APPENDIX C: Formulas

Kendall's W

Kendall's W is the ratio of the sum of the actual variances of rank (sum of the $D^2{}_i$) to the maximum sum of variances of rank. The maximum sum of variances of rank can be calculated as a function of the number of items to be ranked, that is $N(N^2-1)/12$, where N is the number of ranked items.

So our formula for W can be written as:

$$W = \frac{\sum_{i=1}^{N} D_i^2}{N(N^2-1)/12} \tag{1}$$

When perfect agreement on ranking is achieved, the numerator will equal the denominator, yielding W = 1. Otherwise, W will lie somewhere between 0 and 1, with larger values denoting stronger agreement.

For small sets of items (3 £ N £ 7) and up to 20 raters (k), the exact probability for values of W has been worked out and tabled [16, Appendix Table 5]. For larger N or k, the formula

$$X^2 = k(N-1)W \tag{2}$$

yields a value that is approximately distributed as c^2 with $N-1$ degrees of freedom [27].

For Rounds 2 and 3, only half the items are assigned ranks, so the mean ranks represent the distribution of 10 ranks over 20 items. Thus we can say that half the issues are ranked 1, 2, ..., $N/2$ and the other half are ranked as zero by each rater. Since the grand mean of the ranks is calculated as

$$\overline{R} = \frac{\sum_{i=1}^{N} \overline{R}_i}{N} \qquad (3)$$

then the maximum possible sum of variances (sum of the squared deviations from the grand mean) is the sum of the maximum total when only the first half is considered plus the difference added to each deviation by calculating the grand mean over all N items plus the second half difference (which is $N/2$ times the grand mean squared). This can be expressed as

$$\frac{\left(\frac{N}{2}\right)\left(\left(\frac{N}{2}\right)^2 - 1\right)}{12} + N\left(\frac{\frac{N}{2}+1}{4}\right)^2 \qquad (4)$$

By using this expression as the denominator in the formula for Kendall's W, compensation is made for Couger’s method of ranking the issues:

$$W = \frac{\sum_{i=1}^{N} D_i^2}{\frac{\left(\frac{N}{2}\right)\left(\left(\frac{N}{2}\right)^2 - 1\right)}{12} + N\left(\frac{\frac{N}{2}+1}{4}\right)^2} \qquad (5)$$