

Research And Application of The "5-Target Customer Analysis Model" to Address The Illegal Wildlife Trade: The Case of The United States Fish and Wildlife Service

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Abstract. Against the backdrop of the illegal wildlife trade being a global problem involving many governmental and non-governmental organisations, this paper proposes a "5-goal client analysis model" to address this challenge. Firstly, five key assessment indicators, including enforcement capacity, financial support level, human resource level, technological innovation and international co-operation experience, were selected to identify relevant entities to deal with illegal wildlife trade. Potential clients were assessed and analysed through the entropy weighted TOPSIS method, combining the concept of information entropy and a comprehensive assessment of multiple aspects of the clientele, which ultimately identified national-level wildlife management agencies as the best users. For the United States as a major wildlife importer and exporter, the U.S. Fish and Wildlife Service (USFWS) was selected as a potential target. The scope of responsibilities, scope of international cooperation, international relations, and wildlife conservation achievements of the USFWS are further presented, showing significant progress and contributions in combating illegal wildlife trade. The model provides a systematic assessment and solution to effectively address the problem of illegal wildlife trade.

Keywords: Evaluation Indicators; Illegal Wildlife Trade; Entropy-Weight TOPSIS Method.

1. Introduction

Illegal wildlife trade has become a global problem, posing a serious threat to biodiversity, ecosystem stability and public health. Many governmental and non-governmental organisations (NGOs) are working to combat this illegal activity, but coordinating actions and allocating resources is a huge challenge due to the different responsibilities and powers of each party. It is therefore crucial to identify and persuade key stakeholders to support action against illegal wildlife trade^[1-3].

In the process of combating illegal wildlife trade, how to scientifically assess and select key stakeholders becomes a key issue. The selection of clients is directly related to the effective use of resources and the success of policy implementation^[4]. Therefore, we need to establish a systematic assessment model to help identify potential clients with power, resources and interest, and evaluate them comprehensively.

To address the above issues, we first selected five assessment indicators from national and international literature: regulatory enforcement capacity, financial support level, human resource level, technological innovation and international cooperation experience. These indicators will be used as the basis for assessing clients. Next, we weighted and analysed these indicators using the entropy weight TOPSIS method. The entropy weight method calculates the weight of each indicator through information entropy, while the TOPSIS method is used to deal with the multi-indicator decision-making problem and comprehensively assess all aspects of the client. By standardising the data and calculating the composite score, we can identify the best potential clients and provide a scientific basis for combating illegal wildlife trade^[5-6].

2. Target Client Analysis Model

2.1. Selection of Indicators

Illegal wildlife trade is relevant to many governmental and non-governmental organizations, and the type and level of responsibility that should be borne by different entities varies. Our first step therefore needs to be to identify who to persuade.

The title mentions three attributes that customers should have, namely power, resources and interest. Based on this and with reference to the evaluation indexes selected as the focus in the national and international literature, the following five more subdivided factors were finalized.

In order to have a consistent understanding and ownership of the evaluation indicators, the relevant indicators are explained below:

Enforcement capacity of regulations: The fight against illegal wildlife trade requires the support of strong regulatory and enforcement agencies [7-8].

Level of financial support: The management and maintenance of wildlife sanctuaries, wildlife monitoring and research, and the fight against illegal wildlife trade require sufficient funding to guarantee the sustainability of the program.

Level of human resources: The team for combating illegal animal trade should include people with law enforcement experience and investigation skills, who have rich experience in combating all links in the chain of illegal animal trade.

Technological innovation: Remote sensing technology, drones, geographic information system (GIS) technology and other technologies can provide in-depth analysis of the patterns, trends and impacts of the wildlife trade, and provide a scientific basis for the development of precise combating strategies. Indicator weights are shown in figure 1.

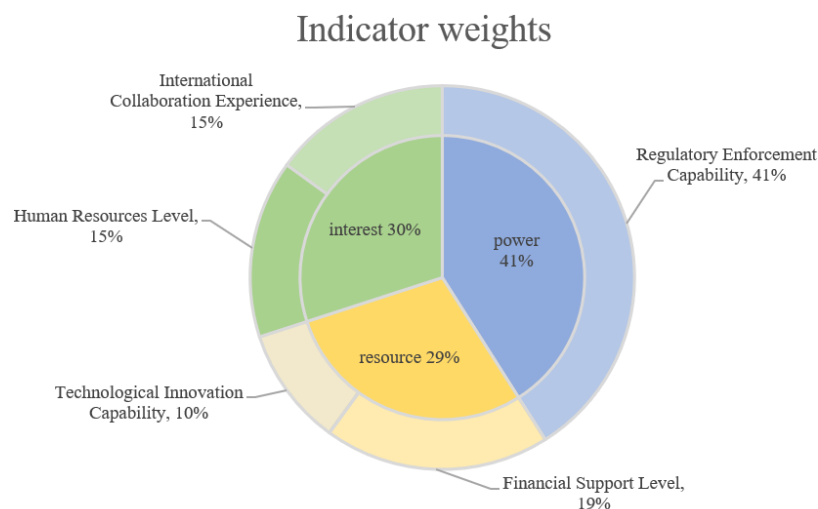


Figure 1: indicator weights

Experience in international cooperation: Organizations with rich experience in international cooperation are able to establish extensive cooperative relationships with other countries and international organizations, develop joint action plans, and strengthen the fight against illegal wildlife trade. After the system of evaluation indicators has been defined, it is necessary to quantify these indicators. Since the evaluation indicators themselves have incomparable dimensions, we perform a dimensionless process after determining the evaluation indicator system. The evaluation weights reflect the relative importance of the factors in the evaluation model [9-10].

2.2. Entropy-Weight TOPSIS method

After finding the five-evaluation metrics, we searched for three categories of potential clients.

By analyzing the topic, we use the Entropy-Weight TOPSIS method for evaluation and analysis because it combines the concept of information entropy, which can better deal with the weight allocation of indicators. At the same time, TOPSIS method is suitable for multi-indicator decision-making problems and can comprehensively evaluate customers in many aspects.

In order to build the mathematical model of the Entropy-Weight TOPSIS method, we first define some symbols:

n : Number of potential clients.

m : Number of indicators assessed.

X : An $n \times m$ matrix, where X_{ij} denotes the score of the i^{th} client on the j^{th} metric.

W : A $1 \times m$ matrix containing the weights of each indicator.

X' : Standardized score matrix.

2.2.1. Step 1: Entropy weight method

The raw score matrix is as follows :

$$X = \begin{bmatrix} 8 & 6 & 9 & 7 & 5 \\ 5 & 9 & 7 & 8 & 6 \\ 7 & 8 & 6 & 9 & 7 \end{bmatrix} \quad (1)$$

Use information entropy to calculate the weights of each indicator. The entropy is calculated using the formula:

$$E_j = - \sum_{i=1}^n \left(\frac{X_{ij}}{\sum_{k=1}^n X_{kj}} \log \frac{X_{ij}}{\sum_{i=1}^n X_{kj}} \right) \quad (2)$$

$$\text{Calculated as } E_1 \approx 0.63, E_2 \approx 0.72, E_3 \approx 0.64, E_4 \approx 0.59, E_5 \approx 0.67 \quad (3)$$

The weight of each indicator is:

$$W_j = \frac{1 - E_j}{\sum_{k=1}^m (1 - E_k)} \quad (4)$$

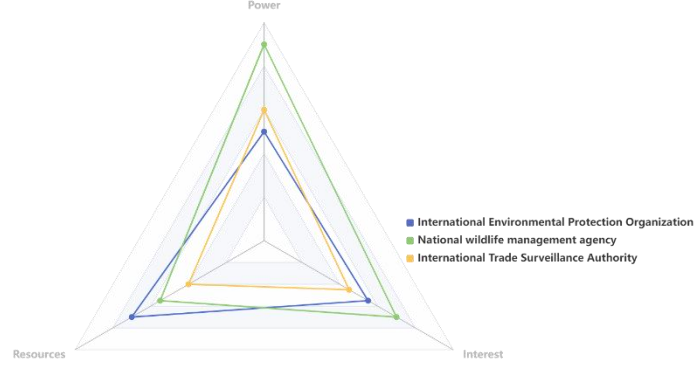


Figure 2: Resuorces&Power&Interest

Resuorces、 power and interest are shown in figure 2.

2.2.2. Step 2: Standardized data

We normalize the original score matrix using a weight matrix. The purpose of standardization is to unify the scores of different evaluation indicators onto the same scale to ensure that each indicator contributes relatively equally to the final result.

Let the original score matrix be X , the weight matrix is W , the standardized score matrix is X'_{ij} . The standardization process is as follows:

For each element in the original score matrix X_{ij} , the standardized score X'_{ij} is calculated as follows

$$X'_{ij} = \frac{X_{ij}}{\sqrt{\sum_{i=1}^n x_{kj}^2}} \quad (5)$$

Where i represents the index of the potential customer, j represents the index of the evaluation indicator, n is the total number of evaluation indicators, W_k is the k^{th} weight in the weight matrix.

Bringing the data into Eq:

$$X' = \begin{bmatrix} 0.94 & 0.45 & 1.00 & 0.70 & 0.17 \\ 0.17 & 1.00 & 0.71 & 0.70 & 0.50 \\ 0.71 & 0.73 & 0.43 & 1.00 & 0.83 \end{bmatrix} \quad (6)$$

2.2.3. Step 3: TOPSIS method

Calculate the positive ideal solution A^+ and the negative ideal solution A^- :

$$\begin{aligned} A^+ &= (\max_{i=1}^n X'_{1i}, \max_{i=1}^n X'_{2i}, \dots, \max_{i=1}^n X'_{mi}) \\ A^- &= (\min_{i=1}^n X'_{1i}, \min_{i=1}^n X'_{2i}, \dots, \min_{i=1}^n X'_{mi}) \end{aligned} \quad (7)$$

Calculate the distance from each client to the positive and negative ideal solutions:

$$D_i^+ = \sqrt{\sum_{j=1}^m (X'_{ij} - A_j^+)^2}$$

$$D_i^- = \sqrt{\sum_{j=1}^m (X'_{ij} - A_j^-)^2}$$
(8)

Calculate the composite score:

$$S_i = \frac{D_i^-}{D_i^+ + D_i^-}$$
(9)

Therefore,

$$S_1 \approx 0.86, S_2 \approx 0.49, S_3 \approx 0.50$$
(10)

Through calculations, we determined that has the highest score ($S_1=0.86$) and National-level Wildlife Management Agency is our best user.

Next, we collected data on the import and export of wildlife animals and plants from different countries and visualized them as in Figures 3 and 4, and we can see that the United States is undoubtedly a major importer and exporter of wildlife animals and plants in terms of the ranking and number of imports and exports, so we chose United States Fish and Wildlife Service (USFWS) for the United States as the most explicit and clear potential object.

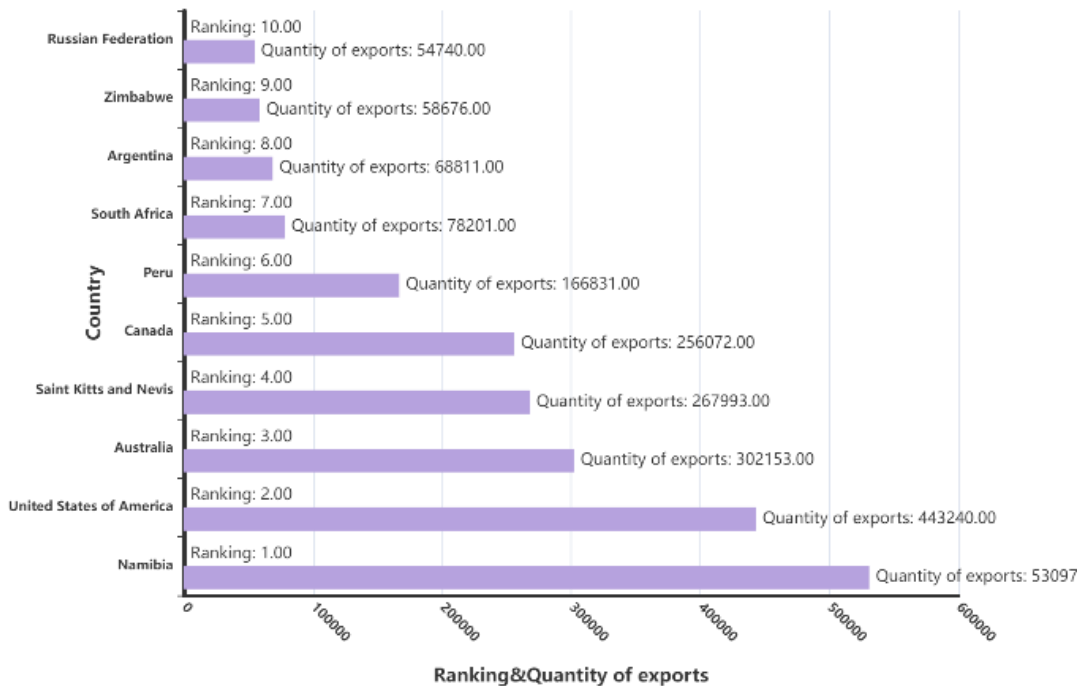


Figure 3: Wildlife TradeView-Export



Figure 4: Wildlife TradeView-Import

2.3. Important work of the USFWS

1) Scope of Authority:

The USFWS is the primary agency of the U.S. government responsible for enforcing CITES. It has the authority to oversee and regulate the import and export trade in endangered species within and outside of the U.S., and has the authority to develop and implement policies to do so.

2) Scope of International Cooperation:

The USFWS works closely with other countries and international organizations to address the threat of the illegal wildlife trade, and it cooperates with a wide range of regions and countries around the globe, participating in many global enforcement actions.

3) International Relations:

The USFWS's international cooperation on the illegal wildlife trade benefits not only wildlife conservation, but also friendly relations and mutual trust between the United States and other countries and organizations.

4) Wildlife Conservation Outcomes:

USFWS has made significant progress in illegal wildlife trade, such as seizing and confiscating a large number of illegal wildlife products within the U.S., such as ivory, rhinoceros horns, tiger bones, and bear gall bladders, etc.; and supporting a number of wildlife conservation programs outside of the U.S., such as anti-poaching and wildlife rescue in Africa, Asia, and Latin America, etc.

3. Conclusions

This paper provides a detailed description of the analytical model for the target client. Firstly, five key assessment indicators affecting illegal wildlife trade are identified: regulatory enforcement capacity, financial support level, human resource level, technological innovation and international cooperation experience. Then, potential customers were evaluated and analysed using the entropy weighted TOPSIS method. By standardising the data and calculating the composite score, national wildlife management agencies were finally identified as the best users. In addition, the U.S. Fish and Wildlife Service (USFWS) was selected as a specific potential cooperation target due to its significant achievements in law enforcement, international cooperation, and wildlife conservation.

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