of mean sampling adequacy, which detects the degree of correlation of a specific variable with others in the dataset. A mean sampling adequacy of 0.500 is considered the bare minimum for factorisation both overall and for individual items (Hair et al. 2014). Appendix 1a contains the correlation matrix of the complete 20-item list administered in wave 1 (2012), while Appendix 1b presents associations in the edited list. Four items were deleted because they either had a very low mean sampling adequacy in wave 1 or remained below 0.500 in the panel dataset. Revising the 20-item list down to 16 items improved its factorability and its ratio of observations to items. After revision 36% of the correlations were significant at $p \leq 0.01$ and the mean sampling adequacy increased to 0.723. All retained items had mean sampling adequacies of >0.500 and the dataset passed Bartlett's test of sphericity with 527.76 ($p \leq 0.0001$), thereby meeting all the criteria for factorability.

The initial assessment was repeated for the 24-item list administered in wave 4 (2016). Three of the four items deleted from the 20-item list produced mean sampling adequacies of <0.500 in the wave 4 cross-section too and the fourth was deleted for consistency. Its mean sampling adequacy was 0.534. The revised 24-item list passed Bartlett's test with a value of 545.49 ($p \leq 0.0001$), included 22% individual correlations significant at $p \leq 0.01$ and had a mean sampling adequacy of 0.720.

The excluded items are unreliable farm labour (x1), predation (x3), a lack of support from the local cooperative (x11) and climate change (x20). High item scores made it desirable not to bury predation

in a scale in the final risk ranking. Correlations indicated that unreliable labour is not really associated with any other threat and although climate change is a buzzword, it is not at all clear what meaning farmers attach to it. Low scores on the lack of support from the cooperative meant that respondents were unanimous that their cooperative was not a source of risk.

3. Factorability of the shorter list used in wave 1 (2012)

This section describes the process of principal component factor analysis applied the 20-item list that was administered in wave 1 (2012). Since this list overlapped by >80% with the list administered in wave 4 (2016), there is an unbalanced panel dataset of $n = 112$ observations that cover the first 20 items. The panel was used as starting point because its larger sample size promised the best chance of uncovering the common structure underpinning these individual risk perceptions. The panel result was validated by factoring the cross sections separately and the 2012 solution went on to form part of the ranking exercise in Section 5.

The panel dataset produced a unrotated factor matrix in which there were five factors with eigenvalues >1 that captured 63% of the sample variance. A scree plot confirmed the existence of five common factors. Factor 1 accounted for 31% of the variance in the unrotated matrix and had half the items load on it, which indicated that varimax rotation would provide clearer separation (this is in the top half of Table 2). Factor loadings of <0.400 were suppressed and items were sorted from large to small loadings within each factor with items that could not be factored listed at the bottom.

Minimum wage regulations (x7), labour laws (x2), the Tenure Act (x6) and other environmental laws (x5) loaded onto factor 1 which was given the preliminary label "labour laws" as these predominated. Factor 2, "security", combined farm attacks (x18), unemployment in the wider economy (x19), land reform (x17) and stock theft (x8). While land reform is essential for redress after 350 years of colonial dispossession in South Africa (Hall 2004; Vink and Kirsten 2019), Zimbabwe's accelerated land reform programme involved violent dispossession after 2000 which Karoo farmers linked to other common forms of crime in their area. High loadings on falling and unstable prices (x14, x15) combined with a lower loading on restrictive predator control measures (x4) to form factor 3. The association was not obvious although farmers are more likely to resort to cheap, illegal predator control measures when profits are low (Nattrass and Conradie 2018). This suggested a "profitability" label which would have been more appropriate if rising costs also loaded on it. Factor 4 was labelled "weather" as it associated drought (x9) with inadequate drought relief (x10). Market access (x12) and rising costs (x13) formed factor 5, which also spoke to profitability and hence the label "profits2". Unstable currency (x16) did not load on any of the five factors, which explains its low communality of 0.375. Marginal communalities on stock theft (x8) and other environmental laws (x5) indicated potential weaknesses with respect to the factorability of these items too.

The model was revised by deleting item x16. The new results (this is in the bottom half of Table 2) produced a Bartlett's test value of 483.05 and four factors with eigenvalues >1 with a marginal fifth. Together the five factors explained 65% of sample variance. The overall mean sampling adequacy of the revised solution was 0.708 with one item <0.500. Factors included the same elements and were labelled as before, and the individual weights changed only marginally. The was a hint of cross loading on the Tenure Act (x6) but the weight was low enough and the dissociation between it and the rest of factor 3 enough to ignore. Cronbach's alpha tests indicated a high degree of scale reliability on the first three factors and potential problems with factors 4 and 5.

The panel result was validated by re-factoring the two cross sections separately. Analysis started with the final panel model. Since the items added in wave 4 (2016) potentially affected all other associations, the wave 1 results were of most interest as it was needed to rank risks later.

The first four factors were extracted more clearly from the wave 1 cross section than the panel dataset (this is not shown). Factor 1, "labour laws", summarised the same four items in a different order and factors 2–4 were also mostly the same as in the panel. The "profits1" factor lost an item

Table 2. Varimax-rotated factor matrices for the 20-item panel dataset ($n = 112$).

		Factor1	Factor2	Factor3	Factor4	Factor5	Communality
		Preliminary factors					
	Preliminary labels	*Laws*	*Security*	*Profits*	*Weather*	*Profits2*	
x7	The minimum wage	0.779					0.729
x2	Labour laws	0.776					0.690
x6	Tenure Act	0.652					0.665
x5	Other environ. laws	0.641					0.524
x18	Farm attacks		0.820				0.711
x19	Unemployment		0.712				0.577
x17	Land reform		0.654				0.614
x8	Stock theft		0.601				0.495
x14	Falling prices			0.864			0.770
x15	Unstable prices			0.801			0.827
x4	Predator control reg.			0.537			0.535
x9	Drought				0.808		0.664
x10	Drought relief				0.729		0.599
x13	Rising costs					0.710	0.660
x12	Market access					0.684	0.607
x16	Unstable currency						0.375
	Eigen values	2.502	2.233	2.143	1.680	1.483	
	Cumulative variance	16%	30%	43%	53%	63%	
		Final factors					
	Final factor labels	*Laws*	*Security*	*Profits*	*Weather*	*Profits2*	
x7	The minimum wage	0.778					0.726
x2	Labour laws	0.773					0.686
x6	Tenure Act	0.653		0.400			0.695
x5	Other environ. Laws	0.645					0.520
x18	Farm attacks		0.821				0.710
x19	Unemployment		0.703				0.565
x17	Land reform		0.681				0.658
x8	Stock theft		0.604				0.499
x14	Falling prices			0.867			0.776
x15	Unstable prices			0.795			0.822
x4	Predator control reg.			0.553			0.553
x9	Drought				0.807		0.662
x10	Drought relief				0.729		0.601
x13	Rising costs					0.708	0.666
x12	Market access					0.689	0.602
	Eigen values	2.412	2.127	2.061	1.683	1.457	
	Cumulative variance	16%	30%	44%	55%	65%	
	Cronbach's alpha	0.705	0.700	0.651	0.552	0.479	

Notes: Factor loadings <0.4 suppressed.
Bartlett = 527.76 ($p \leq 0.0001$) and overall mean sampling adequacy = 0.723 on preliminary solution.
Bartlett = 483.05 ($p \leq 0.0001$) and overall mean sampling adequacy = 0.706 on final solution.

(x4) and gained another (x13) which suggested that its label be changed to "markets". The new elements in factor 2 meant that two unrelated items (x12, x4) now loaded onto factor 5 whose eigenvalue of 1.106 did not offer a strong reason for keeping it. Therefore, the first revision specified a four-factor solution for the 15-item matrix. The first factor identified in the intermediate solution (not shown), with eigenvalue of 2.778, combined the minimum wage (x7), other environmental laws (x5), labour laws (x2) and the Tenure Act (x6). Factor 2, with eigenvalue of 2.335, combined unstable prices (x14, x15) with market access (x12) and rising costs (x13). It extracted 18% of the variance. The composition of the "security" factor was unchanged, its eigenvalue was 2.335 and its marginal contribution 16% of sample variance. Factor 4, "weather", extracted 10% of sample variance with an eigenvalue of 1.471 and its composition was the same as before. Since predator control measures (x4) did not load anywhere in the intermediate solution, further revision removed it thereby simplifying the labels (this is in Table 3).

Table 3. Final varimax-rotated factor matrix for the wave 1 cross section ($n = 57$).

	Factor labels	Factor1 *Laws*	Factor2 *Markets*	Factor3 *Security*	Factor4 *Weather*	Communality
x7	The minimum wage	0.854				0.785
x5	Other environ. laws	0.817				0.731
x2	Labour laws	0.769				0.632
x6	Tenure Act	0.649				0.704
x14	Falling prices		0.866			0.784
x15	Unstable prices		0.806			0.800
x13	Rising costs		0.613			0.629
x12	Market access		0.522			0.454
x18	Farm attacks			0.775		0.632
X8	Stock theft			0.715		0.668
x17	Land reform			0.661		0.642
x19	Unemployment			0.613		0.483
x9	Drought				0.842	0.713
x10	Drought relief				0.491	0.528
	Eigen values	2.748	2.647	2.328	1.462	
	Cumulative variance	20%	39%	55%	66%	
	Cronbach's alpha	0.821	0.735	0.604	0.469	

Notes: Factor loadings <0.40 suppressed.
Bartlett's test of sphericity = 311.49 $p \leq 0.0001$ and mean sampling adequacy = 0.686.

The final four-factor solution obtained from wave 1 produced an overall mean sampling adequacy of 0.658, with a marginal value of 0.4994 on market access (x12). Bartlett's test was 311.49 ($p \leq 0.0001$) and the four retained factors captured 66% of sample variance. The "laws" label was kept on factor 1 which combined minimum wages (x7), other environmental laws (x5), labour laws (x2) and the Tenure Act (x6). The first three items produced loadings >0.75 with the fourth >0.600. It extracted 20% of sample variance in the rotated matrix and had a scale reliability coefficient of 0.821 which means that this scale could usefully replace the four underlying elements in the risk ranking for 2012. The "profits" factor summarised falling and unstable prices (x14, x15) each with a high loading, with the two other items whose loadings fair to marginal (x12, x13). Market access (x12) not only produced a marginal factor loading of 0.522 but also a marginal communality of 0.4545. However, Cronbach's alpha confirmed that despite its low communality, this item added value to the "profits" scale that qualified for inclusion in the ranking exercise. The "security" factor extracted 19% of sample variance and its Cronbach's alpha value of 0.604 confirmed the same close association that is apparent in the high loadings on farm attacks (x18) and stock theft (x8) and medium loadings on land reform (x17) and unemployment (x19). Drought (x9) and drought relief (x10) validated the "weather" factor although its Cronbach's alpha <0.500 suggested that the two items were best ranked separately.

The high degree of overlap between the panel and wave 1 (2012) results already provides some validation of the reliability of this solution, but it would be even better if the wave 4 (2016) would also reproduce this structure.

Rerunning the final panel model on the 20-item subset of the wave 4 data produced a solution that had five factors with unrotated eigenvalues >1 and a sixth with a marginal eigenvalue of 0.997 (this is not shown). The scree plot indicated three factors. Two items cross loaded (x4, x6) and stock theft (x8) now carried a negative sign. The communality on other environmental laws (x5) was 0.307. Deleting item x5 resolved the cross-loading problem but not the negative sign on stock theft (x8) and created a new communality problem on labour laws (x2). Deleting labour laws (x2) resolved the cross-loading problems and deleting stock theft (x8) got rid of its inconvenient negative sign. Pruning the 20-item list to 12 improved the ratio of observations to variables to 4.58:1 for the wave 4 cross-section.

The final factor solution extracted 4 factors that explained two-thirds of the variation in the 2016 cross-section dataset (this is in Table 4). Bartlett's test was 200.82 ($p \leq 0.0001$). The first factor of the

Table 4. Final varimax-rotated factor matrix for the 20-item subset of wave 4 ($n = 55$).

	Variable *Factor labels*	Factor1	Factor2 *Security*	Factor3 *Weather*	Factor4 *Markets*	Communalities
x4	Predator control reg.	0.802				0.651
x6	Tenure Act	0.778				0.726
x14	Falling prices	0.655				0.476
x7	The minimum wage	0.647				0.520
x15	Unstable prices	0.641		0.433		0.664
x18	Farm attacks		0.896			0.812
x17	Land reform		0.833			0.761
x19	Unemployment		0.716			0.624
x9	Drought			0.828		0.718
x10	Drought relief			0.785		0.637
x13	Rising costs				0.845	0.772
x12	Market access				0.754	0.691
	Eigenvalues	2.679	2.138	1.675	1.560	
	Cumulative variance	22%	40%	54%	67%	
	Cronbach's alpha	0.775	0.786	0.591	0.530	

Notes: Factor loadings <0.4 suppressed.
Bartlett's test of sphericity = 200.84 ($p \leq 0.0001$) and mean sampling adequacy = 0.648.

rotated matrix combined five items that explained 22% of the variance. Factor 2 explained 18% of the variance with three items and factors 3 and 4 each combined two items to extract 14% and 13% of the variance respectively. There were only two problems, namely a slight cross loading of unstable commodity prices (x15) on factor 3 and a marginal communality of 0.476 on falling prices (x14), which were both ignored. Cronbach's alpha values of >0.700 indicated high scale reliability on the first two factors, while the value of 0.591 on factor 3 assigned medium reliability to it but there could be problems with factor 4 whose Cronbach's alpha was only 0.530. Three of the four factors were recognisable under their familiar labels. Despite losing stock theft (x8), factor 2 was clearly still "security". Factor 3 was still "weather" and Factor 4 reproduced the original "profits2" factor extracted in the final panel solution. Factor 1 was more difficult to label as it combined "labour laws" and two "profits" variables. The real meaning of this factor could become clearer when the 24-item list is factored (this is in Section 4).

The interim conclusion is that the panel dataset based on the 20-item list used in wave 1 (2012) was factorable and the solution is reliable. The panel data summarised 15 items into 5 factors – laws, security, profits, droughts and profits2 – of which four – laws, security, profits and drought – were validated by rerunning the model on the wave 1 (2012) cross section. The second validation exercise confirmed three of these but also revealed that by wave 4 (2016) risk perceptions might have shifted to link policy to markets that respond to policy.

4. Does the structure of risk perceptions change when items are added?

The edited 24-item list was re-factored from the beginning (see Appendix 2a for the raw list and Appendix 2b for the edited list of items). With a ratio of 2.75:1 observations to variables there were bound to be problems. Bartlett's test of sphericity produced a value of 454.49 ($p \leq 0.0001$) and the overall mean sampling adequacy was 0.720. The first attempt produced six factors with eigenvalues >1 in the unrotated matrix while the scree plot suggested that even more could be extracted (this is not shown). While varimax rotation separated the first three factors well, there were problems with the last three. On factor 4 stock theft (x8) was associated with market access (x12), rising costs (x13) and unstable currency (x16) that it does not fit with and stock theft (x8) had a negative sign. The core of factor 4 was "profits2". Factor 5 combined three "labour laws" items, except that the Tenure Act (x6) crossed loaded with weights of 0.584 and 0.547 on factor 1 and factor 5. The association of the Tenure Act with labour laws is because South Africa's Extension of Security of Tenure Act improves conditions for farmworkers who in the past lived on the land

without tenure security. Factor 6 associated other environmental laws (x5) with restrictive predator control regulations (x4) where it fits under a possible "environmental laws" label, but the latter cross loaded onto factor 1 with weights of 0.676 and 0.404. Factor 1 bore some resemblance to the "government" factor extracted from the 20-item subset (Table 4) and factor 2 and 3 were "security" and "weather".

Keeping all items and restricting the solution to five factors broke the association between items x4 and x5 which destroyed the "environmental laws" factor (this is in the top half of Table 5). Other

Table 5. Varimax-rotated factor matrices for the 24-item list of the wave 4 (2016) survey ($n = 55$).

		Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Communality
			Preliminary factors				
	Preliminary labels		*Security*	*Weather*	*Laws*	*Markets*	
x23	Prospecting	0.835					0.735
x22	Hydraulic fracturing	0.803					0.689
x14	Falling prices	0.728					0.572
x4	Predator control	0.702			0.415		0.666
x15	Unstable prices	0.644					0.646
x24	Politics	0.604					0.501
x6	Tenure Act	0.581			0.532		0.695
x18	Farm attacks		0.894				0.806
x17	Land reform		0.774				0.746
x19	Unemployment		0.702				0.626
x9	Drought			0.825			0.716
x21	Weather weirding			0.760			0.627
x10	Drought relief			0.633			0.434
x2	Labour laws				0.783		0.701
x7	The minimum wage				0.736		0.682
x13	Rising costs					0.759	0.677
x12	Market access					0.737	0.641
x16	Unstable currency					0.522	0.537
x5	Other environ. laws						0.269
x8	Stock theft					−0.531	0.567
	Eigenvalues	3.935	2.366	2.300	1.995	1.934	
	Cumulative variance	20%	32%	43%	53%	63%	
				Final factors			
	Final factor labels	*Govt.*	*Security*	*Weather*	*Laws*	*Markets*	
x23	Prospecting	0.842					0.743
x22	Hydraulic fracturing	0.805					0.689
x4	Predator control	0.723					0.657
x14	Falling prices	0.721					0.563
x15	Unstable prices	0.629		0.410			0.645
x24	Politics	0.586					0.515
x6	Tenure Act	0.566			0.537		0.716
x18	Farm attacks		0.903				0.822
x17	Land reform		0.797				0.787
x19	Unemployment		0.680				0.608
x9	Drought			0.831			0.725
x21	Weather weirding			0.755			0.628
x10	Drought relief			0.655			0.467
x2	Labour laws				0.791		0.723
x7	The minimum wage				0.737		0.669
x12	Market access					0.803	0.741
x13	Rising costs					0.777	0.698
x16	Unstable currency					0.542	0.531
	Eigenvalues	3.805	2.224	2.162	1.895	1.838	
	Cumulative variance	21%	34%	46%	56%	66%	
	Cronbach's alpha	0.864	0.786	0.665	0.675	0.594	

Notes: Factor loadings <0.4 suppressed.
Bartlett = 454.49 ($p \leq 0.0001$) and mean sampling adequacy = 0.720 on preliminary solution.
Bartlett = 410.38 ($p \leq 0.0001$) and mean sampling adequacy = 0.720 on final solution.

environmental laws (x5) no longer loaded with anything else while predator control (x4) was assigned to the "laws" factor with a marginal weight of 0.415. Its primary association remained with factor 1 where its loading was 0.702. The revision did nothing for the inconvenient negative sign on stock theft (x8) on factor 5. In this solution inadequate drought relief's (x10) low communality of 0.434 indicated that it was not well explained although its strong association with drought (x9) and weather weirding (x21) argued for keeping it during the next stage of revision.

The model was refined by deleting stock theft (x8) and other environmental laws (x4) which improved the ratio of observations to variables to 3.06:1 (this is in the bottom half of Table 5). This solution passed Bartlett's test with a value of 410.38 ($p \leq 0.0001$) and exceeded a 0.500 cut-off for overall mean sampling adequacy with a value of 0.720. Just one item's mean sampling adequacy was marginal namely rising costs (x13) and the communality of inadequate drought relief (x10) remained somewhat problematic. The scree plot was still inconclusive, but the eigenvalues identified five factors that would explain two-thirds of variation in the sample. Cronbach's alpha test statistics indicated a high degree of scale reliability on all five factors.

The extra items added in wave 4 enriched to the meaning of the "government" component factored out of the 20-item subset of the 2016 cohort (Table 4). Previously certain policies were linked to some economic factors. In this solution, a longer list of policies (x4, x6, x22 and x23) were linked to politics (x24) and prices (x14, x15), which suggested "the risk of government interference with private enterprise" as suitable label for this new risk component. Not all policies loaded on factor 1 as the labour laws formed factor 4 with the Tenure Act (x6) cross loading. The common element between the policies that loaded on the "government" factor is that they are all considered especially unreasonable by the farmers. The Tenure Act is perceived as eroding property rights by awarding permanent tenure to longstanding farmworkers. South Africa's current minerals policy, which separates the overland rights to land from mineral rights, represents another form of expropriation as hydraulic fracturing threatens the Karoo's meagre water resources and open-cast uranium mining could contaminate rangeland with poisonous dust. The current predator control regulations are likewise experienced as expropriation as they outlaw poisoning and gin trapping which farmers consider the cheapest and amongst the most effective ways of controlling jackals and caracals. The link to the economy might be that poor governance could harm the economy including trade relations, although unstable currency (x16) then also ought to have loaded here, which is not the case.

With stock theft (x8) being unfactorable in this solution, the "security" factor was reduced to farm attacks (17), land reform (x18) and unemployment (x19). All weights are well above the 0.500 cut-off and the scale reliability coefficient of 0.786 gave a clear indication of the close association of these three variables in the 2016 cohort.

The "weather" factor benefitted from the introduction of weather weirding (x21) in wave 4 (2016). Its weight was 0.755 in the final factor matrix. Table 5 reveals that a fourth item, unstable prices (x15) cross loaded on the weather factor, but its weight of 0.410 was low enough to ignore on the basis that it does not fit with the rest of the "weather" items.

With other environmental laws (x5) considered unfactorable in this case, the "laws" component identified before was reduced to "labour laws" consisting of three items (x2, x6 and x7) that all loaded onto factor 4 in this solution, except that the Tenure Act' (x6) cross-loading weights of 0.566 on "government" and 0.537 on "labour laws" were difficult to ignore. But the face validity of having the Tenure Act (x6) in both scales combined with Cronbach's alpha, which increased sharply from 0.565 to 0.675 when it is added to the "labour laws" factor, provided support for tolerating this item in both indices. Cronbach's alpha on the "government" factor was less sensitive to the inclusion or exclusion of the Tenure Act (x6); the scale reliability coefficient was 0.864 when the Tenure Act (x6) was included and 0.848 when it was removed. The Tenure Act (x5) was kept in both scales for ranking purposes.

Factor 5 combined market access (x12), rising costs (x13) and an unstable currency (x16) under the label "markets". Despite the marginal loading of 0.542 and marginal communality of 0.531 on

unstable currency (x16), it contributed meaningfully to the "markets" factor whose scale reliability coefficient of 0.594 cleared it to be entered as a scale in the risk ranking exercise.

5. Risk rankings – Did farmers' priorities remain the same between 2012 and 2016?

Factorisation considerably shorted both risk item lists. The summated scales ranked alongside the unfactored items in Table 6 each had a reliability coefficient of more than 0.500.

The top three rankings were dominated by the same two farming concerns in both years. In 2012 predation (x3) was scored 4.228 out of 5 and in 2016 its mean score went up by 4% to 4.4 out of 5. In second place in 2012 was restrictive predator control regulations (x4) with a score of 3.982 out of 5, followed by drought (x9) with 3.895 out of 5. The predator control item formed part of the "government interference" scale that ranked fourth in 2016 with a score of 3.564 out of 5. The predator control item gave more weight than most to this scale. The "weather" scale – comprising drought, insufficient drought relief and weather weirding – ranked second in 2016 with 3.873 out of 5, followed closely by climate change (x20) with 3.655 out of 5.

Although in 2016 predation management was less heavily contested between scientists and farmers than in 2012 (a description of the 2012 conflict is given in Nattrass and Conradie 2015), farmers continue to experience difficulties with jackal and caracal management (Nattrass and Conradie 2018). Predation causes severe damage in the order of 5% of the tail-docked and weaned lamb crop or 30% of industry turnover (Conradie and Nattrass 2017) and there is no solution in sight.

Rainfall data for the study area reveal that the first half of the twentieth century was much drier than the second. The current drought began between January and June 2017 in the east (Prince Albert/Beaufort West) and in November 2014 in the west (Laingsburg). Before this one, the Beaufort West area had 2 seasonal droughts in 18 good years, while Laingsburg experienced 4 seasonal droughts in 40 good years. In 2012 the sample average was 122% of expected rainfall while the average participant received 106% of expected rainfall in 2016, which does not explain why the weather ranks so highly in this community. There are other reasons why it might though, chief amongst which could be that climate change information frames droughts differently than in the

Table 6. Risk rankings by year with items and summated scales out of 5.

Code	Variable	Mean	Std dev	Min	Max
	2012 ranking (n = 57)				
x3	Predation	4.228	1.053	1	5
x4	Predator control regulations	3.982	1.261	1	5
x9	Drought	3.895	1.175	1	5
x1	Unreliable farm labour	3.491	1.351	1	5
x20	Climate change	3.140	1.260	1	5
scale	Markets scale	3.105	0.895	1	5
scale	Laws scale	3.096	1.095	1	5
scale	Security scale	3	1.076	1	5
x10	Drought relief	2.895	1.160	1	5
x16	Unstable currency	2.719	1.360	1	5
x11	Lack of support from cooperative	1.667	0.988	1	5
	2016 ranking (n = 55)				
x3	Predation	4.4	0.974	2	5
scale	Weather	3.873	0.862	1.333	5
x20	Climate change	3.655	1.126	1	5
scale	Government interference	3.564	0.915	1.143	4.714
scale	Labour laws	3.491	0.996	1	5
scale	Security	3.285	1.245	1	5
x1	Unreliable farm labour	3.255	1.308	1	5
x5	Other environmental laws	3.2	1.311	1	5
x8	Stock theft	2.927	1.345	1	5
scale	Markets scale	2.903	0.793	1.667	5
x11	Lack of support from cooperative	1.491	0.920	1	5

past. A lack of experience of drought amongst current operators and the cumulative effect of years of overgrazing on grazing reserves might also contribute and no doubt the current government's indifference towards commercial agriculture preys on people's minds.

In both years labour ranked somewhere in the middle although the focus shifted from a preoccupation with the quality of the workforce in 2012 to labour regulation in 2016. Security is another middling risk whose mean score rose by 9.5% between 2012 and 2016 although its ranking remained about the same. Issues of market access ranked low in both years and a lack of support from the local cooperative (x11) was universally considered not a risk in either year.

6. Conclusion

This study repeated an earlier principal component factor analysis to extract the underlying structure of farmers' risk perceptions more rigorously and took advantage of a new wave of data to investigate the stability of risk perceptions over time and when respondents are confronted with additional risk items. Greater rigour did not materially affect the structure or risk perceptions and more observations improved the fit. The structure of risk perceptions remained stable over time except that additional items caused farmers to connect familiar issues in new ways that identified "government interference" as a new source of risk in 2016. Despite this, this community continued to rank risks in much the same way in 2016 as in 2012.

With stable constructs available, the models that explain who holds which perceptions can be revisited and the results can now be linked to performance (e.g., Conradie in press). This community's risk perceptions could also be compared to risk perceptions held in other farming communities in the country and region and to rankings based on 7-point scales (see Flaten et al. 2005).

Note

1. The study obtained ethics approval under the code UCT/COM012/2012.

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References

Akcaoz, H., and B. Ozkan. 2005. Determining risk sources and strategies among farmers of contrasting risk awareness: A case study for Cukurova region of Turkey. *Journal of Arid Environments* 62, no. 4: 661–75.

Asravor, R. 2018. Smallholder farmers' risk perceptions and risk management responses: Evidence from the semi-arid region of Ghana. *African Journal of Economic and Management Studies* 9, no. 3: 367–87.

Conradie, B. 2016. The implications of a weak public extension service for the productivity performance of Karoo agriculture. *South African Journal of Agricultural Extension* 44, no. 2: 99–109.

Conradie, B. in press. Designing succesful land reform for the extensive grazing sector. *South African Journal of Agricultural Extension* 47, no. 2: 1–12.

Conradie, B., and A. Landman. 2015. Wool versus mutton in extensive grazing areas. *South African Journal of Agricultural Extension* 43, no. 1: 22–31.

Conradie, B., and N. Nattrass. 2017. The robustness of self-report data on predation: A comparison of two Karoo surveys. *African Journal of Agricultural and Resource Economics* 12, no. 3: 217–29.

Conradie, B., and J. Piesse. 2015. Productivity benchmarking of free-range sheep operations: Technical efficiency, correlates of productivity and dominant technology variants for Laingsburg. *South Africa. Agrekon* 54, no. 2: 1–17.

Conradie, B., and J. Piesse. 2016. Ranking perceived risk to farmers: How important is the environment? *African Journal of Agricultural and Resource Economics* 11, no. 4: 263–76.
Conradie, B., J. Piesse, and C. Thirtle. 2009. District-level total factor productivity in agriculture: Western Cape Province, South Africa, 1952–2002. *Agricultural Economics* 40, no. 3: 265–80.
Conradie, B., J. Piesse, C. Thirtle, N. Vink, and K. Winter. 2013. Explaining declining agricultural total factor productivity in the Karoo districts of the Western Cape, 1952–2002 Agrekon, 52(S1), 1–23.
Esterhuyse, S., M. Avenant, N. Redelinghuys, A. Kijko, J. Glazewski, L. Plit, M. Kemp, et al. 2018. Monitoring of unconventional oil and gas extraction and its policy implications: A case study from South Africa. *Energy Policy* 118: 109–20.
Flaten, O., G. Lien, M. Koesling, P.S. Valle, and M. Ebbesvik. 2005. Comparing risk perceptions and risk management in organic and conventional dairy farming: Empirical results from Norway. *Livestock Production Science* 95, no. 1–2: 11–25.
Gebreegziabher, K., and T. Tadesse. 2014. Risk perception and management in smallholder dairy farming in Tigray, Northern Ethiopia. *Journal of Risk Research* 17, no. 3: 367–81.
Hair, J.F. Jr., W.C. Black, B.J. Babin, and R.E. Anderson. 2014. *Multivariate data analysis*. 7th ed. Harlow, UK: Pearson.
Hall, R. 2004. A political economy of land reform in South Africa. *Review of African Political Economy* 31, no. 100: 213–27.
Hulme, M. 2015. Climate and its changes: A cultural appraisal. *Geo: Geography and Environment* 2, no. 1: 1–11.
Jara, M.K. 2019. *Land redistribution in South Africa: Pondering the solidarity economy alternative*. Keynote paper presented at "Resolving the Land Question" conference, University of the Western Cape South Africa, 4-5 February 2019.
Kirsten, J.F., and J. Van Zyl. 1996. The costs and benefits of providing agricultural support services to rural households in the developing areas of South Africa. *Development Southern Africa* 13, no. 3: 415–28.
Kisaka-Lwayo, M., and A. Obi. 2012. Risk perceptions and management strategies by smallholder farmers in KwaZulu-Natal Province, South Africa. *International Journal of Agricultural Management* 1, no. 3: 28–39.
Lumsden, T., R. Schultze, and B. Hewitson. 2009. Evaluation of potential changes in hydrologically relevant statistics of rainfall in Southern Africa under conditions of climate change. *Water SA* 35, no. 5: 649–56.
Meuwissen, M.P.M., R.B.M. Huirne, and J.B. Hardaker. 2001. Risk and risk management: An empirical analysis of Dutch livestock farmers. *Livestock Production Science* 69, no. 1: 43–53.
Morales, C., A. Garrido, P. Palinkas, and C. Szekely. 2008. *Risks perceptions and risk management instruments in the European Union: Do farmers have a clear idea of what they need*. 8th EAAE Congress, Gent.
Nattrass, N., and B. Conradie. 2015. Jackal narratives: Predator control and contested ecologies in the Karoo, South Africa. *Journal of Southern African Studies* 41, no. 4: 753–71.
Nattrass, N., and B. Conradie. 2018. Predators, livestock losses and poison in the South African Karoo. *Journal of Cleaner Production* 194, no. 1: 777–85.
Vink, N., and J. Kirsten. 2019. Principles and practice for successful farm land redistribution in South Africa. Working paper 57, Programme for Land and Agrarian Studies, University of the Western Cape, South Africa.

Appendices

Appendix 1a: Correlation matrix and mean sampling adequacy of the 20-item list

Wave 1	x1	x2	x3	x4	x5	x6	x7	x8	x9	x10	x11	x12	x13	x14	x15	x16	x17	x18	x19	x20	MSA	MSA panel
x1	1																				**0.361**	0.618
x2	**0.37**	1																			0.786	0.769
x3	0.16	0.04	1																		**0.321**	**0.488**
x4	−0.2	0.17	0.22	1																	**0.474**	0.661
x5	0.26	**0.52**	−0	0.15	1																0.590	0.766
x6	0.3	**0.53**	−0.2	0.22	**0.51**	1															0.690	0.791
x7	0.31	**0.59**	−0	0.08	**0.58**	**0.5**	1														0.699	0.722
x8	0.25	0.1	0.09	−0	0.08	0.17	0.29	1													0.651	0.647
x9	−0.1	0.03	0.31	−0	0.13	−0.1	0.13	−0.1	1												0.267	0.533
x10	0.1	0.16	0.03	0.02	**0.41**	0.18	0.32	−0.1	0.31	1											0.679	0.782
x11	0.27	0.21	−0.2	−0.1	0.15	0.19	0.12	0.09	−0.1	0.22	1										0.539	**0.459**
x12	0.07	0.11	−0.1	0.14	0.28	0.33	−0	0.2	−0.2	0.21	0.27	1									**0.482**	0.694
x13	0.33	0.32	0.19	0.08	0.1	**0.36**	0.14	0.1	0.18	0.27	0.22	0.28	1								0.555	0.670
x14	0.07	0.16	−0	0.11	0.23	0.33	0.08	−0.3	−0.1	0.21	0.29	**0.35**	**0.34**	1							0.572	0.591
x15	0.06	0.29	0.03	0.17	**0.47**	**0.38**	0.27	−0.2	0.16	**0.42**	0.29	0.22	**0.5**	**0.73**	1						0.569	0.661
x16	0.05	0.33	−0	0.08	0.32	0.29	**0.4**	0.28	−0.1	0.01	0.23	0.26	0.15	0.3	0.27	1					0.741	0.819
x17	0.23	0.33	−0.2	0.1	0.2	**0.57**	0.24	0.26	−0	0.03	0.16	0.28	0.33	0.28	0.21	0.24	1				**0.498**	0.683
x18	0.05	0.11	0.06	0.1	−0.1	0.17	0.14	**0.44**	−0.1	−0.2	0.04	0.23	0.14	−0	−0.1	0.28	**0.49**	1			**0.439**	0.599
x19	0.12	0.11	−0	0.14	0.09	0.16	0.21	**0.36**	0.06	−0	0.22	−0	0.19	−0	0.12	0.28	0.32	0.25	1		0.596	0.792
x20	0.25	0.11	0.15	−0.1	0.08	0.19	0.23	0.25	**0.35**	−0	−0	0.03	0.2	−0.1	0.13	0.15	0.03	**0.34**	0.24	1	**0.269**	**0.498**

Notes: Correlations significant at $p \leq 0.01$ in bold (12%).
Overall mean sampling adequacy for wave 1 = 0.542 ($n = 57$) and for the panel = 0.674 ($n = 112$).
Bartlett's test of sphericity for panel dataset = 639.30 ($p \leq 0.0001$). Barlett's test of sphericity for wave 1 = 451.55 ($p \leq 0.0001$).

Appendix 1b: Correlation matrix and mean sampling adequacy of the revised 20-item list with 4 factors deleted

Wave 1	x2	x4	x5	x6	x7	x8	x9	x10	x12	x13	x14	x15	x16	x17	x18	x19	MSA	MSA panel
x2	1																0.770	0.778
x4	0.209	1															0.649	0.812
x5	**0.346**	**0.259**	1														0.696	0.840
x6	**0.459**	**0.371**	**0.386**	1													0.788	0.812
x7	**0.480**	0.209	**0.438**	**0.473**	1												0.682	0.694
x8	0.055	0.077	0.142	0.202	**0.300**	1											0.634	0.660
x9	0.074	0.048	0.200	0.035	0.201	0.075	1										0.554	0.612
x10	0.130	−0.025	**0.301**	0.158	**0.294**	0.090	**0.382**	1									0.694	0.738
x12	0.137	0.083	0.116	**0.301**	−0.075	0.024	−0.194	0.013	1								0.531	0.658
x13	0.232	0.069	0.060	**0.301**	−0.018	−0.015	0.184	0.155	**0.315**	1							0.622	0.623
x14	0.081	**0.258**	0.120	**0.347**	0.049	−0.092	−0.051	0.067	0.231	0.194	1						0.620	0.603
x15	0.184	**0.258**	**0.319**	**0.414**	**0.264**	−0.080	**0.249**	**0.319**	0.183	**0.402**	**0.656**	1					0.670	0.667
x16	0.235	0.164	**0.352**	**0.278**	**0.309**	0.135	−0.002	0.105	**0.290**	0.195	0.239	**0.331**	1				0.797	0.795
x17	**0.372**	0.166	0.195	**0.485**	**0.252**	0.223	−0.010	0.085	0.209	0.208	**0.248**	0.177	**0.262**	1			0.684	0.737
x18	0.151	0.061	0.042	0.156	0.064	**0.313**	−0.049	−0.045	0.178	0.118	0.049	0.001	**0.291**	**0.563**	1		0.643	0.661
x19	0.179	0.189	0.231	**0.256**	0.228	**0.298**	0.083	0.124	0.047	0.199	0.053	0.161	**0.343**	**0.411**	**0.384**	1	0.678	0.814

Notes: Correlations significant at $p \leq 0.01$ in bold (36%).
Overall mean sampling adequacy for wave 1 = 0.680 ($n = 57$) and for the panel = 0.723 ($n = 112$).
Bartlett's test of sphericity for panel dataset = 527.76 ($p \leq 0.0001$). Bartlett's test of sphericity for wave 1 = 399.44 ($p \leq 0.0001$).

Appendix 2a: Correlation matrix and mean sampling adequacy of the 24-item list used in wave 4 (2016)

	x1	x2	x3	x4	x5	x6	x7	x8	x9	x10	x11	x12	x13	x14	x15	x16	x17	x18	MSA
x1	1																		**0.484**
x2	**0.63**	1																	0.581
x3	0.18	0.14	1																**0.470**
x4	0.19	0.25	0.08	1															0.861
x5	0.21	0.16	−0.06	**0.43**	1														0.559
x6	0.27	**0.37**	0.23	**0.56**	0.25	1													0.799
x7	0.22	**0.39**	0.18	**0.41**	0.22	**0.46**	1												0.603
x8	−0.16	0.00	0.16	0.18	0.22	0.25	0.34	1											0.606
x9	−0.09	0.13	**0.36**	0.14	0.24	0.17	0.22	0.23	1										0.593
x10	0.05	0.12	0.20	−0.01	0.08	0.13	0.10	0.30	**0.42**	1									0.513
x11	−0.12	−0.06	−0.02	−0.32	−0.04	−0.12	−0.14	0.18	0.06	0.13	1								**0.384**
x12	0.33	0.17	−0.15	−0.01	−0.01	0.29	−0.05	−0.20	−0.18	−0.09	0.31	1							0.534
x13	0.28	0.12	0.24	0.05	0.03	0.22	−0.19	−0.18	0.21	0.08	0.03	**0.36**	1						0.507
x14	−0.05	−0.02	−0.08	**0.43**	0.09	**0.42**	0.15	0.23	0.09	0.11	−0.10	−0.02	−0.06	1					0.628
x15	0.09	0.04	0.23	**0.38**	0.13	**0.46**	0.29	0.16	**0.38**	0.26	−0.09	0.12	0.25	**0.57**					0.795
x16	**0.41**	0.13	0.00	0.29	**0.36**	0.26	0.16	−0.03	0.09	0.10	0.15	**0.39**	0.28	0.26	**0.44**	1			0.733
x17	0.26	**0.42**	0.01	0.26	0.17	**0.38**	0.24	0.18	0.01	0.08	−0.17	0.16	0.06	0.27	0.13	0.27	1		0.644
x18	0.22	0.19	0.07	0.02	0.14	0.14	−0.02	0.17	0.00	0.07	0.03	0.13	0.09	0.14	0.09	0.31	**0.64**	1	0.669
x19	0.25	0.26	0.07	0.28	0.33	**0.36**	0.18	0.24	0.06	0.15	0.08	0.16	0.24	0.24	0.24	**0.38**	**0.49**	**0.52**	0.802
x20	0.10	0.05	0.20	−0.01	0.02	0.13	0.04	0.04	**0.50**	0.30	−0.08	0.03	0.26	0.01	**0.37**	0.21	0.13	0.20	0.534
x21	0.04	−0.03	0.23	0.10	0.22	0.08	0.13	0.20	**0.52**	0.25	0.02	−0.13	0.23	0.05	**0.35**	0.20	−0.08	0.06	0.557
x22	0.07	0.14	0.09	**0.55**	0.18	**0.42**	0.22	0.34	0.11	0.16	−0.25	0.05	−0.01	**0.42**	**0.42**	0.24	0.34	0.14	0.720
x23	0.09	0.14	0.07	**0.59**	0.29	**0.49**	0.25	0.29	0.11	0.15	−0.21	0.07	0.01	**0.41**	**0.45**	0.29	0.22	0.13	0.749
x24	−0.07	0.15	0.22	**0.46**	0.10	**0.50**	0.32	0.21	0.17	**0.38**	0.04	0.10	0.13	0.34	**0.38**	0.18	0.14	0.02	0.639

Appendix 2a (cont.)

	X19	X20	x21	x22	x23	x24	MSA
x19	1						0.802
x20	0.193	1					0.534
x21	0.18	**0.80**	1				0.557
x22	0.24	0.25	0.22	1			0.720
x23	**0.36**	0.27	0.31	**0.85**	1		0.749
x24	0.24	0.11	0.23	**0.42**	**0.52**	1	0.639

Notes: Correlations significant at $p \leq 0.01$ in bold (16%).
Overall mean sampling adequacy for wave 4 = 0.643.
Bartlett's test of sphericity for wave 4 = 639.3 ($p \leq 0.0001$).

Appendix 2b: Correlation matrix and mean sampling adequacy of the revised 24-item list used in wave 4 (2016)

	x2	x4	x5	x6	x7	x8	x9	x10	x12	x13	x14	x15	x16	x17	x18	x19	x21	x22	x23	x24	MSA
x2	1																				0.719
x4	0.25	1																			0.821
x5	0.16	**0.43**	1																		0.678
x6	**0.37**	**0.56**	0.25	1																	0.835
x7	**0.39**	**0.41**	0.22	**0.46**	1																0.614
x8	0.00	0.18	0.22	0.25	0.34	1															0.684
x9	0.13	0.14	0.24	0.17	0.22	0.23	1														0.688
x10	0.12	−0.01	0.08	0.13	0.10	0.30	**0.42**	1													0.594
x12	0.17	−0.01	−0.01	0.29	−0.05	−0.20	−0.18	−0.09	1												0.596
x13	0.12	0.05	0.03	0.22	−0.19	−0.18	0.21	0.08	**0.36**	1											0.497
x14	−0.02	**0.43**	0.09	**0.42**	0.15	0.23	0.09	0.11	-0.02	−0.06	1										0.729
x15	0.04	**0.38**	0.13	**0.46**	0.29	0.16	**0.38**	0.26	0.12	0.25	**0.57**	1									0.785
x16	0.13	0.29	**0.36**	0.26	0.16	−0.03	0.09	0.10	**0.39**	0.28	0.26	**0.44**	1								0.733
x17	**0.42**	0.26	0.17	**0.38**	0.24	0.18	0.01	0.08	0.16	0.06	0.27	0.13	0.27	1							0.687
x18	0.19	0.02	0.14	0.14	−0.02	0.17	0.00	0.07	0.13	0.09	0.14	0.09	0.31	**0.64**	1						0.641
x19	0.26	0.28	0.33	**0.36**	0.18	0.24	0.06	0.15	0.16	0.24	0.24	0.24	**0.38**	**0.49**	**0.52**	1					0.814
x21	−0.03	0.10	0.22	0.08	0.13	0.20	**0.52**	0.25	−0.13	0.23	0.05	**0.35**	0.20	−0.08	0.06	0.18	1				0.705
x22	0.14	**0.55**	0.18	**0.42**	0.22	0.34	0.11	0.16	0.05	−0.01	**0.42**	**0.42**	0.24	0.34	0.14	0.24	0.22	1			0.696
x23	0.14	**0.59**	0.29	**0.49**	0.25	0.29	0.11	0.15	0.07	0.01	**0.41**	**0.45**	0.29	0.22	0.13	**0.36**	0.31	**0.85**	1		0.726
x24	0.15	**0.46**	0.10	**0.50**	0.32	0.21	0.17	**0.38**	0.10	0.13	0.34	**0.38**	0.18	0.14	0.02	0.24	0.23	**0.42**	**0.52**	1	0.803

Correlations significant at $p \leq 0.01$ in bold (22%).
Overall mean sampling adequacy = 0.720.
Bartlett's test of sphericity = 454.49 ($p \leq 0.0001$).