Section S1: An Implementation of the ER technique

To better understand the implementation of the ER technique, the following steps demonstrate the complete implementation of the ER to assess the DBB system as a sample.

1. The belief structures were gathered based on participants' perceptions of the understudied procurement system. For instance, if 30% of the participants graded the DBB under a specific criterion as Excellent, 20% as Very good, 20% as good, 10% as fair, and 20% as poor, the belief structure could be described as $\{(EX, 0.30), (VG, 0.20), (G, 0.20), (F, 0.10), (P, 0.20), (H, 0)\}$. Accordingly, the belief structures of the DBB system of all subcriteria that affect the selection of procurement approaches can be expressed as follows:

$S(CC) = \{(EX, 0.28), (VG, 0.21), (G, 0.15), (F, 0.21), (P, 0.15), (H, 0)\},$

$S(FA) = \{(EX, 0.28), (VG, 0.15), (G, 0.07), (F, 0.43), (P, 0.07), (H, 0)\},$

$S(SC) = \{(EX, 0.07), (VG, 0.15), (G, 0.21), (F, 0.29), (P, 0.29), (H, 0)\},$

$S(PP) = \{(EX, 0.15), (VG, 0.29), (G, 0.15), (F, 0.15), (P, 0.22), (H, 0.07)\},$

$S(AD) = \{(EX, 0.07), (VG, 0.143), (G, 0.22), (F, 0.15), (P, 0.43), (H, 0)\},$

$S(CP) = \{(EX, 0.07), (VG, 0.0), (G, 0.07), (F, 0.50), (P, 0.36), (H, 0)\},$

$S(In.) = \{(EX, 0.15), (VG, 0.0), (G, 0.15), (F, 0.36), (P, 0.29), (H, 0.07)\},$

$S(RRS) = \{(EX, 0.0), (VG, 0.07), (G, 0.07), (F, 0.29), (P, 0.57), (H, 0)\},$

$S(PrP) = \{(EX, 0.15), (VG, 0.07), (G, 0.21), (F, 0.21), (P, 0.36), (H, 0)\},$

$S(PCh) = \{(EX, 0.02), (VG, 0), (G, 0.08), (F, 0.05), (P, 0.36), (H, 0)\},$

$S(PR) = \{(EX, 0.07), (VG, 0.29), (G, 0.07), (F, 0.43), (P, 0.15), (H, 0)\},$

$S(PQ) = \{(EX, 0.15), (VG, 0), (G, 0.50), (F, 0.36), (P, 0.0), (H, 0)\},$

$S(PC) = \{(EX, 0), (VG, 0), (G, 0.36), (F, 0.43), (P, 0.15), (H, 0.07)\},$

$S(OC) = \{(EX, 0.21), (VG, 0.15), (G, 0.29), (F, 0.21), (P, 0), (H, 0.15)\},$

$S(OP) = \{(EX, 0.29), (VG, 0.21), (G, 0.29), (F, 0.15), (P, 0.07), (H, 0)\}$

Where EX = Excellent, VG = Very Good, G = Good, F = Fair, P = Poor, H = Ignorance; CC = cost control, FA = funding arrangement, SC = schedule control, PP = procurement plan, AD = avoid disputes, CP = collaboration processes, In. = Integration, RRS = risk/rewards sharing, PrP = prefabrication processes, PCh = project change, PR = project's regularity, PQ = project quality, PC = project conditions, OC = owner's capabilities, OP = owner's preferences.

2. The local weights (w_i) of the subcriteria, which were calculated by the ANP technique, included in each main criterion are w_{CC} = 0.47, w_{FA} = 0.53, w_{SC} = 0.72, w_{PP} = 0.28, w_{AD} = 0.20, w_{CP} = 0.32, w_{In} = 0.24, w_{RRs} = 0.24, w_{PrP} = 0.18, w_{PCh} = 0.15, w_{PR} = 0.27, w_{PQ} = 0.28, w_{PC} = 0.12, w_{OC} = 0.59, w_{OP} = 0.41.
3. Following that, the belief structures calculated above for each subcriterion are turned into probability masses by multiplying the local weight by each grade belief.

$m(CC) = \{(EX, 0.13), (VG, 0.09), (G, 0.07), (F, 0.09), (P, 0.07), (H, 0.53)\},$

$m(FA) = \{(EX, 0.14), (VG, 0.08), (G, 0.04), (F, 0.22), (P, 0.04), (H, 0.47)\},$

$m(SC) = \{(EX, 0.05), (VG, 0.11), (G, 0.15), (F, 0.20), (P, 0.20), (H, 0.29)\},$

$m(PP) = \{(EX, 0.04), (VG, 0.08), (G, 0.04), (F, 0.04), (P, 0.06), (H, 0.73)\},$

$m(AD) = \{(EX, 0.01), (VG, 0.03), (G, 0.04), (F, 0.03), (P, 0.09), (H, 80)\},$

$m(CP) = \{(EX, 0.02), (VG, 0.0), (G, 0.2), (F, 0.16), (P, 0.11), (H, 68)\},$

$m(In.) = \{(EX, 0.04), (VG, 0.0), (G, 0.04), (F, 0.10), (P, 0.08), (H, 0.75)\},$

$m(RRS) = \{(EX, 0.0), (VG, 0.02), (G, 0.02), (F, 0.07), (P, 0.14), (H, 76)\},$

$m(PrP) = \{(EX, 0.03), (VG, 0.01), (G, 0.04), (F, 0.04), (P, 0.06), (H, 0.82)\},$

$m(PCh) = \{(EX, 0.02), (VG, 0), (G, 0.03), (F, 0.04), (P, 0.05), (H, 0.85)\},$

$m(PR) = \{(EX, 0.02), (VG, 0.08), (G, 0.02), (F, 0.12), (P, 0.04), (H, 0.73)\},$

$m(PQ) = \{(EX, 0.04), (VG, 0), (G, 0.14), (F, 0.10), (P, 0.0), (H, 0.72)\},$

$m(PC) = \{(EX, 0), (VG, 0), (G, 0.04), (F, 0.04), (P, 0.01), (H, 0.90)\},$

$m(OC) = \{(EX, 0.13), (VG, 0.08), (G, 0.16), (F, 0.13), (P, 0), (H, 0.49)\},$

$m(OP) = \{(EX, 0.12), (VG, 0.09), (G, 0.12), (F, 0.06), (P, 0.03), (H, 0.59)\}$

4. Next, the subcriteria included in each criterion are aggregated. The normalizing factor $K_{1(CC+FA)}$ is calculated. Then, an individual probability mass that combines both *cost control* and *funding arrangements* subcriteria can be calculated using equations (*14*, *15*, *16*) be expressed as follows:

   $K_{1(CC+FA)} = 1.24$

   $m(CC + FA) = m(Cost) =$

   $\{(EX, 0.19), (VG, 0.12), (G, 0.07), (F, 0.24), (P, 0.07), (H, 0.31)\}$

5. Followimg that, $m(Cost)$ is transformed into a belief structure by calculating the remaining probability mass caused by the weights of the main criteria ($\bar{m}_{H,i}$) and the remaining probability mass unassigned to grades due to incompleteness of information ($\tilde{m}_{H,i}$).

   $\bar{m}_{H,i} = 0.31, \tilde{m}_{H,i} = 0.0$

   $S(Cost) = \{(EX, 0.29), (VG, 0.17), (G, 0.10), (F, 0.34), (P, 0.10), (H, 0.0)\}$

6. Steps 4 and 5 are repeated to aggregate the probability masses of "Schedule" criteria, as expressed below.

   $K_{1(SC+PP)} = 1.18$

   $m(CC + FA) = m(Time) =$

   $\{(EX, 0.06), (VG, 0.13), (G, 0.15), (F, 0.20), (P, 0.21), (H, 0.25)\}$

   $\bar{m}_{H,i} = 0.24, \tilde{m}_{H,i} = 0.01$

   $S(Time) = \{(EX, 0.09), (VG, 0.19), (G, 0.19), (F, 0.25), (P, 0.27), (H, 0.02)\}$

7. Similarly, Steps 4 and 5 are repeated to aggregate the probability masses of the "Relationships and processes" criteria, as expressed below.

   $K_{1(AD+CP)} = 1.05$

   $m(AD + CP) = \{(EX, 0.03), (VG, 0.02), (G, 0.05), (F, 0.16), (P, 0.17), (H, 0.57)\}$

   $K_{1(AD+CP+In)} = 1.08$

$m(AD + CP + In) =$

$\{(EX, 0.05), (VG, 0.02), (G, 0.07), (F, 0.21), (P, 0.20), (H, 0.46)\}$

$K_{1(AD+CP+In+RRS)} = 1.09$

$m(AD + CP + In + RRS) =$

$\{(EX, 0.04), (VG, 0.02), (G, 0.07), (F, 0.22), (P, 0.26), (H, 0.38)\}$

$\bar{m}_{H,i} = 0.37, \tilde{m}_{H,i} = 0.01$

$S(Relationships\ \&\ processes) =$

$\{(EX, 0.046), (VG, 0.07), (G, 0.11), (F, 0.27), (P, 0.48), (H, 0.02)\}$

8. Again, Steps 4 and 5 are repeated to aggregate the probability masses of the "Project's characteristics" criteria, as expressed below.

$K_{1(PrP+PCh)} = 1.02$

$m(PrP + PCh) = \{(EX, 0.04), (VG, 0.01), (G, 0.06), (F, 0.07), (P, 0.11), (H, 0.71)\}$

$K_{1(PrP+PCh+PR)} = 1.07$

$m(PrP + PCh + PR) =$

$\{(EX, 0.05), (VG, 0.07), (G, 0.06), (F, 0.15), (P, 0.12), (H, 0.55)\}$

$K_{1(PrP+PCh+PR+PQ)} = 1.113$

$m(PrP + PCh + PR + PQ) =$

$\{(EX, 0.07), (VG, 0.06), (G, 0.15), (F, 0.20), (P, 0.09), (H, 0.44)\}$

$K_{1(PrP+PCh+PR+PQ+PC)} = 1.04$

$m(PrP + PCh + PR + PQ + PC) =$

$\{(EX, 0.06), (VG, 0.05), (G, 0.17), (F, 0.23), (P, 0.10), (H, 0.41)\}$

$\bar{m}_{H,i} = 0.41, \tilde{m}_{H,i} = 0.003$

$S(Project's\ characteritics) =$

$\{(EX, 0.11), (VG, 0.09), (G, 0.32), (F, 0.36), (P, 0.12), (H, 0.01)\}$

9. Once again, Steps 4 and 5 are repeated to aggregate the probability masses of the "Owner's characteristics" criteria, as expressed below.

$K_{1(OC+OP)} = 1.19$

$m(OC + OP) = m(Owner's\ characteristics) =$

$\{(EX, 0.17), (VG, 0.12), (G, 0.21), (F, 0.13), (P, 0.02), (H, 0.35)\}$

$\bar{m}_{H,i} = 0.29, \tilde{m}_{H,i} = 0.06$

$S(Owner's\ characteristics) =$

$\{(EX, 0.24), (VG, 0.17), (G, 0.29), (F, 0.18), (P, 0.03), (H, 0.08)$

10. After aggregating the subcriteria included in each main criteria, the main criteria are similarly aggregated. The probability mass for each main criterion is calculated by multiplying the belief grades with the criteria weights, calculated using the ANP technique.

$m(Cost) = \{(EX, 0.05), (VG, 0.03), (G, 0.02), (F, 0.06), (P, 0.02), (H, 0.82)\}$

$m(Time) = \{(EX, 0.01), (VG, 0.10), (G, 0.04), (F, 0.04), (P, 0.01), (H, 0.89)\}$

$K_{1(Cost+time)} = 1.016$

$m(Cost + Time) =$

$\{(EX, 0.06), (VG, 0.04), (G, 0.05), (F, 0.03), (P, 0.03), (H, 0.74)\}$

$K_{1(Cost+time+Relations)} = 1.049$

$m(Relations) = \{(EX, 0.05), (VG, 0.03), (G, 0.02), (F, 0.06), (P, 0.02), (H, 0.82)\}$

$m(Cost + Time + Relations) =$

$\{(EX, 0.05), (VG, 0.04), (G, 0.06), (F, 0.13), (P, 0.11), (H, 0.60)\}$

$K_{1(Cost+time+Relations+Project)} = 1.11$

$m(Cost + Time + Relations + Project) =$

$\{(EX, 0.07), (VG, 0.05), (G, 0.12), (F, 0.19), (P, 0.11), (H, 0.45)\}$

$K_{1(Cost+time+Relations+Project+Owner)} = 1.063$

$m(Cost + Time + Relations + Project + Owner) = m(Overall) =$

$\{(EX, 0.08), (VG, 0.06), (G, 0.14), (F, 0.20), (P, 0.11), (H, 0.41)\}$

11. The final aggregated probability mass is then transformed into belief degrees, as expressed below.

    $\bar{m}_{H,i} = 0.404, \tilde{m}_{H,i} = 0.01$

    $S(Overall) = \{(EX, 0.14), (VG, 0.11), (G, 0.23), (F, 0.33), (P, 0.18), (H, 0.02)\}$

12. Finally, the expected utility intervals of the DBB system are calculated so that the system can be compared to other procurement systems.

    $u_{max}(DBB) = (0.11 \times 4 + 0.23 \times 3 + 0.33 \times 2 + 0.18 \times 1) + (0.14 + 0.02) \times 5$

    = 2.77

    $u_{min}(DBB) = (0.18 + 0.02) \times 1 + (0.14 \times 5 + 0.11 \times 4 + 0.23 \times 3 + 0.33 \times 2)$

    = 2.69

    $u_{avg}(DBB) = 2.73$