The Indicators Constructed by FAHP and the Delphi Method to Evaluate Sustainable Development of Taiwan’s Indigenous Tribal Environment

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Abstract. The research aims to investigate the indicators for evaluation of sustainable development of Taiwan’s indigenous tribal environment. For that matter, the indicators for evaluation of sustainable development of Taiwan’s indigenous tribal environment are obtained from literature reviews and further analysed through two questionnaire surveys by the Delphi method and the Fuzzy Analytic Hierarchy Process (FAHP). The research findings are summarized as follows: (1) Five first-class indicators and 24 second-class indicators for evaluation of sustainable development of Taiwan’s indigenous tribal environment are derived; (2) First-class indicators are life culture, art culture, historical site, natural environment and tribe experience according to their weights from high to low; (3) Nine key factors for evaluation of sustainable development of Taiwan’s indigenous tribal environment are celebration of festival, traditional cuisine, life etiquette & custom, architectural feature, ancient monument, traditional artistry, life experience, life style and industrial activity. The research findings as suggestions for sustainable development of Taiwan’s indigenous tribal environment will be submitted to the relevant organizations or other researchers who are interested in our research in their follow-up studies.

1. Introduction
Aboriginal tribal tourism which is based on traditional ethnic festival activities, tribal infrastructures, tribal venues, natural landscape/environment and human culture resources of an indigenous tribe and integrated with sightseeing, travel, tourist lodging, dining, shopping, experience and recreation should be designed and planned meticulously and accompanied with tourist experiences in tribal sightseeing activities for creation of an aboriginal tourism tribe that provides visitors with comprehension to the tribal tourism and exemplary tribal life and close attention to aboriginals as well as development of an indigenous tribe for promotion of revenues of aboriginals and sustainable operation of an indigenous tribe. As shown in statistics, the demands from the tourist market in Taiwan is still sustaining growth and development but converting to deeply experiencing and exploring local natural environment and cultural customs/practices gradually from customary superficial understandings of scenic spots and historical sites in the early days that disappointed the tourist population when the economic level is promoted and an individual’s leisure time increases (Wu, S. Y. et al., 2005; Liu, Y. L., 2011). Liang, P. K. (2008) advocated that indigenous tourism should be grown with cultural resources of aboriginals...
predominantly and developed to be tourist activities which include handicrafts, costumes, architecture, music, dances and traditional cultures of aboriginals.

1.1. Motivation of research
Aboriginal cultures are Taiwan’s precious assets with the cultural value and enduring tourist appeal. Accordingly, it is a critical issue for development of aboriginal tourism in which visitors are able to comprehend, agree and nurture emotional links with indigenous cultures during interactions with aboriginals at a tourist destination in addition to satisfaction of visitors’ curiosities and pleasant experiences (Chiang, Y. J., Yang, P. H., Chiu, S. K., 2017). Ryan (2002) proposed the role of aboriginals at the tourist industry and their cultures as the selling point of tourism inherently. [1] In contrast to the mainstream Han culture, Taiwan’s indigenous cultures are known for their distinctiveness and scarcity such as language, dance, fiesta, handicraft, legend, traditional athletics, etc., all of which are precious resources of Taiwan (Hung, C. H., 2003).

1.2. Purpose of research
1. Explore factors with respect to sustainable development of Taiwan’s indigenous tribal environment.
2. Construct the indicators for sustainable development of Taiwan’s indigenous tribal environment.
3. Analyze weights of the indicators for sustainable development of Taiwan’s indigenous tribal environment.

2. Research method

2.1. Research architecture
For sustainable development of Taiwan’s indigenous tribal environment as the main purpose in this research, we set up the research architecture based on the research purpose, field surveys and literature reviews as shown in Figure 1-2 in order to construct indicators for sustainable development of Taiwan’s indigenous tribal environment. [2]

![Figure 1. The research architecture to construct indicators for sustainable development of Taiwan’s indigenous tribal environment](image-url)
2.2. Research tool

![Diagram of indicators for sustainable development of Taiwan’s indigenous tribal environment]

**Figure 2.** Preliminary structure for indicators with effects on sustainable development of Taiwan’s indigenous tribal environment

2.3. Design of the expert questionnaire by the Delphi method

According to literature reviews and academic theories, the “evaluation of sustainable development of Taiwan’s indigenous tribal environment” is planned and designed for the expert questionnaire survey by the Delphi method. After the questions in the questionnaire are reviewed by experts and/or scholars in several rounds, the rational, satisfactory and objective hierarchical structure based on the eventually consistency evaluation as the criteria is constructed for ensuring the validity of the questionnaire survey in this research.

2.4. Research objects for the questionnaire by the Delphi method and FAHP

The “evaluation of sustainable development of Taiwan’s indigenous tribal environment” refers to the Delphi method and FAHP through experts’ and/or scholars’ reviews of the questionnaire. The whole questionnaire design process includes the following procedures:

1. FAHP expert questionnaire design.
2. FAHP expert selection.
3. FAHP expert questionnaire distribution, recovery and processing.

3. Result and analysis

3.1 Analysis of the questionnaire based on the Delphi method

In the expert to the index revision and the addition question item aspect, this study will adopt "industrial experience", "technological experience", "life experience", "ancient road exploration" and other factors to conduct the second round of Delphi investigation. As shown in table 1
| First-class indicator                                      | MV  | Mode | SD  | CV  | Modified first-class indicator | Result judgment |
|-----------------------------------------------------------|-----|------|-----|-----|---------------------------------|-----------------|
| A. Life culture dimension                                | 5.00| 5    | 0   | 0.00| -                               | Reserved        |
| B. Art culture dimension                                 | 4.86| 5    | 0.32| 0.07| -                               | Reserved        |
| C. Historic site dimension                               | 4.86| 5    | 0.42| 0.09| -                               | Reserved        |
| D. Natural environment dimension                         | 4.43| 5    | 0.82| 0.19| -                               | Reserved        |
| E. Tribe dimension                                       | 4.71| 5    | 0.48| 0.10| -                               | Reserved        |
| A1. Celebration of festival                              | 4.86| 5    | 0.32| 0.07| -                               | Reserved        |
| A2. Characteristics of food                              | 4.71| 5    | 0.68| 0.14| -                               | Reserved        |
| A3. Life style                                           | 4.43| 5    | 0.71| 0.16| -                               | Reserved        |
| A4. Industrial activity                                  | 4.29| 5    | 0.68| 0.16| -                               | Reserved        |
| A5. Life etiquette & custom                              | 4.29| 5    | 1.32| 0.31| -                               | keep            |
| B1. Music dance performance                              | 5.00| 5    | 0.32| 0.06| -                               | Reserved        |
| B2. Traditional costume                                 | 4.71| 5    | 0.63| 0.13| -                               | Reserved        |
| B3. Handicraft                                           | 4.86| 5    | 0.42| 0.09| -                               | Reserved        |
| B4. Painted sculpture art                                | 4.86| 5    | 0.42| 0.09| -                               | Reserved        |
| B5. Linguistic culture                                   | 4.57| 5    | 0.7  | 0.15| -                               | keep            |
| C1. Legend                                               | 4.29| 5    | 0.68| 0.16| -                               | Reserved        |
| C2. Ancient monument                                     | 4.71| 5    | 0.48| 0.10| -                               | Reserved        |
| C3. Recreational facilities                              | 4.00| 5    | 1.05| 0.26| -                               | Keep            |
| C4. Architectural feature                                | 4.29| 5    | 1.27| 0.30| -                               | Keep            |
| C5. Historic weapon                                      | -   | -    | -   | -   | -                               | New             |
| D1. Geological landscape                                 | 3.43| 4    | 0.85| 0.25| -                               | Keep            |
| D2. Landscape                                            | 4.00| 4    | 0.88| 0.22| -                               | Topographic landscape Correction |
| D3. Geographical position                                | 4.14| 5    | 0.95| 0.23| -                               | Geographic landscape Correction |
| D4. Animal ecological landscape                          | 4.00| 4    | 0.94| 0.24| -                               | Reserved        |
| D5. Botanic ecological landscape                         | 3.86| 4    | 0.88| 0.23| -                               | Reserved        |
| E1. Industrial experience                                | 4.29| 4    | 0.50| 0.12| -                               | Reserved        |
| E2. Craft DIY experience                                 | 4.57| 5    | 0.52| 0.11| -                               | Handicraft DIY experience Correction |
| E3. Life experience                                      | 4.43| 5    | 0.53| 0.12| -                               | Reserved        |
| E4. Ancient road hiking                                  | 4.00| 4    | 0.88| 0.22| -                               | Ancient path exploration Correction |
3.2 The results and analysis of the second round Delphi questionnaire on environmental sustainable development assessment index of aboriginal tribes in Taiwan. As shown in table 2

Table 2. Questionnaire analysis factors of sustainable development of aboriginal tribes in Taiwan

| First-class indicator | MV | Mode | SD | CV | Modified second-class indicator | Result judgment |
|-----------------------|----|------|----|----|---------------------------------|-----------------|
| A. Life culture dimension | 4.78 | 5 | 0.42 | 0.09 | - | convergence |
| B. Art culture dimension | 4.67 | 5 | 0.47 | 0.10 | - | convergence |
| C. Historic site dimension | 4.67 | 5 | 0.47 | 0.10 | - | convergence |
| D. Natural environment dimension | 4.33 | 5 | 0.67 | 0.15 | - | convergence |
| E. Tribe dimension | 4.67 | 5 | 0.47 | 0.10 | - | convergence |
| A1. Celebration of festival | 4.89 | 5 | 0.33 | 0.07 | - | convergence |
| A2. Characteristics of food | 4.78 | 5 | 0.09 | 0.09 | - | convergence |
| A3. Life style | 4.22 | 5 | 0.19 | 0.19 | - | convergence |
| A4. Industrial activity | 4.22 | 5 | 0.19 | 0.19 | - | convergence |
| A5. Life etiquette & custom | 4.56 | 5 | 0.16 | 0.16 | - | convergence |
| B1. Music dance performance | 4.78 | 5 | 0.44 | 0.09 | - | convergence |
| B2. Traditional costume | 4.56 | 5 | 0.53 | 0.12 | - | convergence |
| B3. Handicraft | 4.33 | 5 | 0.71 | 0.16 | - | convergence |
| B4. Painted sculpture art | 4.44 | 4 | 0.53 | 0.12 | - | convergence |
| B5. Linguistic culture | 4.22 | 4 | 0.67 | 0.16 | - | convergence |
| C1. Legend | 4.11 | 4 | 0.6 | 0.10 | - | convergence |
| C2. Ancient monument | 4.44 | 4 | 0.53 | 0.10 | - | convergence |
| C3. Recreational facilities | 3.67 | 4 | 0.5 | 0.10 | - | convergence |
| C4. Architectural feature | 4.44 | 4 | 0.5 | 0.10 | - | convergence |
| C5. Historic weapon | 3.56 | 4 | 0.73 | 0.20 | - | convergence |
| D1. Geological landscape | 3.67 | 4 | 0.71 | 0.10 | - | convergence |
| D2. Landscape | 3.56 | 3 | 0.53 | 0.10 | - | convergence |
| D3. Geographical position | 4.00 | 5 | 0.87 | 0.04 | - | convergence |
| D4. Animal ecological landscape | 3.67 | 4 | 0.50 | 0.10 | - | convergence |
| D5. Botanic ecological landscape | 4.00 | 4 | 0.0 | 0.00 | - | convergence |
| E1. Industrial experience | 4.22 | 5 | 0.97 | 0.23 | - | convergence |
| E2. Craft DIY experience | 4.66 | 5 | 0.5 | 0.11 | - | convergence |
| E3. Life experience | 4.44 | 5 | 0.73 | 0.16 | - | convergence |
| E4. Ancient road hiking | 4.11 | 4 | 0.6 | 0.15 | - | convergence |
3.3 Weight analysis of first-class indicators

According to the weight analysis of first-class, the life culture dimension (W=0.374) is the highest, in the following order, they are historical sites dimension (W=0.194), art culture dimension (W=0.181), tribal dimension (W=0.145), and natural environment dimension (W=0.104), as shown in Table 3.

Table 3. Table for analyzing overall weights of indicators to evaluate tourism attractions of an indigenous tribe

| First-class indicator | Relative weight | Overall rank | Second-class indicator | Relative weight | Subgroup rank | Absolute weight | Overall rank |
|-----------------------|-----------------|--------------|------------------------|-----------------|---------------|----------------|--------------|
| Life culture dimension| 0.374           | 1            | Celebration of festival| 0.367           | 1             | 13.7           | 1            |
|                       |                 |              | Traditional cuisine    | 0.218           | 2             | 8.2            | 2            |
|                       |                 |              | Life style             | 0.114           | 4             | 4.3            | 8            |
|                       |                 |              | Industrial activity    | 0.111           | 5             | 4.2            | 9            |
|                       |                 |              | Life etiquette         | 0.190           | 3             | 4.2            | 3            |
| Art culture dimension | 0.181           | 3            | Traditional artistry   | 0.309           | 1             | 7.1            | 6            |
|                       |                 |              | Traditional costume    | 0.163           | 4             | 5.6            | 15           |
|                       |                 |              | Handicraft             | 0.147           | 5             | 3.0            | 16           |
|                       |                 |              | Painted sculpture art  | 0.170           | 3             | 3.1            | 14           |
|                       |                 |              | Linguistic culture     | 0.212           | 2             | 3.8            | 12           |
| Historic site dimension| 0.195           | 2            | Legend                 | 0.211           | 3             | 4.1            | 10           |
|                       |                 |              | Ancient monument       | 0.298           | 2             | 5.8            | 5            |
|                       |                 |              | Recreational facilities| 0.083           | 5             | 1.6            | 22           |
|                       |                 |              | Architectural feature  | 0.320           | 1             | 6.2            | 4            |
|                       |                 |              | Historic weapon        | 0.088           | 4             | 1.7            | 21           |
| Natural environment dimension| 0.104 | 5         | Geological landscape | 0.066           | 5             | 0.7            | 24           |
|                       |                 |              | Topographic landscape  | 0.215           | 3             | 2.2            | 19           |
|                       |                 |              | Geographic landscape   | 0.362           | 1             | 3.8            | 13           |
|                       |                 |              | Animal ecological landscape | 0.206 | 2  | 2.1 | 20 |
|                       |                 |              | Botanic ecological landscape | 0.151 | 4  | 1.6 | 23 |
| Tribe dimension       | 0.145           | 4            | Industrial experience  | 0.176           | 4             | 2.6            | 18           |
|                       |                 |              | Handicraft DIY experience| 0.176           | 3             | 2.6            | 17           |
|                       |                 |              | Life experience        | 0.380           | 1             | 5.5            | 7            |
|                       |                 |              | Ancient path exploration| 0.269           | 2             | 3.9            | 11           |
4. Conclusion and recommendation

4.1 Conclusion

4.1.1. Results for the survey by the Delphi method

After literature reviews, there are five first-class indicators and 23 second-class indicators derived from the first-round questionnaire survey by the Delphi method in this research. Based on recommendations of experts/scholars summarized, some modifications of second-class indicators are shown as follows: “music/dance performance” changed to “traditional artistry”; “geographic landscape” changed to “geographic position”; “topographic landscape” changed to “topographic feature”; “DIY experience” changed to “handicraft DIY experience”; “ancient path hiking” changed to “ancient path exploration”; a new second-class indicator of “historic weapon” added into the “historical site dimension”. Then, the second-round questionnaire survey is conducted with the above second-class indicators modified. Finally, there are five first-class indicators and 24 second-class indicators in total derived from the second-round questionnaire survey by the Delphi method.

2. Weight analysis for the questionnaire by FAHP

After the indicator structure for “factors of tourism attractions for an indigenous tribe” is modified by the Delphi method for the second-round questionnaire survey, the weight analyses for these indicators are carried out by FAHP. As indicated in outcomes in the research, the order of the first-class indicators according to their weights from high to low is “life culture dimension”, “historical site dimension”, “art culture dimension”, “tribe experience dimension” and “natural environment dimension”: (1) “life culture dimension”: “celebration of festival” is the indicator with the highest relative weight in a total of five second-class indicators; (2) “art culture dimension”: “traditional artistry” is the indicator with the highest relative weight in a total of five second-class indicators; (3) “historical site dimension”: “architectural feature” is the indicator with the highest relative weight in a total of five second-class indicators; (4) “natural environment dimension”: “geographic position” is the indicator with the highest relative weight in a total of four second-class indicators. In this research, there are nine key factors with significant attractions of aboriginal tribal tourism found: celebration of festival; traditional cuisine; life etiquette & custom; architectural feature; ancient monument; traditional artistry; life experience; life style; industrial activity.

4.2 Recommendation

4.2.1. Recommendation to relevant organizations

The main purpose to promote industrial development in an indigenous tribe by the government or relevant organizations is to raise the reputation of an indigenous tribe and encourage tourists’ intentions to visit the tribe. In this regard, the key point of an aboriginal tourism tribe appealing to tourists is the relevant industries in this tribe.

4.2.1.1. Hold the festival activities in an indigenous tribe

It can be seen from analytic results that “celebration of festival”, which is taken by experts/scholars as the critical factor of “life culture dimension” among all second-class indicators, best represents the cultural characteristics of an indigenous tribe.[4] The festival activity of aboriginals constitutes the most powerful factor for tribal tourism in “life culture”. Accordingly, we recommend the festival activities of an indigenous tribe should be held.

4.2.1.2. Advocate the traditional artistry of an indigenous tribe

As shown in analytic results in this research, “traditional artistry”, which is the critical factor of “art culture dimension” among all second-class indicators according to opinions of experts/scholars, includes dance, playing of musical instruments and singing performance, all of them present
aboriginals’ performing gifts and appeal to visitors. Accordingly, we recommend the traditional artistry of an indigenous tribe should be advocated.

4.2.1.3. Maintain the architectural feature of an indigenous tribe
As shown in analytic results in this research, “architectural feature”, which is the critical factor of “historical site dimension” among all second-class indicators according to opinions of experts/scholars, represents a particular tribe in 16 indigenous tribes in Taiwan and is an indispensable part of the historical site and the significant goal appealing to visitors. Accordingly, the architectural feature of an indigenous tribe should be maintained.

4.2.1.4. Sustain the geographic landscape
It can be seen from analytic results that “geographic landscape” is taken by experts/scholars as the critical factor of “natural environment dimension” among all second-class indicators. The geographic landscape is an important factor because the transportation and the geographic position of an indigenous tribe usually located at a remote mountainous area are probably inaccessible and ought to be considered by visitors who are attracted by tribal tourism at an indigenous tribe. Accordingly, we recommend the geographic landscape should be sustained.

4.2.1.5. Add the life experience of an indigenous tribe
It can be seen from analytic results that “life experience” is taken by experts/scholars as the critical factor of “tribe experience dimension” among all second-class indicators. The life experience of aboriginals is considered as the most attractive factor for tribal tourism when the lives and cultures in an indigenous tribe are deeply felt by visitors. Accordingly, we recommend the life experience should be added. [5]

4.3. Recommendation for research in the future
In this research, we conclude that celebration of festival, traditional artistry, architectural feature, geographic landscape and life experience are the most important factors among all second-class indicators according to the expert questionnaire. For researchers who are interested in further exploring and assessing the structure for indicators in detail, the consistency of results between the non-expert questionnaire and the expert questionnaire can be checked in their researches.

5. Reference
[1] Wu T C 2003 Tribal Tourism and Ecological Tourism(Conference news of Taiwan Agribusiness Management Association, 35) p 15–18
[2] Hou C H and Li S H and Hsieh T H 2004 Marginalization and further Marginalization - Cultural Shock for Tourism Development at Lan-yu (Proceedings of 2004 Cross-Strait Leisure Agriculture & Tourism Seminar) p 16–1–16–18
[3] Kuo T I 1999 Ecological Tourism (Taipei: Yang-Chih Book Co., Ltd)
[4] Huang C T and Weng Y C 2005 Tendency and Strategy for Development of Cultural and Ecological Tourism at an Indigenous Tribe (Proceedings of 2005 Diagnosis of Taiwan’s Ecological Tourism International Seminar) p C-36–C-49
[5] Mukherjee N, Hugé J, Sutherland W J, McNeill J, Van Opstal M and Dahdouh-Guebas F and Koedam N 2015 The Delphi technique in ecology and biological conservation: Applications and guidelines (Methods in Ecology and Evolution) p 1097–1109
[6] Stewart B T, Gyedu A, Quansah R, Addo W L and Afoko A and Agbenorku P 2016 District-level hospital trauma care audit filters: Delphi technique for defining context-appropriate indicators for quality improvement initiative evaluation in developing countries (Injury)47(1) p 211–219