APPENDIX 1

S1. AHP Methodology

The methodology used for the AHP analysis has been adopted from methodology developed by Saaty (Saaty 1980; Saaty 1985; Saaty 1990; Saaty and Kearns 1991). The AHP analysis used in this study is of two stage hierarchy structure as in this analysis the aim is to find the priority of the constructs using the Eigen vector. These Eigen vectors forms the degree of importance for the HOQ-1. The generic steps used for AHP analysis has been iterated below. Firstly the problem is determined and goal is identified. Secondly the hierarchy structure from the top (the objectives from a decision-makers viewpoint) through the intermediate levels (criteria on which sub- sequent levels depend) to the lowest level which usually contains the list of alternatives is formed. Thirdly a set of pair-wise comparison matrices (size n×n) for each of the lower levels with one matrix for each element in the level immediately above by using the relative scale measurement was formed. The pair-wise comparisons have been conducted in terms of which element dominates the other there are n (n-1)/2 judgments required to develop the set of matrices, reciprocals are automatically assigned in each pair-wise comparison. Fourthly hierarchical synthesis is now used to weight the eigenvectors by the weights of the criteria and the sum is taken over all weighted eigenvector entries corresponding to those in the next lower level of the hierarchy. Fifthly, having made all the pair-wise comparisons, the consistency is determined by using the Eigen value, λ_{max}, to calculate the consistency index, CI as follows:

$$CI = \frac{\lambda max - n}{n-1} \qquad \text{.....equation 1}$$

Where n is the matrix size. Judgment consistency can be checked by taking the consistency ratio (CR) of CI with the appropriate value in table. S2. The CR is acceptable, if it does not

exceed 0.10. If it is more, the judgment matrix is inconsistent. To obtain a consistent matrix, judgments should be reviewed and improved.

$$CR = \frac{CI}{\text{Random Consistency}} \qquad \text{.....equation 2}$$

S2. QFD Methodology

The QFD methodology used for the study consists of three house of quality (HOQ-1, HOQ-2, HOQ-3). The HOQ-1 analysis yielded the weight factors. These weight factors were used as a degree of importance for the HOQ-2 and the weight factor obtained from the HOQ-2 was used as degree of importance for the HOQ-3. The scale for QFD analysis was divided into four categories: strong relationship, medium relationship, weak relationship, no relationship; the criteria's were assigned a value of 9,3,1,0 respectively. The generic methodology adopted for QFD analysis has been iterated below. Firstly identification of customer requirements which are also known as "WHATs" was carried out. Secondly identification of technical requirements which are also known as "HOWs" was carried out. Thirdly the central relationship matrix that is HOQ's is constructed using expert opinion that is the relationship ratings is obtained on a predefined relationship scale of 9,3,1,0. Fourthly the computation of degree of importance for whats of HOQ's are obtained. In this analysis the degree of importance for the HOQ-1 is obtained by an AHP analysis and for the How's the degree of importance of requirements was calculated based on the equation 3.

$$W_j = \sum_{i=1}^{m} R_{ij} C_i \qquad \text{.....equation 3}$$

Where W_j is the degree of importance for the jth constructs (WHAT's) (j=1, 2 . . . n); R_{ij} is the quantified relationship between the ith constructs (HOW's) and the jth constructs in the central relationship matrix (HOQs); and C_i is the importance weighing of the ith constructs.

Fifthly the normalization of the degree of importance of constructs using equation

$$W_j' = \frac{W_j}{\sum_{j=1}^{n} W_j} \times 100 \qquad \text{.....equation 4}$$

Where, W_j' is the normalized importance degree for the jth constructs (j=1, 2... n)

Numerical rating	Verbal judgments of preferences
1	Equal importance
3	Somewhat more important
5	Much more important
7	Very much more important
9	Absolutely more important.
2,4,6,8	Intermediate values

Table S1: Saaty Scale

Size of matrix	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Random consistency	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51	1.48	1.56	1.57	1.59

Table S2: Random Consistency Index