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# NATIONAL WAQF-BASED FOREST INDEX: TOWARDS ENVIRONMENTAL SUSTAINABILITY AND COMMUNITY EMPOWERMENT THROUGH SHARIA FINANCIAL INNOVATION

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**ABSTRACT**

Currently, the existing concepts of waqf management and forest management are still separated. It creates an opportunity to develop the concept of waqf-based forest management. This study aims to develop a National Waqf-based Forest Index (NWFI) as a standardized tool to measure the performance of waqf-based forest management practices. This research is a quantitative study that began with preliminary research and was followed by interviews with seven experts using the Analytical Hierarchy Process (AHP). Based on preliminary research, the index comprises five dimensions: institution (with three aspects), process (with three aspects), system (with three aspects), outcome (with twelve aspects), and impact (with three aspects). It is found in the AHP analysis that the institution and process dimension is considered the most important aspect for waqf-based forests, with an importance score of 0.227, followed by the system and impact dimension (0.197), and the outcome dimension (0.152). Based on the consistency rate, all experts' assessments were consistent. Regarding rater agreement, the outcome dimension and several indicators related to the environment and social facilities achieved the highest level of agreement (W ~0.400–0.500), whereas other dimensions and aspects, such as expert opinions, showed significant dispersion. In conclusion, this waqf-based forest index has the potential to strengthen the role of Islamic finance in supporting sustainable projects by providing the basic practical tool for the waqf-based forest nazhir and policy-makers to

assess waqf-based forest management and construct future good nazhir governance. Further research and pilot projects are important to evaluate its effectiveness in measuring waqf-based forest management practically.

## INTRODUCTION

A waqf-based forest, in the context of Islamic economics and finance, is a natural asset that is endowed to utilize forest products for the public good, which has a great potential to support environmental conservation and community empowerment (K. Ali & Kassim, 2020; Candra et al., 2024; K.M. Ali & Kassim, 2021). Waqf-based forests play a role in balancing the utilization of natural resources that incorporates social, economic, and ecological values in line with Islamic teachings (Jannah et al., 2021; Restiyani et al., 2023; Sup, 2021; Umam et al., 2024). In Indonesia, the practice of waqf-based forest management continues to develop. It began with development practices in Aceh in 2012, followed by Bogor in 2018, Mojokerto in 2021 (K. Ali & Jannah, 2024), and Gunung Sindur in 2025. Furthermore, a roadshow for the development of forest waqf and waqf-based forests was held by the Ministry of Religion, along with a focus group discussion, resulting in several agreements on the development of waqf-based forests in Indonesia (BWI.go.id, 2025). Based on the results of the FGD, it is known that the area of waqf-based forests in Indonesia has reached 68 ha, and has the potential to expand to more than 7000 ha (Ichsan, 2025). One of the important points of the agreement is the roadmap for the national waqf-based forests development, including the preparation of initial principles and guidelines for good nazhir governance (GNG) and standardization of waqf-based forest governance throughout Indonesia.

Forest management has long been the main approach to forest resource management in many countries (MacDicken et al., 2015). It encompasses a range of practices, such as reforestation (Wang et al., 2025), maintenance of forests to increase carbon sequestration (Sevillano et al., 2025), and the use of advanced technologies for forest monitoring and protection (Sidiq, 2021). There are some standards in forest management, for example, the international forest management standard created by the Sustainable Forestry Initiative (SFI, 2022) and the national (Indonesian) standard for sustainable forest management (IFCC, 2014, 2021). In line with this, various recent studies have also revealed the significant role of spiritual/religious values in forest management (de Pater et al., 2023; Roux et al., 2022). Waqf management, on the other hand, is a concept in Islamic economics and finance that governs how waqf should be managed for public benefit (Hassan et al., 2018). Waqf management involves the management of endowed assets, such as land, buildings, and forests, intending to

distribute their benefits to needy groups (*mauquf 'alaih*), such as people experiencing poverty and orphans (Jannah et al., 2020; Restiyani et al., 2023). Waqf-based forests served as one example of environmental waqf. It promotes sustainable development and the enforcement of intergenerational justice (Setyorini et al., 2020), and it also contributes to forest conservation and SDGS (K. Ali & Kassim, 2020).

Nowadays, the waqf-based forest research continues, including its development using SWOT-ANP method (K. M. Ali & Kassim, 2021), its agroforestry practices (Jannah et al., 2021) the brand equity analysis (Firmannudin et al., 2024), its social innovation and the benefits obtained (Candra et al., 2024; Firdaus & Prasetiyo, 2024; Firdaus & Wahyudi, 2024), selection of waqf-based forest locations (Jannah, Sarkawi, & Othman, 2024), and waqf-based forest management strategies (Jannah, Sarkawi, Othman, et al., 2024; Nur & Irfany, 2024; Restiyani et al., 2023; Umam et al., 2024). Despite the rapid development of waqf-based forests in Indonesia and the growing focus on waqf-based forest research, there remains a significant gap in a measurable framework to assess the performance of waqf-based forests by integrating the concepts of waqf management and forest management. Therefore, this study aims to develop a National Waqf-based Forest Index as a standardized tool to measure the performance of waqf-based forest management practices. A sustainable waqf-based forest index, grounded in sharia principles, has the potential to enhance the role of Islamic finance in supporting environmentally and socially sustainable projects. This research will attempt to fill the knowledge gap and make an important contribution to sustainability and empowerment through the concept of an innovative Waqf-based Forest Index.

## LITERATURE REVIEW

### 1. Forest Management and Index

Sustainable forest management (SFM) is the management and utilization of forests, including maintaining biodiversity, productivity levels, regeneration capacity, forest vitality, and potential for current and future needs, as well as other relevant ecological, economic, and social needs at every level for all human beings without harming other ecosystems (Borland et al., 2016; Brockerhoff et al., 2017; Siry et al., 2018). To support the implementation of SFM, the United Nations Conference on Environment and Development (UNCED) developed the Montréal Process Framework of C&I (MPC&I) to measure, monitor, and report progress towards SFM based on ecological, economic, and social dimensions in seven criteria and 54 specific indicators (Canadian Forest Service, 2015). In Indonesia, the IFCC (Indonesian Forestry Certification Cooperation) promotes a sustainable forest management standard based on various international frameworks, including the ITTO (International Tropical Timber Organization) and PEFC (Programme for the Endorsement of Forest Certification) Council, which incorporates the concept of continuous improvement (IFCC, 2021). In terms of

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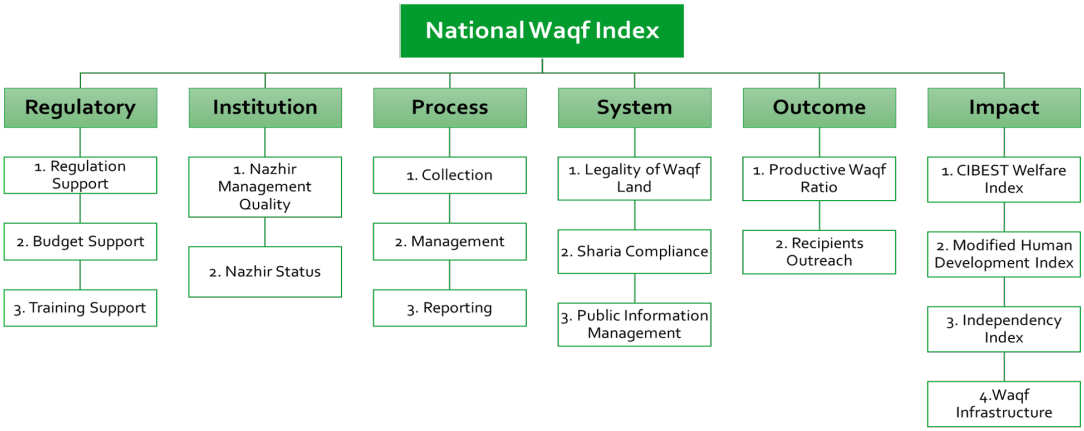
operations, there are seven criteria for SFM requirements, covering forest health, biodiversity, contribution to carbon and climate change mitigation, and also some socio-economic functions (IFCC, 2021). Although frameworks such as the Montréal Process and the IFCC standards have addressed the ecological, social, and economic dimensions of forest management, there are still many things that need to be improved. One issue is the lack of serious attention to forest management, which is based on religious values that strengthen ethical and spiritual commitments to preserving nature. Forest resource management based on religious teachings such as Islam, which places tauhid, amanah, and istikhlaf (sustainability) as its main principles, has not been accommodated explicitly in the existing forest management framework. This shortcoming indicates the need for a more holistic approach, incorporating a religious dimension as an integral part of forest management policies and practices.

## 2. Waqf Management and Index

Waqf management is important for the sustainability of waqf assets, especially in maintaining and increasing value through sound asset management principles. If waqf assets are not properly maintained, the results will not contribute much to the benefit of society (Jannah et al., 2024). The inefficiency of waqf management and maintenance is due to 1) inadequate funding; 2) suboptimal performance of waqf managers; 3) unregistered or uncertified waqf land; 4) outdated data; and 5) seizure of property rights by heirs (Abas & Raji, 2018). In Indonesia, waqf is regulated by several regulations, including Law No. 41 of 2004 concerning Waqf, Government Regulation No. 42 of 2006 concerning Waqf, BWI Regulation No. 1 of 2020 concerning Guidelines for the Management and Development of Waqf Property, and other regulations. Although waqf in Indonesia has shown good progress, things such as increasing waqf awareness and government support, accelerating waqf certification, improving nazhir management, and digitization and data integration must be pursued to improve waqf performance. Thus, waqf performance measurement is very crucial to ensure that the nazhir is properly responsible and accountable in managing waqf institutions (Noordin et al., 2017). The National Waqf Index (IWN), which was launched in 2020, is used as a standardized measurement tool that can serve as a reference for national waqf performance (Figure 1) (BWI, 2022; Lestari et al., 2023). In IWN, six dimensions measure waqf performance, namely regulation, institution, process, system, outcome, and impact. This index includes waqf and religious matters that have not been included in the previous forest management. Therefore, the integration of IFCC, MPC&I, and IWN is an important basis for the formulation of the National Waqf-based Forest Index.




Source: (Lestari et al., 2023)

Figure 1. National Waqf Index (IWN) Scheme

## 3. National Waqf-based Forest Index

According to the IWN scheme, six dimensions comprehensively cover all the important aspects for maintaining the national waqf performance: Regulatory, Institution, Process, System, Outcome, and Impact. However, this IWN index includes assessments for government regulations related to waqf in that province, such as Governor Decrees, whereas the National Waqf-based Forest Index only assesses the nazhir/waqf manager, without involving any government regulation. Therefore, the Regulatory dimension is not included in the National Waqf-based Forest Index. The rest of the dimensions are based on the IFCC, MPC&I, IWN, and the in-depth interview results in the preliminary research, with the study and application limited only to the waqf-based forest area in Indonesia, which are listed below:

### a. Institutional Dimension

The institutional dimension reflects factors related to the institutional condition of the waqf-based forest manager (nazhir). The aspects of the institutional dimension are legality, responsibility, commitment, and resources. The legal aspect relates to the waqf land ownership's legal status based on applicable laws and regulations, namely the waqf pledge deed (AIW) and a waqf land certificate, to formalize the ownership transfer as a basis for the nazhir to manage the land. (BWI, 2022; Jannah, Sarkawi, & Othman, 2024; Zain et al., 2019). The second aspect of the institutional dimension is commitment and responsibility, related to organizational structure, vision and mission, financial statements, and annual allocation to collection ratio percentage to reflect their responsibility to achieve sustainable forest management goals (IFCC, 2021). However, nazhir's competence in waqf institutions is often inadequate, both in terms of knowledge and expertise (Umar & Aliyu, 2019; Yumarni, 2019; Astuti & Tanjung, 2019). Thus, the resource aspect includes human resources aspects; nazhir certification, full-time HR as supervisors, managing waqf assets, and for research and development, to address this problem.

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**b. Process Dimension**

The process dimension is a factor related to the business process of waqf practices. The limitation of waqf funds is due to inadequate waqf fund collection activities (K. M. Ali & Kassim, 2021). Therefore, there needs to be a strategy to intensify the collection of waqf funds, one of which is by having a waqf asset collection partner (Tanjung et al., 2022). One of the examples of green financing is Green Sukuk and Sustainability Sukuk, issued by IsDB for funds allocated to green and social projects (IsDB, 2019). According to Restiyani et al. (2023), in implementing a waqf management plan, several things need to be prepared, such as a long-term program plan or strategic plan and a long-term budget for the strategic plan. A strategic plan is a more detailed document that describes the objectives, programs, and activities to be implemented (Fahmi et al., 2022). Besides, the routine meetings for monitoring and evaluation for the team are also crucial to ensure the progress of each process (Agita & Anwar, 2021).

**c. System Dimension**

The system dimension relates to aspects that are not directly related to the waqf business process but are important to support it, such as the availability of standards and SOPs, information and data systems, and risk management (BWI, 2022). The effectiveness of the SOP is evident in its consistent implementation of indicators, serving as a coordination and communication tool, as well as a protective measure in the event of adverse incidents affecting the institution (Khaya & Warsito, 2024). The establishment of a centralized national waqf database will significantly improve the efficiency and effectiveness of waqf operations and administration, enhancing integrity and transparency within the system (Mahomed et al., 2023). Waqf assets, especially land, can be at risk of being lost due to legal issues, such as ownership claims by other parties or administrative problems related to land status (Jalil, 2020; Syarief, 2021). Therefore, risk management is necessary to minimize these issues, for example, by ensuring that waqf land registration and certification are carried out correctly and are legally valid.

**d. Outcome Dimension**

The outcomes of waqf-based forests encompass various benefits that can be derived, both directly and indirectly, including environmental, economic, and social aspects. Waqf-based forests must remain forests, so the land must be dominated by trees (K. M. Ali & Kassim, 2021; Jannah, Sarkawi, Othman, et al., 2024). Strategic management is needed to address ecological risks, such as in areas prone to landslides or erosion, and even mitigation for forest fires (Nur & Irfany, 2024). Waqf-based forests have great potential to support SDG 6, which relates to biodiversity, mainly if managed sustainably with consideration for nature conservation and the principles of healthy ecosystems (K. Ali & Kassim, 2020; Yaakob et al., 2017). For the land itself, forests can enhance soil fertility, and the use of organic materials, such as fertilizers and pesticides, plays a crucial role in enhancing forest vitality (de Urzedo et al., 2013).

Community economic empowerment in waqf-based forests can be carried out through various activities based on the sustainable use of natural resources, and supported by access and facilities (Jannah, Sarkawi, Othman, et al., 2024). Waqf-based forests are closely tied to the social life of the surrounding community, as the main *mauquf'alaih* (beneficiaries). As previously explained, waqf-based forests not only provide ecological and economic benefits but also social benefits. One of these social benefits is reflected in the presence of facilities for public open interaction spaces (BAZNAS, 2017; Rochani et al., 2022).

**e. Impact Dimension**

This factor is intended to measure the impact of waqf programs on the well-being of the community and the extent of social and religious services provided through waqf (BWI, 2022). The management of waqf-based forests not only requires a good technical and managerial approach but also must be supported by facilities and support systems that can facilitate the sustainability and success of forest management, both from religious and environmental perspectives, accompanied with the participation of the local community in various activities (Jannah, Sarkawi, Othman, et al., 2024; Cokrohadisumarto & Sari, 2024). This governance shows that waqf-based forests have the potential to become centres for sustainable community empowerment.

## RESEARCH METHODS

### 1. Preliminary Research

This research was conducted from January to July 2024, preceded by a literature review and an in-depth interview as preliminary research. The preliminary research was conducted during January-February 2024. The literature review was taken from journals, books, and other related documents. Meanwhile, in-depth interviews were conducted with five experts from various fields (regulators, practitioners, and academics) as part of the preliminary research (Table 1) to gather deeper information and insights for compiling the national waqf-based forest index.

Table 1. Experts' list, institution, and participation in the research

| No | Initial | Role | Institution and Position | Experience in Waqf/Forest Issues (Year) | Participation Stage | |
|---|---|---|---|---|---|---|
| | | | | | Preliminary | AHP |
| 1 | KSL | Academics | Lecturer of Economics and Environmental Resources, Faculty of Economics and Management, IPB University | 7 | V | |

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| | | | | | | |
|---|---|---|---|---|---|---|
| 2 | SSW | Practitioner | Member of the Center of Environmental and Natural Resources Institute (LPLH-SDA), Indonesian Ulama Council (MUI), and Head of Public Relations and Cooperation of APHI | 9 | V | V |
| 3 | FMM | Academics | Dean of Agriculture and Biology Faculty, National University | 20 | V | V |
| 4 | HSP | Regulator | Head of the Center of Environmental and Natural Resources Institute (LPLH-SDA), Indonesian Ulema Council (MUI) | 15 | V | V |
| 5 | AGS | Practitioner | Chief of YPM Mojokerto Waqf-based Forest | 18 | V | V |
| 6 | LDA | Academics | Lecturer in Islamic Economics, IPB University | 20 | | V |
| 7 | FNS | Regulator | Member of the Ministry of Religious Affairs | 8 | | V |
| 8 | EMH | Regulator | Commissioner of the National Waqf Board (Badan Wakaf Indonesia/BWI) | 17 | | V |

**2. Data Collection**

In this study, data collection is the next step after the National Waqf-based Forest Index AHP scheme has been formulated. This method involves conducting interviews and completing an AHP questionnaire by seven predetermined experts. These seven experts come from various fields of expertise: regulators, academics, and practitioners (Table 1). This number is larger than the number of experts involved in the preliminary study, allowing for more comprehensive input. The purpose of data collection is to obtain expert opinions on the importance level of each dimension, aspect, and indicator of the National Waqf-based Forest for further analysis.

According to Saaty and Vargas (2006), there is no minimum number of expert respondents in the AHP method. Sample size can vary depending on the complexity and needs of the study. The seven experts compared the level of importance of each level of the scheme using the pairwise comparison technique, giving a value of 1-9. Pairwise comparison is the core of decision-making with the AHP method, and is highly dependent on the consistency of the experts (Emrouznejad & Marra, 2017). Therefore, the base-criterion method is used in the AHP questionnaire to minimize inconsistency and prevent bias, so that experts only assess the importance of each criterion against one basic criterion (Haseli et al., 2019).

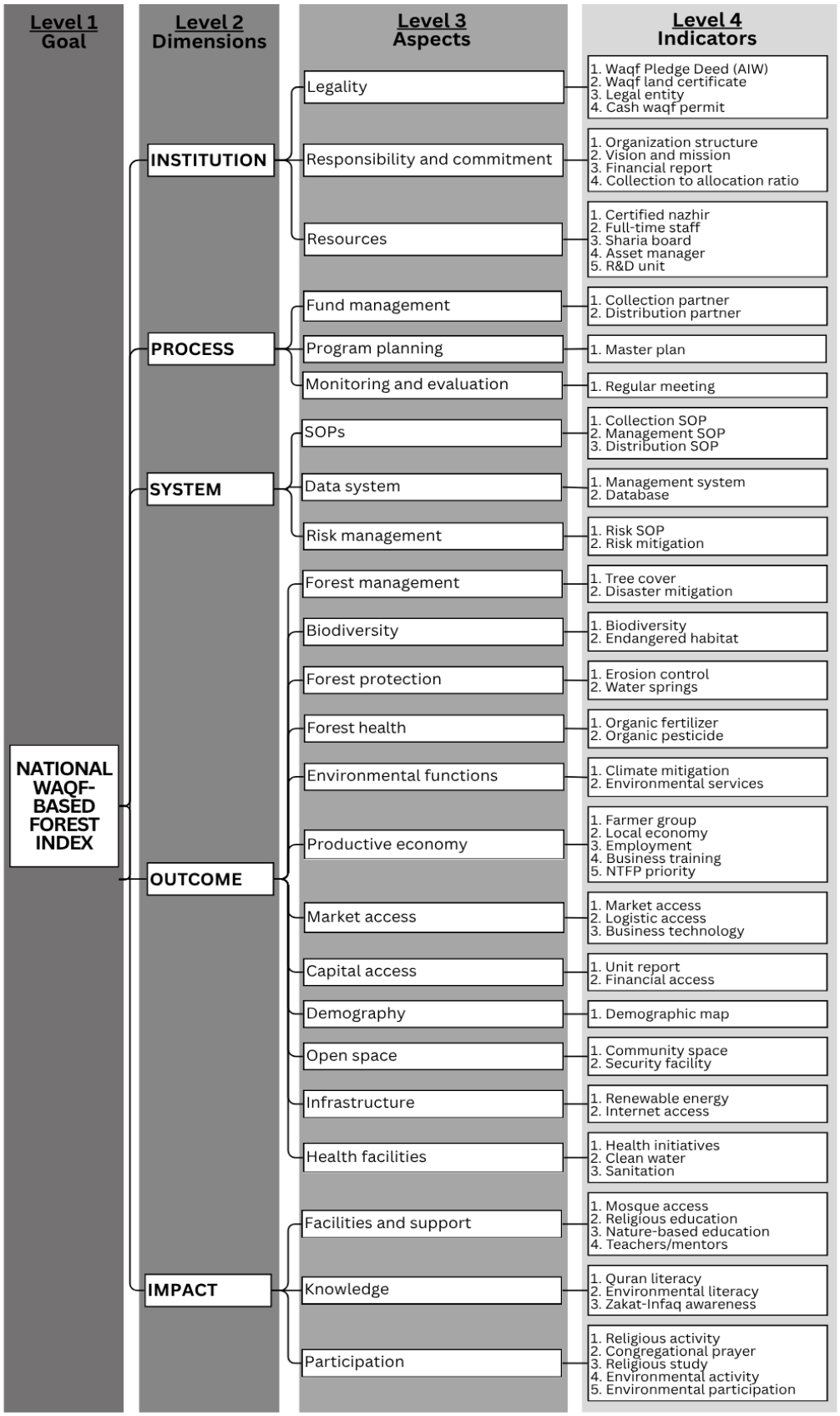


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Figure 2. National Waqf-based Forest Index AHP scheme

**3. Data Analysis**

The Analytical Hierarchy Process (AHP) method was used to score the importance of each dimension, aspect, and indicator of the national waqf-based forests (Figure 2). The following is a brief explanation of the AHP steps, which were carried out using SuperDecision software and MS Excel. The research team obtained priority values for each component of the National Waqf-based Forest Index, along with the rater agreement (W) and p-value for measuring the consensus and its significance.

a. The pairwise comparison data based on every expert's judgment were processed using Super Decisions 2.10 software to determine their priority and consistency. Expert opinions are declared consistent if the consistency ratio is below 0.1 and inconsistent if it is above 0.1, so the pairwise comparison assessment must be repeated.
b. After ensuring that each expert's assessment is consistent based on the SuperDecision software, the next step is to calculate the Geometric Mean. The goal of this calculation is to reach a consensus or a single opinion from a set of numerical values generated by each expert through previous pairwise comparisons. The geometric mean is the most common way to combine the opinions of several experts into one unit (Grošelj & Dolinar, 2023; Saaty & Vargas, 2006). The geometric mean value is obtained by entering all raw comparison data from the questionnaire into Microsoft Excel, marking it with different colors (red and black), then inverting the numbers with specific colors that have a smaller amount of data in each column. From the results of the inverse, the geometric mean value can be calculated by entering the geometric mean formula in Microsoft Excel. The following is the Geometric Mean calculation formula to get the average weight of all experts.

$$GM_k = (R_1 * R_2 \ldots R_n)^{1/n}$$

where: $GM_k$ = Geometric Mean of the dataset
$R_1 \ldots R_n$ = individual values in the dataset
n = total number of values in the dataset

The geometric mean calculation is applied to all dimensions, aspects, and indicators of the National Waqf-based Forest Index. The final priority score obtained in SuperDecision after inputting the Geometric Mean value becomes the final weighting score for each dimension, aspect, and indicator. The total weighting for each dimension, aspect, and indicator is 1.

c. After obtaining the geometric mean value from each comparison, the number is re-entered into SuperDecision to get a consensus on the importance value from all experts.

The Consistency Ratio (CR/inconsistency) for every dimension is less than 0.1 (CR < 0.1), so it can be concluded that the preferences of experts or decision makers in comparing various criteria or alternatives are acceptable and do not show any significant inconsistencies.

d. Even though it is not strictly necessary to calculate rater agreement in AHP, this stage is still carried out to identify the levels that have different views from each expert. (Ascarya et al, 2022). To determine the level of expert agreement within each cluster, Rater Agreement was calculated using Kendall's Coefficient of Concordance (W). The range of values used is 0 < W < 1, where 0 (zero) means no agreement and 1 (one) means perfect agreement. The calculation was performed by transposing the research data into MS Excel and calculating the W value as follows:

$$W = \frac{12\,S}{m^2(n^3-n)}$$

where:
- m = number of experts
- **n** = number of objects or elements being ranked
- $S = \Sigma (Ri - \bar{R})^2$ = the sum of squared deviations of each object's total rank from the average total rank
- $Ri = \Sigma rij$ = the total rank of object i given by all raters
- $\bar{R} = (1/n)\,\Sigma Ri$ = the average of all total ranks across objects

e. Then, to determine the significance of the rater agreement value, a p-value calculation is performed to ensure that the agreement is not a coincidence. If the p-value is < 0.05, the consensus is declared real and reliable. Conversely, if the p-value is > 0.05, the agreement is weak and may be random or coincidental. The p-value is calculated by converting the W value to the chi-square test statistic ($\chi^2$) in MS Excel, with degrees of freedom (df) = n-1, as follows:

$$\text{p-value} = P\left(\chi^2_{df=n-1} \geq \chi^2_{calculated}\right)$$

where:
- **p-value** = the probability that the chi-square statistic with $df = n - 1$ takes a value greater than or equal to the calculated test statistic
- $\chi^2$ = chi-square statistic
- (df) = n-1 = degrees of freedom, equal to the number of items being ranked minus 1

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n = number of objects or items being ranked

$\chi^2_{calculated}$ = the test statistic calculated from Kendall's W

**RESULT**

Using the Analytic Hierarchy Process (AHP) with seven experts in waqf management, forestry, and waqf-based forest nazhir as practitioners, it was established that the institutional and procedural dimensions were the most decisive focal points in constructing waqf-based forests, each carrying a relative weight of 0.227. In the case of the Institutional Dimension, Legality is the highest scored aspect (0.413), which indicates the importance of land registration and legal documentation in guaranteed and accountable forest endowment practices and legalistic frameworks. In the process dimension, fund management, program implementation, and evaluation were assigned equal importance (0.333) as well, which suggests that perception toward all procedural phases is uniformly related to the sustainability of the program.

The system dimension received a weight of 0.197 in the AHP results. This dimension includes indicators such as the existence of standard procedures for managing waqf-based forest assets and mechanisms for transparent distribution. Meanwhile, the outcome dimension was assigned the lowest score (0.152), which reflects its role as the result of a well-functioning institutional, procedural, and system framework. Indicators in this dimension include ecological outputs (e.g., biodiversity support and carbon absorption) as well as economic contributions to surrounding communities.

Lastly, the impact dimension was assigned a weight of 0.197. This dimension has indicators such as the availability of religious and environmental facilities, community knowledge on religion and environment, as well as community participation, which portray the social value of waqf-based forest for the local communities. A complete summary of AHP results is provided in Table 2. The important scores in Table 2 are highlighted with a green gradient color to indicate their level of importance in each dimension, aspect, and indicator. Darker green indicates higher levels of importance, while lighter green indicates lower levels of importance. If added up, each indicator, aspect, and dimension will have a total weight of 1,000.

Table 2. AHP results for the National Waqf-based Forest Index

| Dimension | Weight | Aspect | Weight | Indicator | Weight |
|---|---|---|---|---|---|
| Institution | 0.227 | Legality | 0.413 | Waqf Pledge Deed | 0.395 |
| | | | | Waqf land certificate | 0.239 |
| | | | | Legal entity | 0.198 |
| | | | | Cash waqf permit | 0.168 |
| | | | | Total weight | 1.000 |
| | | | 0.327 | Organization structure | 0.312 |

| Dimension | Weight | Aspect | Weight | Indicator | Weight |
|---|---|---|---|---|---|
| | | Responsibility and commitment | | Vision and mission | 0.280 |
| | | | | Financial report | 0.280 |
| | | | | Collection to allocation ratio | 0.127 |
| | | | | Total weight | 1.000 |
| | | Resources | 0.260 | Certified nazhir | 0.219 |
| | | | | Full-time staff | 0.258 |
| | | | | Sharia board | 0.194 |
| | | | | Asset manager | 0.219 |
| | | | | R&D unit | 0.110 |
| | | | | Total weight | 1.000 |
| | | Total weight | 1.000 | | |
| Process | 0.277 | Fund management | 0.333 | Collection partner | 0.667 |
| | | | | Distribution partner | 0.333 |
| | | | | Total weight | 1.000 |
| | | Program planning | 0.333 | Master plan | 1.000 |
| | | | | Total weight | 1.000 |
| | | Monitoring, evaluation | 0.333 | Regular meeting | 1.000 |
| | | | | Total weight | 1.000 |
| | | Total weight | 1.000 | | |
| System | 0.197 | SOPs | 0.333 | Collection SOP | 0.333 |
| | | | | Management SOP | 0.333 |
| | | | | Distribution SOP | 0.333 |
| | | | | Total weight | 1.000 |
| | | Data system | 0.333 | Management system | 0.667 |
| | | | | Database | 0.333 |
| | | | | Total weight | 1.000 |
| | | Risk management | 0.333 | Risk SOP | 0.500 |
| | | | | Risk mitigation | 0.500 |
| | | | | Total weight | 1.000 |
| | | Total weight | 1.000 | | |
| Outcome | 0.152 | Forest management | 0.152 | Tree cover | 0.667 |
| | | | | Disaster mitigation | 0.333 |
| | | | | Total weight | 1.000 |
| | | Biodiversity | 0.116 | Biodiversity | 0.500 |
| | | | | Endangered habitat | 0.500 |
| | | | | Total weight | 1.000 |
| | | Forest protection | 0.106 | Erosion control | 0.500 |

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| Dimension | Weight | Aspect | Weight | Indicator | Weight |
|---|---|---|---|---|---|
| | | | | Water springs | 0.500 |
| | | | | Total weight | 1.000 |
| | | Forest health | 0.110 | Organic fertilizer | 0.667 |
| | | | | Organic pesticide | 0.333 |
| | | | | Total weight | 1.000 |
| | | Environmental functions | 0.120 | Climate mitigation | 0.667 |
| | | | | Environmental services | 0.333 |
| | | | | Total weight | 1.000 |
| | | Productive economy | 0.098 | Farmer group | 0.227 |
| | | | | Local economy | 0.227 |
| | | | | Employment | 0.197 |
| | | | | Business training | 0.197 |
| | | | | NTFP priority | 0.152 |
| | | | | Total weight | 1.000 |
| | | Market access | 0.067 | Market access | 0.333 |
| | | | | Logistic access | 0.333 |
| | | | | Business technology | 0.333 |
| | | | | Total weight | 1.000 |
| | | Capital access | 0.067 | Unit report | 0.500 |
| | | | | Financial access | 0.500 |
| | | | | Total weight | 1.000 |
| | | Demography | 0.041 | Demographic map | 1.000 |
| | | | | Total weight | 1.000 |
| | | Open space | 0.050 | Community space | 0.500 |
| | | | | Security facility | 0.500 |
| | | | | Total weight | 1.000 |
| | | Infrastructure | 0.039 | Renewable energy | 0.500 |
| | | | | Internet access | 0.500 |
| | | | | Total weight | 1.000 |
| | | Health facilities | 0.035 | Health initiatives | 0.333 |
| | | | | Clean water | 0.333 |
| | | | | Sanitation | 0.333 |
| | | | | Total weight | 1.000 |
| | | Total weight | 1.000 | | |
| Impact | 0.197 | Facilities and support | 0.333 | Mosque access | 0.366 |
| | | | | Religious education | 0.278 |
| | | | | Nature-based education | 0.233 |
| | | | | Teachers/mentors | 0.124 |

| Dimension | Weight | Aspect | Weight | Indicator | Weight |
|---|---|---|---|---|---|
| | | | | Total weight | 1.000 |
| | | Knowledge | 0.333 | Qur'an literacy | 0.333 |
| | | | | Environmental literacy | 0.333 |
| | | | | Zakat-Infaq awareness | 0.333 |
| | | | | Total weight | 1.000 |
| | | Participation | 0.333 | Religious activity | 0.197 |
| | | | | Congregational prayer | 0.227 |
| | | | | Religious study | 0.227 |
| | | | | Environmental activity | 0.152 |
| | | | | Env. participation | 0.197 |
| | | | | Total weight | 1.000 |
| | | Total weight | 1.000 | | |
| Total weight | 1.000 | | | | |

Meanwhile, Table 3 shows the CR (consistency rate), W (rater agreement), and p-value of each element compared at one level. Based on the calculation results in Table 3, it can be seen that all CR values are below 0.1. The highest CR value was obtained by comparing aspects within the institutional dimension, specifically at 0.052. However, all these values indicate that the opinions of all experts are consistent. On the other hand, almost all comparisons have relatively low W values and high p-values. Of all the components compared, only a few components have a relatively high W value with a significant p-value at the 5% level, namely aspects in the outcome dimension (W = 0.496, p-value 0.000), indicators in the health facilities aspect (W = 0.435, p-value = 0.047), and indicators in the facilities and support aspect (W = 0.412, p-value = 0.034). Meanwhile, the indicator for the forest health aspect obtained a relatively high W value of 0.510, but it was not yet significant, with a p-value of 0.059. This evidence indicates differences in opinion among experts when assessing complex dimensions, aspects, and indicators.

Table 2. Consistency rate, rater agreement, and p-value from every comparison

| No | Level | Compared Elements | n | CR | W | p-value |
|---|---|---|---|---|---|---|
| 1 | Goal → Dimensions | Institution, Process, System, Outcome, Impact | 5 | 0.017 | 0.109 | 0.551 |
| 1.1 | Institution → Aspects | Legality, Responsibility and commitment, Resources | 3 | 0.052 | 0.143 | 0.368 |
| 1.2 | Process → Aspects | Fund management, Program planning, Monitoring-evaluation | 3 | 0.000 | 0.048 | 0.717 |

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| No | Level | Compared Elements | n | CR | W | p-value |
|---|---|---|---|---|---|---|
| 1.3 | System → Aspects | SOPs, Data system, Risk management | 3 | 0.000 | 0.027 | 0.827 |
| 1.4 | Outcome → Aspects | Forest management, Biodiversity, Forest protection, Forest health, Environmental functions, productive economy, Market access, Capital access, Demography, Open space, Infrastructure, Health facilities | 12 | 0.010 | 0.496 | 0.000* |
| 1.5 | Impact → Aspects | Facilities and support, Knowledge, Participation | 3 | 0.000 | 0.027 | 0.827 |
| 1.1.1 | Legality → Indicator | Waqf Pledge Deed, Waqf land certificate, Legal entity, Cash waqf permit | 4 | 0.023 | 0.253 | 0.150 |
| 1.1.2 | Responsibility and commitment → Indicator | Organization structure, Vision and mission, Financial report, Collection to allocation ratio | 4 | 0.008 | 0.321 | 0.080 |
| 1.1.3 | Resources → Indicator | Certified nazhir, Full-time staff, Sharia board, Asset manager, R&D unit | 5 | 0.013 | 0.198 | 0.235 |
| 1.2.1 | Fund management → Indicator | Collection partner, Distribution partner | 2 | 0.000 | 0.327 | 0.131 |
| 1.3.1 | SOPs → Indicator | Collection SOP, Management SOP, Distribution SOP | 3 | 0.000 | 0.088 | 0.538 |
| 1.3.2 | Data system → Indicator | Management system, Database | 2 | 0.000 | 0.184 | 0.257 |
| 1.3.3 | Risk management → Indicator | Risk SOP, Risk mitigation | 2 | 0.000 | 0.020 | 0.705 |
| 1.4.1 | Forest management → Indicator | Tree cover, Disaster mitigation | 2 | 0.000 | 0.184 | 0.257 |
| 1.4.2 | Biodiversity → Indicator | Biodiversity, Endangered habitat | 2 | 0.000 | 0.000 | 1.000 |
| 1.4.3 | Forest protection → Indicator | Erosion control, Water springs | 2 | 0.000 | 0.327 | 0.131 |
| 1.4.4 | Forest health → Indicator | Organic fertilizer, Organic pesticide | 2 | 0.000 | 0.510 | 0.059 |

| No | Level | Compared Elements | n | CR | W | p-value |
|---|---|---|---|---|---|---|
| 1.4.5 | Environmental functions → Indicator | Climate mitigation, Environmental services | 2 | 0.000 | 0.327 | 0.131 |
| 1.4.6 | Productive economy → Indicator | Farmer group, Local economy, Employment, Business training, NTFP priority | 5 | 0.017 | 0.100 | 0.590 |
| 1.4.7 | Market access → Indicator | Market access, Logistic access, Business technology | 3 | 0.000 | 0.088 | 0.538 |
| 1.4.8 | Capital access → Indicator | Unit report, Financial access | 2 | 0.000 | 0.184 | 0.257 |
| 1.4.10 | Open space → Indicator | Community space, Security facility | 2 | 0.000 | 0.082 | 0.450 |
| 1.4.11 | Infrastructure → Indicator | Renewable energy, Internet access | 2 | 0.000 | 0.082 | 0.450 |
| 1.4.12 | Health facilities → Indicator | Health initiatives, Clean water, Sanitation | 3 | 0.000 | 0.435 | 0.047* |
| 1.5.1 | Facilities and support → Indicator | Mosque access, Religious education, Nature-based education, Teachers/mentors | 4 | 0.017 | 0.412 | 0.034* |
| 1.5.2 | Knowledge → Indicator | Qur'an literacy, Environmental literacy, Zakat-Infaq awareness | 3 | 0.000 | 0.048 | 0.717 |
| 1.5.3 | Participation → Indicator | Religious activity, Congregational prayer, Religious study, Environmental activity, Environmental participation | 5 | 0.017 | 0.158 | 0.353 |

*significant at 5% level

## DISCUSSION

This research has successfully formulated a standard structure for the National Waqf-based Forest Index, consisting of the conceptual and methodological foundation of the index. The national waqf-based forest index consists of five dimensions, twenty-four aspects, and sixty-four indicators, each with its own weighting through AHP calculations. This compiled index is still normative and serves as a measure of the waqf-based forest nazhir performance. However, to calculate the actual work value of each waqf-based forest nazhir, a further weighting method is required for each indicator, for example, by using a Likert scale.

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Based on the AHP results, the most important things to be considered by nazhir at first time is the institutional dimension (weighted 0.277). In this dimension, the legality aspect, such as the existence of a Waqf Pledge Deed and BPN waqf land certificate, is important for the waqf-based forest to ensure its sustainability. This issue is aligned with Anwar (2020), who stated that a waqf land certificate proves ownership of a legality and legal force to the parties whose identities are mentioned, prevents disputes, and becomes strong evidence. The waqf-based forest management institution must also have a clear vision, mission, goals, and organizational structure, as mentioned in IFCC (2021). In addition, the existence of adequate human resources (both in terms of capability and quantity) is one of the keys to waqf-based forest institutions.

Having equal importance with the first dimension, the process dimension (weighted 0.277) indicated that the waqf-based forest management cannot be separated from the collection and distribution of waqf-based forest funds. The existence of partners who support these two activities ensures that the process of collecting and distributing waqf can run optimally. Accordingly, the management of waqf-based forests must be monitored and evaluated to measure their effectiveness and efficiency. This outcome aligns with the statement by Agita and Anwar (2021), which mentions that a routine control check has also been conducted for the management of waqf in Al-Azhar Waqf Foundation.

Experts consider the system dimension in the National Waqf-based Forest Index assessment to be quite important (weighted 0.197). This dimension encompasses the existence of standard operating procedures for every waqf-based forest nazhir activity, including the collection, management, and distribution of waqf proceeds. This conclusion aligns with Khaya & Warsito's (2024) statement regarding the effectiveness of organizations with SOPs. Furthermore, the existence of an integrated database and information system can also improve nazhir's performance. Furthermore, managing potential risks such as human resource loss, disasters, and loss of waqf assets is also a crucial aspect of nazhir preparation.

The impact dimension (weighted 0.197) consists of indicators such as Quran literacy, Islamic environmental ethics, and zakat awareness, highlighting the specific and unique religious orientation of waqf-based forest governance. These indicators encompass crucial elements that underlie attitudes and behaviors that promote environmental care based on faith. This result is in line with UNDP and BWI (2022), which stressed that Islamic teachings direct harmony with nature as one of God's mandates. Integrating indicators regarding increasing the religio-spiritual nature of the community as mauquf'alaih in the Waqf-Based Forest Index not only distinguishes it from conventional indices but also aligns it with a sustainable community-based Islamic environment.

The last dimension is the outcome (weighted 0.152), with the most dimensions and indicators, representing the ecological, economic, and social aspects. Trees, as the central part of the forest function, serve as an ecosystem buffer that supports biodiversity, provides habitat

for various species, regulates the water cycle, and facilitates other ecological processes. High biodiversity, whether at the landscape, ecosystem, or species level, supports the sustainability and stability of the ecosystem as a whole, with both flora and fauna playing a role in maintaining the ecological cycle. Waqf-based forests can also function as large-scale carbon sinks. If managed well, they can provide sustainable "carbon sequestration," helping to reduce greenhouse gas emissions from deforestation or land conversion, in line with the Green Waqf Framework mentioned by Mahsun et al. (2022) and also previous research by Ali et al. (2025). This ecological role strengthens the argument for waqf integration in climate policy frameworks. Good market access and infrastructure are important aspects in ensuring the economic and social sustainability of waqf-based forests. A well-managed waqf-based forest should also have productive economic aspects that not only provide ecological benefits but also support the economic welfare of the surrounding community. Waqf-based forests with a productive economy play an important role in advancing a sustainable natural resource-based economy while providing broader social and environmental benefits. According to Regan (2017), access to markets, infrastructure, and capital is essential for business activities. Demographic mapping of communities around the waqf-based forest area is another important element in sustainable and inclusive waqf-based forest management. This mapping provides a clear picture of the social, economic, and cultural characteristics of the surrounding community, which can be used to design more targeted forest management policies, increase community empowerment, and mitigate potential conflicts that may arise. Lastly, to support social and cultural aspects and enhance the sustainability of forest management, facilities in waqf-based forest areas are crucial, such as open spaces, electricity, communication, and information infrastructure. The existence of this facility infrastructure allows for more efficient forest management, provides economic, social, and environmental benefits, and strengthens connectivity between various stakeholders.

Based on the consistency rate, all experts' assessments were consistent, as all comparisons had CR values below 0.01. This report indicates that each expert provided a logical and consistent assessment when comparing elements at each level. However, the majority of Kendall's W calculations were close to 0, indicating that not all dimensions, aspects, and indicators achieved a strong consensus among experts. Consistently, the majority of p-values were high, indicating that expert preferences were random or highly variable.

Regarding the rater agreement, it appears that the outcome dimension and several indicators related to the environment and social facilities achieved the highest level of agreement (W ~0.400–0.500). In contrast, for other dimensions and aspects, expert opinions were highly dispersed (W values were minimal, approaching 0). Thus, it appears that experts were more aligned (reaching a real consensus) in assessing issues related to program outcomes, such as concrete results in the field from forest management and health facilities.

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On the other hand, other dimensions and aspects, particularly the impact dimension, showed a diversity of opinions, indicating that experts were less unanimous in their prioritization of specific dimensions and indicators.

At the Goal level, W = 10.109, with a p-value of 0.551. This remark indicates no significant expert consensus on the priorities of the five dimensions of the NWFI. At the dimension level, only the outcome dimension had a relatively high W value, at 0.496, with a p-value of 0.000. This result indicates that experts were quite unanimous in their ranking of the importance of outcome aspects. Meanwhile, the other four dimensions had relatively low W values and high p-values, indicating almost no agreement among experts. At the aspect level, several indicators showed moderate to strong agreement with statistical significance. For health facilities and facilities and support, high W values (0.435 for health facilities and 0.412 for facilities and support) with a significant p-value indicate a relatively substantial agreement among experts regarding the importance of these two indicators. On the other hand, other indicators had low W values, even for the biodiversity aspect, where W = 0.000 and p-value = 1.000. This outcome suggests that expert preferences are completely random or contradictory, and generally, there appears to be no real agreement among experts on these indicators.

In the AHP method, this is considered normal because experts come from diverse backgrounds and have diverse focuses, thus viewing the NWFI dimensions from different perspectives. The final value represents the resultant expert opinion vector, representing a mathematical compromise of diverse perspectives. Thus, even though consensus is not strong, these weights are still considered valid as representative aggregates, as in several previous studies using similar methods (Endri et al., 2022). Even if there is no significant agreement among all respondents, the priority weights can still be used as index values by considering the perspectives of all parties.

At the technical level, this study contributes by integrating the concept of ‘good nazhir governance’, which focuses on waqf asset management and environmental sustainability based on faith/spirituality. In addition, this index has the potential to serve as a reference for evaluating nazhir’s performance standards, as the waqf-based forest managers. This index also provides input to regulators, considering that there is no standardization of formal governance systems for waqf related to forests nowadays. However, there are several limitations in this study. One of them is the use of the expert judgment method, which has not been fully validated based on field facts from ongoing waqf-based forest management practices. Therefore, the application of this national waqf-based forest index needs to be the focus of further research. This policy is essential to test the feasibility of the index while assessing the performance of existing waqf-based forest nazhirs. In addition, the application of the index can also evaluate the multi-stakeholder participation mechanism, as well as consider the most appropriate criteria and techniques for assessing index weights.

This study has important value and novelty from the integration of sharia fiqh and sustainable green management. The National Waqf Forest Index is planned not only to be a tool for measuring nazhir performance, but can also be used as a guideline for designing national waqf forests that are inclusive, sustainable, and have a broad impact.

## CONCLUSION

This study resulted in a National Waqf-based Forest Index, a management standard to provide a measurable basis for the development of waqf-based forests in Indonesia. There are five dimensions: institution, process, system, outcome, and impact, with 24 aspects and a total of 64 measurable indicators. According to the AHP methods weighted by interdisciplinary experts, the institution and process dimension is considered the most important. It indicates that the clarity of legalization and the continuity of the program are successful waqf-based forest management principles. This study shows the implementation of a combination of Islamic finance and sustainable environmental management. The National Waqf-based Forest Index can serve not only as a practical tool to measure nazhir performance but also as a guide to establishing waqf-based forests that are socially inclusive and beneficial for the climate.

Aside from furnishing a technical outline, this research contributes theoretically by combining waqf governance with environmental management for a sustainability model grounded in faith principles. From the viewpoint of policy making, the index may assist in setting standardization and performance evaluation for nazhir institutions and regulators in the absence of formal governance systems for forest-related waqf. However, this study still has some limitations. For example, the current index relies on the expert assessment and still lacks validation based on the current waqf-based forest management practices. Further research should focus on implementing the index to assess the performance of several waqf-based forest nazhirs in several locations in Indonesia, to assess the index's applicability, explore the multi-stakeholder engagement mechanism, and consider adaptive weighting techniques.

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## AUTHOR CONTRIBUTIONS

K. M. A.: Conceptualization, In-Depth Interview, Observation, Funding Acquisition; H. T.: Conceptualization, Supervision, Validation; R. S.: Conceptualization, Investigation, Formal Analysis; I. F. S.: Data Collection, Data Analysis, Writing–Original Draft Preparation; M. J.:

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Visualization, Writing–Review and Editing; M. M.: Resources, Data Curation, Writing–Original Draft Preparation.

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