Evaluating the Weights of Criteria for Decoupling Point Positioning

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New Trends and

Abstract

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1. Introduction

2. Leagile Supply Chain Strategy

3. Methodology

3.1. Fuzzy Dematel

Step 1: Evaluating the criteria using fuzzy linguistic scale

Step 2: Aggregating the assessments of decision makers and deriving average matrix:

$$Z$$

Step 3: Normalizing the direct-relation matrix:

$$X$$

$$X = s \cdot Z$$

$$s = \frac{1}{\sum_{i,j} z_{ij}} \quad i, j = 1, \dots, n$$

Step 4: Attaining total-relation matrix:

$$T = X(1-X)^{-1}$$

Step 5: Setting a threshold value and producing a causal diagram:

$$T$$

$$p$$

$$T$$

$$T$$

$$D$$

$$R$$

$$D_i + R_j, D_i - R_j$$

$$D_i + R_j$$

$$D_i - R_j$$

3.2. Dematel based ANP (DANP)

Step 1: Establishing unweighted supermatrix:

$$T_c$$

$$T$$

$$T_c$$

$$T_c^\alpha,$$

$$T_c^\alpha = \begin{bmatrix} \cdot & \dots & \cdot & \dots & \cdot \\ t_{c^{11}}^{\alpha 11} & \dots & t_{c^{12}}^{\alpha 12} & \dots & t_{c^{1n}}^{\alpha 1n} \\ \vdots & \vdots & \vdots & \vdots & \vdots \end{bmatrix}$$

$$T_c^{\alpha 11} = \begin{bmatrix} t_{c^{11}}^{\alpha 11} & \dots & t_{c^{12}}^{\alpha 11} & \dots & t_{c^{1m_1}}^{\alpha 11} \\ t_{c^{12}}^{\alpha 11} & \dots & t_{c^{13}}^{\alpha 11} & \dots & t_{c^{1m_2}}^{\alpha 11} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ t_{c^{m_1 1}}^{\alpha 11} & \dots & t_{c^{m_1 2}}^{\alpha 11} & \dots & t_{c^{m_1 m_1}}^{\alpha 11} \end{bmatrix} \begin{bmatrix} t_{c^{11}}^{\alpha 11} & \dots & t_{c^{1j}}^{\alpha 11} & \dots & t_{c^{1m_1}}^{\alpha 11} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ t_{c^{i2}}^{\alpha 11} & \dots & t_{c^{ij}}^{\alpha 11} & \dots & t_{c^{im_1}}^{\alpha 11} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ t_{c^{m_1 1}}^{\alpha 11} & \dots & t_{c^{m_1 j}}^{\alpha 11} & \dots & t_{c^{m_1 m_1}}^{\alpha 11} \end{bmatrix}$$

$$W = (T_C^\alpha)' = \begin{bmatrix} \dot{W}^{1j} & \dots & \dot{W}^{ij} & \dots & \dot{W}^{nj} \end{bmatrix}$$

Step 2: Obtaining weighted supermatrix:

$$T_D^\alpha$$

$$T_D = \begin{bmatrix} \dot{t}_n^{i1} & \dots & \dot{t}_n^{ij} & \dots & \dot{t}_n^{in} \end{bmatrix}$$

$$T_D^\alpha = \begin{bmatrix} t_D^{11}/d_1 & \dots & t_D^{1j}/d_1 & \dots & t_D^{1n}/d_1 \\ t_D^{i1}/d_i & \dots & t_D^{ij}/d_i & \dots & t_D^{in}/d_i \\ t_D^{n1}/d_n & \dots & t_D^{nj}/d_n & \dots & t_D^{nn}/d_n \end{bmatrix} \begin{bmatrix} t_D^{\alpha 11} & \dots & t_D^{\alpha 1j} & \dots & t_D^{\alpha 1n} \\ t_D^{\alpha i1} & \dots & t_D^{\alpha ij} & \dots & t_D^{\alpha in} \\ t_D^{\alpha n1} & \dots & t_D^{\alpha nj} & \dots & t_D^{\alpha nn} \end{bmatrix}$$

$$W^\alpha = T_D^\alpha W = \begin{bmatrix} t_D^{\alpha 11} \times W^{11} & \dots & t_D^{\alpha i1} \times W^{i1} & \dots & t_D^{\alpha n1} \times W^{n1} \\ t_D^{\alpha 1j} \times W^{1j} & \dots & t_D^{\alpha ij} \times W^{ij} & \dots & t_D^{\alpha nj} \times W^{nj} \\ t_D^{\alpha 1n} \times W^{1n} & \dots & t_D^{\alpha in} \times W^{in} & \dots & t_D^{\alpha nn} \times W^{nn} \end{bmatrix}$$

Step 3: Limiting the weighted supermatrix:

k

4. Application

$$Z$$

x

$$T$$
$$T$$
$$T$$
 t_{ij}^*

Table 1. Sum of Rows and Columns of Dimensions

	C_1	C_2	C_3	D_i	R_j	D_i+R_j	D_i-R_j
C_1							
C_2							
C_3							

$$D_i + R_j$$
$$D_i - R_j$$
 $D_i - R_j$ $D_i - R_j$
$$T$$

Figure 1. Causal Diagram Between Dimensions

Table 2. Matrix *T* of All Criteria

$$T = \begin{bmatrix} 0,185 & 0,247 & 0,374 & 0,316 & 0,340 & 0,223 & 0,342 & 0,329 & 0,312 & 0,275 & 0,301 \\ 0,221 & 0,186 & 0,386 & 0,303 & 0,318 & 0,232 & 0,308 & 0,324 & 0,324 & 0,288 & 0,286 \\ 0,337 & 0,368 & 0,419 & 0,444 & 0,451 & 0,339 & 0,477 & 0,480 & 0,474 & 0,434 & 0,444 \\ 0,265 & 0,260 & 0,417 & 0,270 & 0,355 & 0,263 & 0,379 & 0,368 & 0,395 & 0,319 & 0,315 \\ 0,297 & 0,263 & 0,429 & 0,340 & 0,282 & 0,262 & 0,391 & 0,364 & 0,382 & 0,330 & 0,319 \\ 0,202 & 0,237 & 0,349 & 0,289 & 0,291 & 0,194 & 0,313 & 0,332 & 0,353 & 0,302 & 0,312 \\ 0,276 & 0,308 & 0,481 & 0,392 & 0,404 & 0,330 & 0,332 & 0,448 & 0,426 & 0,371 & 0,388 \\ 0,301 & 0,325 & 0,495 & 0,415 & 0,412 & 0,327 & 0,434 & 0,351 & 0,450 & 0,386 & 0,419 \\ 0,274 & 0,267 & 0,423 & 0,372 & 0,372 & 0,324 & 0,385 & 0,404 & 0,324 & 0,381 & 0,390 \\ 0,256 & 0,249 & 0,397 & 0,328 & 0,348 & 0,288 & 0,351 & 0,369 & 0,390 & 0,260 & 0,350 \\ 0,263 & 0,249 & 0,391 & 0,319 & 0,330 & 0,291 & 0,345 & 0,367 & 0,368 & 0,328 & 0,263 \end{bmatrix}$$

$$T$$

Table 3. Sum of Rows and Sum of Columns of All Criteria

	C ₁₁	C ₁₂	C ₁₃	C ₁₄	C ₁₅	C ₂₁	C ₂₂	C ₂₃	C ₃₁	C ₃₂	C ₃₃
D _i											
R _j											
D _i +R _j											
D _i -R _j

Table4. Weights of Criteria Obtained by DANP Method

Criteria (i)	C ₁₁	C ₁₂	C ₁₃	C ₁₄	C ₁₅	C ₂₁	C ₂₂	C ₂₃	C ₃₁	C ₃₂	C ₃₃
Weight (W _i)											

$$D_i+R_j$$

$$D_i+R_j$$

5. Conclusions

$$T$$

$$D_i+R_j$$

$$D_i-R_j$$

$$D_i-R_j$$

$$D_i-R_j$$

$$D_i-R_j$$

$$D_i+R_j$$

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