APPENDIX B

THE AHP PROCEDURE

The example of pair-wise comparisons as developed in Level 2: *Resources* Perspective of KBLVAM is used to show the procedure of the AHP determination (Table B.1).

Table B.1: Matrix of AHP Pair-Wise Comparisons

Aspect	Human	Technology	Financial
Human	1	3	3
Technology	1/3	1	1/2
Financial	1/3	2	1

This matrix should be synthesised and normalised before the calculation for its consistency could be done. In order to synthesise the judgements in this matrix, the value in each column is added up to get a total value for each column as shown in Table B.2.

Table B.2: Matrix of AHP Pair-Wise Comparisons with Total Value for Each Column

	Human	Technology	Financial
Human	1	3	3
Technology	1/3 = 0.3333	1	½= 0.5
Financial	1/3 = 0.3333	2	1
$\sum a_{ij}$ =	1.6666	6	4.5

In order to normalise the matrix, each entry in each column must be divided by the total of the column (shown in Table B.3).

Table B.3: Normalised Matrix of Pair-Wise Comparisons

	Human	Technology	Financial
Human	1/1.6666	3/6	3/4.5
Technology	0.3333/1.6666	1/6	0.5/4.5
Financial	0.3333/1.6666	2/6	1/4.5
$\sum a_{ij}$ =	1.6666/1.6666=1	6/6=1	4.5/4.5=1

The calculation for average for each row is done as follow. Firstly, adding all the entry in each row before divided by the number of elements or entries in the row. In this case, the number of entries is three. The average for each row is known as priority vector (Table B.4).

Table B.4: Calculation of Priority Vector

				Total	**Average**
Human	0.6000	0.5	0.6667	1.7667	0.5889
Technology	0.2000	0.1667	0.1111	0.4778	0.1592
Financial	0.2000	0.3333	0.2222	0.7555	0.2519

Based on the normalised matrix, the test of consistency is done to ensure the judgement made by the decision maker is good and acceptable. The AHP measures the judgement that presented in the matrix by using Consistency Ratio (CR) [Saaty (2008)]. The value of CR should be $\leq 10\%$, and if it is $> 10\%$, then the judgement should be reviewed. The mathematical process integrates the weights and develops the overall evaluation of the decision alternatives. The process of calculating the Consistency Index (CI), which is known as λ_{max} (lambda max) is shown as follows.

Firstly, each entry in the matrix is multiplied by the priority vector (Table B.5).

Table B.5: Multiplication of Entries

Human	1 x 0.5889	3 x 0.1593	3 x 0.2518
Technology	0.3333 x 0.5889	1 x 0.1593	0.5 x 0.2518
Financial	0.3333 x 0.5889	2 x 0.1593	1 x 0.2518

All the values in each row are added up to get the total value of the row. Then each of the total value of the row is divided by the corresponding priority vector to obtain a new vector which is called NV as shown in Table B.6.

Table B.6: Matrix of AHP pair-wise comparisons

				Total	**NV**
Human	0.5889	0.4779	0.7554	1.8222	1.8222/0.5889 = 3.094
Technology	0.1962	0.1593	0.1259	0.4814	0.4814/0.1592 = 3.022
Financial	0.1962	0.3186	0.2518	0.7666	0.7666/0.2519 = 3.044

$$\lambda_{max} = \frac{3.094 + 3.022 + 3.044}{3}$$

$$= 3.053$$

Consistency Index (CI) = $(\lambda_{max} - N)/ (N - 1)$; N = matrix size

$$CI = \frac{3.053 - 3}{2}$$

$$= 0.0265$$

The Random Index (RI) for the various matrix sizes, N, have been approximated by Saaty (2008), based on a large simulation runs. These values are illustrated in Table B.7.

Table B.7: Random Index (RI)

N	1	2	3	4	5	6	7	8
RI	0	0	0.52	0.89	1.11	1.25	1.35	1.41

Based on Table B.7, the calculation to get a CR with RI = 0.52 (N=3) is as follows:

CR = CI / RI

= 0.0265/0.52

= 0.051 (= 5.1%)

Since the CR value is ≤ 10%, then the judgement made by the KBLVAM is consistent and decision could be made based on the highest priority vector.