*Supplementary information*

# INTEGRATED APPROACH FOR EXPLORING CRITICAL ELEMENTS THAT AFFECT SUSTAINABLE DEVELOPMENT OF CULTURAL AND CREATIVE INDUSTRIES

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## Appendix A

The concept of entropy originated with the ancient Greeks and refers to change and transformation. The German physicist Clausius introduced this concept to thermodynamics in 1865 to measure the disorder of a physical system. Used to measure energy, entropy can describe temperature changes and distribution in a system. As the entropy value increases, a system becomes increasingly disordered and vice versa. In 1948, Shannon applied entropy to information and proposed using entropy for calculating the weight of uncertainty. Because the value of entropy is derived from data, it is objective and has been widely used. Its calculation is as follows:

1. Establishing an evaluation matrix of original data

Evaluation of $m$ samples is based on $n$ evaluative criteria to build an initial matrix for evaluation.

$$D = \left[ X_{ij} \right]_{m \times n} = \begin{array}{c} \\ A_1 \\ A_2 \\ \vdots \\ A_m \end{array} \begin{array}{cccc} C_1 & C_2 & \cdots & C_n \end{array} \atop \left[ \begin{array}{cccc} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \ddots & \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{array} \right]_{m \times n} \quad , \quad i = 1, 2, \ldots, m \; ; \; j = 1, 2, \ldots n. \quad (A1)$$

2. Regularizing the initial matrix

The matrix must be regularized as different evaluations of original data may be conducted with different units of measurement that must be unified to ensure data consistency and comparability. To set a unified objective benchmark, the original matrix is regularized. $R = \left[ r_{ij} \right]$ is the regularized matrix.

$$r_{ij} = \frac{xi_j}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}}, \quad i=1,2,\ldots,m; \quad j=1,2,\ldots n. \tag{A2}$$

$$R = \left[r_{ij}\right]_{m\times n} = \begin{array}{c} \\ A_1 \\ A_2 \\ \vdots \\ A_m \end{array} \begin{array}{cccc} C_1 & C_2 & \cdots & C_n \\ \left[\begin{array}{cccc} r_{11} & r_{12} & \cdots & r_{1n} \\ r_{21} & r_{22} & \cdots & r_{2n} \\ \vdots & \vdots & \ddots & \\ r_{m1} & r_{m2} & \cdots & r_{mn} \end{array}\right]_{m\times n} \end{array}, \quad i=1,2,\ldots,m; \quad j=1,2,\ldots n. \tag{A3}$$

3. Calculating the weight value of each criterion, $C_1, C_2, \ldots, C_n$

$e_j$ is the entropy value of $j$ criteria, and $1/\ln m$ is a constant that controls the value of $e_j$ in a range between 0 and 1.

$$e_j = -\frac{1}{\ln m}\sum_{i=1}^{m} r_{ij} \ln r_{ij}, \quad i=1,2,\ldots,m; \quad j=1,2,\ldots n. \tag{A4}$$

4. Calculating the weight $w_j$ of each evaluation

$$W = (w_1, w_2, \ldots, w_n), \quad w_j = \frac{1-e_j}{\sum_{j=1}^{n} 1-e_j}, \quad i=1,2,\ldots,m; j=1,2,\ldots n. \tag{A5}$$

## Appendix B

Table A1. Variables of the four dimensions

| Dimension | Variable | Measurement |
|---|---|---|
| Culture and administration | Local government budget for culture expenditure | Government's released budget for culture expenditure (unit: thousand NTD) |
| | Local government budget for culture expenditure per capita | Local government budget for culture expenditure (unit: NTD/person) |
| | Percentage (%) of local government budget for culture expenditure in total local government budge | Local government budget for culture expenditure/total budget of local government |
| | Headcount of the Ministry of Culture and its subordinate organs | Full-time employees hired by government organs for cultural affaires |
| | Number of cultural volunteers in local government | Culture volunteers are those with arts and culture specialties who are selected by cultural affairs units to promote culture and art-related work |

*End of Table A1*

| Dimension | Variable | Measurement |
|---|---|---|
| Culture and education | Rate of participation in culture | Percentage of people participating in cultural activities |
| | Number of applications for ISBN | The international standard book number (ISBN) is the internationally unified numbering system for book publication and management to facilitate international communication and publication statistics. |
| | Percentage (%) of higher education graduates from culture-related narrower subjects to total number of graduates | Education under education; arts, humanities and design under arts and humanities; communications under social science, business and law; personal services under services. |
| | Total budget of community building (million NT$) | Community building is conducted with the existence and awareness of common community as the prerequisite to developing consensus, autonomy, and promotion of the concept of community building and characteristics of the community via active participation of residents. |
| Culture and society | Monuments/historic buildings/ settlements/cultural landscape/ ruins | Culture assets refer to designated or registered assets with historic, cultural, art or scientific value, including 9 types in 7 categories: 1) monuments, historic buildings, settlements; 2) ruins; 3) cultural landscape; 4) traditional arts; 5) folk customs and related cultural relics; 6) antiquities; and 7) natural landscape. |
| | Mean number of places for cultural and art activities per 10,000 people | Places for cultural activities such as exhibitions and performances that are open for people to participate or visit (unit: places/10,000 people) |
| | Number of cultural and art activities | Cultural activities that allow people to participate or visit in a set period, primarily including exhibitions and performances. |
| Culture and industry | Number of companies in cultural and creative industries | Number of companies in cultural and creative industries/10,000 people |
| | Number of employees in culture-related industries | Number of employees in the education services, art, entertainment, and leisure services |