Client assessment and selection model based on the analytic hierarchy process approach: Global Monitoring of Illegal Wildlife Trade project

Yuan Hong [*, #], Yi Lou [#]

School of Management Science and Engineering, Nanjing University of Information Science & Technology, Nanjing, China, 210044

* Corresponding Author Email: 202113630031@nuist.edu.cn

#These authors contributed equally.

Abstract. Illegal wildlife trade on a global scale poses a serious threat to ecosystems and the environment, as well as risk challenges in the areas of finance and insurance. This study proposes a data-driven project based on a comprehensive understanding of trends in illegal trade and effective measures to reduce its scale. Through in-depth analysis of historical data, implementation of a continuous monitoring and tracking system, and collection of relevant data for continuous assessment, we are able to more accurately identify illegal trade behavior. Using data analysis techniques, such as time series analysis and GIS analysis, we will create visualization reports to provide a scientific basis for relevant decision makers. This study also selected the most suitable partner to facilitate the successful implementation of the project through a tiered analysis process. Ultimately, we identified an authoritative, well-resourced target client with a deep interest in ecological conservation, providing a solution to the challenges of illegal trade in the financial and insurance sectors.

Keywords: Illegal trade monitoring, analytical hierarchy approach, United Nations Environment Programme (UNEP).

1. Introduction

The protection of the environment and ecosystems is an increasingly important issue in today's globalized finance and insurance sectors. Illegal trade on a global scale not only poses a huge threat to wildlife, but also poses significant risks and challenges to the finance and insurance industries. The scale of the illegal trade in wildlife is estimated to be as high as US$26.5 billion per year, making it the fourth largest illegal trade activity globally. In the face of this continuously growing problem, how to effectively monitor and analyze illegal trade activities through a data-driven approach has become one of the focuses of attention in the finance and insurance sectors [1-3].

To address this challenge, this study proposes a project based on data analysis that aims to provide a comprehensive understanding of the trends in illegal trade activities and to take effective measures to reduce the scale of this illegal trade. Through in-depth analysis of historical data related to illegal wildlife trade, implementation of a continuous monitoring and tracking system, and collection of relevant data for continuous assessment, we will be able to more accurately identify illegal trade behaviors and take timely measures to combat criminal behavior. Through data analysis techniques, such as time-series analysis and geographic information system (GIS) analysis, we will create visualization reports to comprehensively investigate the patterns and trends of illicit trade and provide a scientific basis for relevant policymakers [4].

However, to achieve the goals of this project, we urgently need a partner with authority, resources, and an interest in ecological conservation. This partner will play a key role in policy development and implementation, have adequate financial support, and have a deep understanding of biodiversity issues. Therefore, choosing a most suitable target client becomes a crucial part of the process [5-6]. Through the in-depth discussion and analysis in this study, we hope to provide professionals in the finance and insurance fields with a fresh way of thinking and approaching this global challenge [7].

2. Client Evaluation and Selection Model

2.1. Project Introduction

Globally, the illicit trade in wildlife and plants poses a significant threat to our invaluable biodiversity, exerting a detrimental impact on the environment. Current estimates indicate that the annual illegal trade in wildlife and plants reaches staggering amounts, reaching up to $26.5 billion, ranking it as the fourth-largest illegal trade globally. In response to this pressing challenge, we propose a data-driven initiative designed to achieve a comprehensive understanding of trade trends. This involves conducting in-depth analyses of historical data related to illegal wildlife trade, implementing continuous monitoring and tracking systems for wildlife involved in illicit trade, and collecting relevant data for ongoing assessment. Furthermore, the project aims to implement effective measures aimed at reducing the scale of this illegal trade [8-10].

●**Project Objectives**

Our goal is to promptly identify illegal wildlife trade through a 5-year project plan, thereby precisely intercepting trade operations and combating criminals, leading to a significant reduction in the scale of illegal wildlife trade.

●**Project Plan**

By utilizing data analysis techniques, including time series analysis and Geographic Information System (GIS) analysis, we will create visual reports to thoroughly investigate the patterns and trends of illegal trade, providing scientific evidence for relevant decision-makers.

●**Project Status**

To drive the plan to reduce illegal wildlife trade, we urgently require the support of a target client with authority, resources, and an interest in ecological conservation. An ideal partner will play a pivotal role in policy-making and enforcement, have financial backing, and possess a deep understanding of biodiversity issues. We look forward to joining forces with such a client to jointly implement a data-driven project, establishing a global monitoring and control mechanism for illegal wildlife trade, and making a positive contribution to the sustainable development of the global ecosystem.

2.2. Evaluating Potential Clients

Among the numerous potential target clients, we urgently need to select the most suitable partner to support the smooth implementation of the plan. Given that the project takes a global perspective on wildlife conservation, we require potential target clients to play a key role in global policy-making and enforcement, have sufficient financial strength, and possess a deep understanding of biodiversity issues. To achieve this goal, we employ the Analytic Hierarchy Process (AHP) model to comprehensively evaluate various potential clients and ultimately determine the optimal partner.

Step1: Defining Decision Objectives and Evaluation Criteria

We will select the best target client as the decision objective. To ensure the selection of the optimal target client, we will consider the following factors comprehensively:

●Powers: The potential client's ability to promote international conservation policies, cooperative initiatives, and resource allocation.

●Resources: The material and immaterial assets possessed, including financial funds, technical equipment, professional knowledge, talent teams and international partnership relationships.

●Interest: The potential client's interest and commitment to the cause of wildlife conservation.

Step2: Selecting Potential Clients

To drive the implementation of the project on a global scale, we will focus on the following potential clients:

●Intergovernmental Organizations: Primarily the United Nations Environment Programme (UNEP), which is a leading institution in the global environmental field.

●International Environmental Conservation Organizations: Such as the World Wide Fund for Nature (WWF) or the International Union for Conservation of Nature (IUCN).

●International Trade Regulatory Bodies: Such as the wildlife trade regulatory body under the World Trade Organization (WTO), or the enforcement agency of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

●National Wildlife Management Agencies: Mainly referring to the wildlife conservation departments of national governments, such as the United States Fish and Wildlife Service (USFWS).

Step3: Establishing a Hierarchy

The target client selection issue is constructed into a hierarchical structure (as shown in Figure 1), with the target layer being the decision objective, which is to select the best client; the criterion layer consists of the evaluation criteria; and the scheme layer comprises the potential clients available for selection.

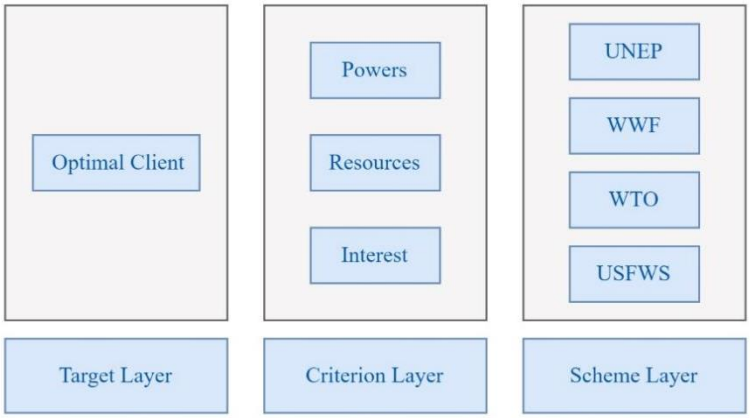

Figure 1. AHP model graph.

Step4: Constructing Pairwise Comparison Matrices to Calculate Weights

Assume that $C_1, \ldots, C_m$ represent criteria for decision-making, and $W = (w_1, \ldots, w_m)^T$ is the normalized weight vector determined through pairwise comparisons, satisfying the normalization condition:

$$\sum_{j=1}^{m} w_j = 1, \ (w_j \geq 0, \ j = 1, \ldots, m) \tag{1}$$

Table 1. The 1–9 scales for pairwise comparisons in the AHP.

Importance intensity	Definition
1	Equal importance
3	Moderate importance
5	Strong importance
7	Very strong importance
9	Extreme importance
2,4,6,8	Intermediate values
Reciprocals	Reciprocals for inverse comparison

Table 1 presents the 9-point importance scale proposed by Saaty and their corresponding definitions. By using this importance scale, we can conduct pairwise comparisons of the decision criteria, and the results of these pairwise comparisons are then used to construct a matrix known as a judgment matrix or pairwise comparison matrix. The matrix is defined as follows:

$$A = (a_{ij})_{m \times m} = \begin{matrix} C_1 \\ C_2 \\ \vdots \\ C_m \end{matrix} \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1m} \\ a_{21} & a_{22} & \cdots & a_{2m} \\ \vdots & \vdots & \cdots & \vdots \\ a_{m1} & a_{m2} & \cdots & a_{mm} \end{bmatrix} \tag{2}$$

Where a_{ij} represents the result of the importance comparison between decision criteria w_i and w_j, satisfying the characteristics $a_{ij}=1$ and $a_{ij}=1/a_{ji}$. For the weight vector w, it can be determined by solving the following characteristic equation:

$$AW=\lambda_{\max}W \tag{3}$$

$\lambda_{\max}$ Represents the largest eigenvalue of the pairwise comparison matrix A referencing the steps mentioned above, we have constructed a 3×3 comparison matrix A by individually comparing the importance of the three decision criteria: power, resources, and interest. The matrix A is shown as follows:

$$A=\begin{bmatrix} 1 & 3 & 5 \\ 0.333 & 1 & 4 \\ 0.2 & 0.25 & 1 \end{bmatrix} \tag{4}$$

The weights of the three indicators are: $0.6267, 0.27969, 0.09362$ the maximum eigenvalue $\lambda_{\max}=2.466$

Using the same method, we compared the importance of intergovernmental organizations, international environmental conservation organizations, international trade regulatory bodies, and national wildlife management agencies under the three criteria, constructing three comparison matrices and obtaining the results as shown in Table 2.

Table 2. Weights of Alternatives under Three Criteria.

Node Item	Intergovernmental Organizations	International Conservation Organizations	International Trade Organizations	National-Level Animal Protection Organizations
Powers	0.544	0.216	0.164	0.075
Interest	0.275	0.463	0.085	0.176
Resources	0.529	0.269	0.134	0.068

Step5: Consistency Test

To ensure the consistency among the importance of each element, we need to perform a consistency test on the pairwise comparison matrices. We use CR index to test each matrix:

$$CR=\frac{CI}{RI} \tag{5}$$

$$CI=(\lambda_{\max}-n)/(n-1) \tag{6}$$

$\lambda_{\max}$ The largest eigenvalue of the matrix, and n is the order of the matrix. A lower CI indicates better consistency in the matrix. RI is dependent on the order of the comparison matrix; generally, as the order of the pairwise comparison matrix increases, the likelihood of random consistency error also increases, as shown in Table 3.

Table 3. Random inconsistency index for pairwise comparison matrices.

n	1	2	3	4	5	6	7	8	9	10
RI	0.00	0.00	0.90	0.58	1.12	1.24	1.32	1.41	1.45	1.49

After calculation, we obtained CI values for the constructed matrices of $0.082, 0.061, 0.068, 0.033$, all of which are less than 0.1, and therefore, and they all pass the consistency test.

Step6: Final Ranking

Once the weights of the decision criteria and the weights of each alternative under each criterion have been determined through the pairwise comparison matrices, we can use the Simple Additive

Weighting (SAW) method to determine the overall weight (or priority) of each alternative relative to the decision objective:

$$w_{A_i} = \sum_{j=1}^{m} w_{ij} w_j, \qquad i = 1, \ldots, n \tag{7}$$

Where w_j represents the weight of the decision criterion, w_{ij} represents the weight of alternative i under criterion j, and w_{A_i} represents the overall weight of the alternative relative to the decision objective. Using these overall weights, a priority ranking of the alternatives can be established, thereby selecting the optimal alternative. The alternative with the highest overall weight is considered the best choice.

By calculating the SAW, we determined the overall weights for the four alternative options: intergovernmental organizations, international environmental conservation organizations, international trade regulatory bodies, and national wildlife management agencies: 0.515, 0.254, 0.149, and 0.08.

2.3. Identifying the Optimal Client

We comprehensively considered the three criteria of power, resources, and interest, and through the construction of an AHP hierarchical structure model, we evaluated the four potential clients. The evaluation results showed that the overall weights for the four alternative options—intergovernmental organizations, international environmental conservation organizations, international trade regulatory bodies, and national wildlife management agencies—were 0.515, 0.254, 0.419, and 0.083. Therefore, the best client for the project is an intergovernmental organization, specifically, we choose the United Nations Environment Programme (UNEP) as the best target client for the project.

Under our project, what can UNEP realistically do?

●Power: As the leading institution in the environmental field of the United Nations, UNEP has an authoritative position in setting environmental policies and driving the international environmental agenda. In terms of project promotion, UNEP can make full use of its authoritative reputation, guide more countries and stakeholders to support and join our project through extensive publicity and promotion, and promote the expansion and sustainable development of the project. With its global influence, it can lead to greater protective effects for the project on a global scale.

●Resources: As a leading institution in the global environmental field, UNEP has abundant resources, including financial support, professional talent, scientific research institutions, and so on. Considering that our project requires global data on illegal wildlife trade, UNEP can provide advanced data science technology to more accurately detect and predict illegal trading behaviors. In addition, UNEP can dispatch professional teams to support the implementation of the project, including ecologists, data scientists, wildlife experts, and others, to provide all-round technical and professional support for the project.

●Interest: UNEP is committed to promoting the sustainable development of the global environment and has a deep interest and commitment to the sustainable development of our wildlife conservation project. During the design, implementation, and continuous development stages of the project, UNEP will continue to provide comprehensive support to ensure that the project achieves effective results in practice and promotes the future sustainability of the project.

3. Conclusions

Through this study, we developed a data-driven model based on a program designed to reduce the scale of the illegal wildlife trade. We selected an authoritative, resourceful target client with a deep interest in ecological conservation to provide the basis for a successful project. By thoroughly evaluating and selecting potential clients, we provided a promising solution for the financial and insurance sectors. In addition, using a tiered analysis approach, we have effectively identified the best

partners, providing a solid foundation for successful project implementation. Through this project, we will provide valuable support for the protection of ecosystems and the environment, and offer a viable engagement opportunity for the finance and insurance sectors to work together to address the challenges posed by illegal trade.

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