A RISK ALLOCATION METHOD OF SPONGE CITY PPP PROJECTS: MULTICRITERIA COMPARISON IN DIFFERENT PROPORTIONS

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1. GENERAL INSTRCUTIONS

Although PPP model has many advantages in implementing Sponge City projects in China, such as reducing the life cycle cost and improving the efficiency of public services [1], the risk of failure is still high, and risk allocation has an important impact on the success of sponge cities.

The risk allocation of Sponge City PPP projects vary from qualitative and probability method, such as proportion method, scenario analysis method and quantitative methods in qualitative method aspect, and risk sharing mechanism based on improved TOPSIS method, utility theory and game perspective. However, the subjective color is strong in qualitative methods; and quantitative methods are complex and time-consuming to operate though it can be calculated to obtain specific numerical proportions.

Therefore, this paper introduces a method of risk determination that can combine qualitative and quantitative advantage, named multicriteria comparison in different proportions method.

2. MULTICRITERIA COMPARISON IN DIFFERENT PROPORTIONS METHOD

Multicriteria comparison in different proportions method draws on the principle of the multicriteria methodology [2] for determining the organizational structure. The specific ideas and operations are 1) Score each option under each weighting criterion. 2) Establish a concordance matrix to measure the Synergy degree between each option. 3) Establish a disconcordance matrix to measure the conflict degree between each option.4) Establish outranking matrix by joint concordance and disconcordance matrix.

Following is a numerical example of multicriteria comparison in different proportions method (Figure 1). Firstly, different schemes (Gx) are scored according to different criteria (Cx). Secondly, According to the scoring results, compare all schemes in pairs. For example, when G1 and G2 are compared, C1 (G1)=2<C1 (G2)=4, C2 (G1)=4>C2 (G2), C3 (G1)=3>C3 (G2)=2, C4 (G1)=4<C3 (G2)=5, C5 (G1)=3>C5 (G2)=2, it can be concluded that G1 is inferior to G2 in C1 and C4, and superior to G2 in C2, C3 and C5. Third, calculate the weighted score superior to other schemes. For example, C(G1, G2)= Wc2+Wc3+Wc5 = 0.2 + 0.2 + 0.2 = 0.6. Fourth, when C(Gi, Gj) > 0.5, then use 1 to record it as a satisfaction; for else results, use 0 to record it, which means do not satisfy. Fifth, calculate the discordance (conflict degree) of each evaluation factor in different schemes, for example, D (G1, G2) = max [(4-2), (3-4), (2-3), (5-4), (2-3)] = 2. The maximum value obtained is used as the threshold value of the conflict degree of each scheme. If it is less than the threshold value, it means that the degree coordination test has passed and is recorded as 1, otherwise it is recorded as 0. Compare the Concordance test result with the Discrepancy test result. When both results are 1 (pass), they pass, Otherwise, 0 will be recorded as failed. Lastly, get the priority of each scheme. Scheme G1 takes precedence over others.

(1) Numerical Multicriteria Matrix

Different Proportions	Criteria				
	C1	C2	C3	C4	C5
G1(20%)	2	4	3	4	3
G2(35%)	4	3	2	5	2
G3(45%)	3	2	5	3	2
G4(60%)	5	1	2	1	4
Weight	0.2	0.2	0.2	0.2	0.2

(2) Concordance Subsystems Matrix

	G1	G2	G3	G4
G1	—	[2,3,5]	[2,4,5]	[2,3,4]
G2	[1,4]	—	[1,2,4,5]	[2,3,4]
G3	[1,3]	[3,5]	—	[2,3,4]
G4	[1,5]	[1,3,5]	[1,5]	—

(3) Concordance Matrix

	G1	G2	G3	G4
G1	—	0.6	0.6	0.6
G2	0.4	—	0.8	0.6
G3	0.4	0.4	—	0.6
G4	0.4	0.6	0.4	—

(4) Concordance Test Result

	G1	G2	G3	G4
G1	—	1	1	1
G2	0	—	1	1
G3	0	0	—	1
G4	0	1	0	—

(5) Discordance Matrix

	G1	G2	G3	G4
G1	—	2	2	3
G2	1	—	3	2
G3	2	2	—	2
G4	3	4	3	—

(6) Discordance Test Result

	G1	G2	G3	G4
G1	—	1	1	1
G2	1	—	1	1
G3	1	1	—	1
G4	1	0	1	—

(7) Outranking Matrix

	G1	G2	G3	G4
G1	—	1	1	1
G2	0	—	1	1
G3	0	0	—	1
G4	0	0	0	—

(8) Outranking Figure

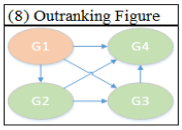

Figure 1 A numerical example of multicriteria comparison in different proportions method

3. CONCLUSIONS

Multicriteria comparison in different proportions method for risk allocation combines the advantages of quantitative and qualitative analysis methods to a certain extent. It retains the rater's attitude towards each criteria, and fully considers the feasibility of different schemes from the perspective of concordance and discordance to increase the scientificity of decision-making. It is flexible and convenient to operate.

REFERENCES

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