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TOPSIS BASED DECISION MAKING FOR FINANCIAL PERFORMANCE IN MALAYSIA RENEWABLE ENERGY SECTOR

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Abstract

The growth of Malaysia's renewable energy sector calls for objective methods to evaluate the financial performance of industry players. This study utilizes the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), a multi-criteria decision-making (MCDM) approach, to assess and rank 27 renewable energy companies based on 2024 financial data obtained from Datastream. These companies are evaluated using nine financial ratios as criteria to construct a financial performance index.

The TOPSIS model was applied to measure each company's relative closeness to an ideal performance benchmark. Results showed significant variation in financial performance, with top-ranking firms displaying stronger profitability and financial balance. Larger and more diversified companies generally outperformed smaller peers.

The study offers a practical, replicable framework for evaluating financial efficiency in the renewable energy sector. It provides useful insights for investors, policymakers, and corporate decision-makers seeking data-driven tools for strategic planning and sustainability-oriented investment decisions.

INTRODUCTION

The increasing urgency of climate change mitigation and sustainable energy transition has placed renewable energy sectors at the forefront of global economic and environmental agendas. Malaysia, as a developing country with ambitious sustainability goals, has been actively promoting renewable energy through national frameworks such as the Renewable Energy Act 2011 and initiatives led by the Sustainable Energy Development Authority (SEDA) (Petinrin & Shaaban, 2015). Despite policy support, evaluating the financial viability and sustainability of renewable energy firms remains a challenge due to the multifaceted nature of performance metrics, encompassing profitability, liquidity, solvency, and market value indicators (Badri Shah et al., 2021; Rastogi et al., 2020).

Multi-Criteria Decision-Making (MCDM) methods have emerged as powerful tools for handling complex decision environments involving multiple conflicting criteria (Taherdoost & Madanchian, 2023). One widely adopted method is the Technique for Order Preference by Similarity to Ideal Solution

(TOPSIS), which ranks alternatives based on their geometric closeness to an ideal solution(Almoghathawi et al., 2017; Fahami et al., 2019b; Hoe et al., 2020; Yalcin et al., 2012). TOPSIS has seen successful application in financial evaluations (Abd Rahim et al., 2020; Azhar et al., 2022), technology assessment (Halicka, 2020; Shafei et al., 2024) , and energy planning (İ. Kaya et al., 2018; T. Kaya & Kahraman, 2011)

In renewable energy contexts, MCDM applications have guided optimal energy source selection (Murtaja et al., 2025), technology ranking (Cayir Ervural et al., 2018), and investment strategy (Taylan et al., 2020). However, most focus on technical and sustainability criteria, with limited integration of financial indicators (Liu et al., 2021).

Despite these advancements, few studies comprehensively evaluate financial performance of renewable energy companies in Malaysia using a robust, data-driven MCDM approach. This research addresses that gap by applying the TOPSIS method to assess financial performance of 27 renewable energy firms using 2024 Datastream data. Drawing on frameworks and insights from the literature (Chen & Shimerda, 1981; Fahami et al., 2019a), the objectives are to construct a financial performance index, to rank the firms using TOPSIS and to deliver insights for strategic investment and policy planning.

RESEARCH METHODOLOGY

Based on data retrieved from DataStream, Table 1 shows the 27 renewable energy companies that listed in Malaysia for the year 2024. The TOPSIS method was used to assess their financial performance based on nine financial ratios. These include Current Ratio, Dividend Yield, EPS, Gross Profit Margin, Operating Profit Margin, P/E Ratio, and ROE are to be maximized, while Debt Ratio should be minimized.

Table 1. Renewable energy companies in Malaysia stock market

Company Name	Company Code
Dialog Group Berhad	C1
Yinson Holdings	C2
Bumi Armada Bhd	C3
Dayang Enterprise	C4
Velesto Energy	C5
Hibiscus Petroleum	C6
Bm Greentech	C7
Solarvest Holding	C8
Petron Malaysia	C9
Lianson Fleet	C10
Pekat Group	C11
Coastal Contracts	C12
Wasco	C13
Kinergy	C14
Cypark Resources	C15
Malaysia Marine	C16
Deleum Bhd	C17
Hengyuan Refining Co	C18
Samaiden Group	C19
T7 Global Bhd	C20
Petra Energy Bhd	C21
Uzma Bhd	C22
Steel Hawk Bhd	C23
Knm Group Bhd	C24

Carimin	C25
Barakah Offshore	C26
Mega First Corp	C27

Source: DataStream

The TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) method is a decision-making tool designed to handle problems involving multiple evaluation criteria. It works by identifying solutions that are closest to the ideal (best) option and farthest from the negative (worst) option, based on geometric distance. This approach helps to rank alternatives in a way that reflects how well they satisfy the desired criteria. In this study, the TOPSIS method was applied in seven systematic steps, as shown below

Step 1: Decision Matrix $\left(\left(x_{ij}\right)_{m\times n}\right)$ *Formation.*

To create a decision matrix, m alternatives (companies) and n criteria (financial ratios) are considered. Each alternative is assigned a score for each criterion x_{ij}, resulting in the construction of a matrix $\left(x_{ij}\right)_{m\times n}$ denoted as below.

$$(x_{ij})_{m\times n} = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ . & & & . \\ . & & & . \\ . & & & . \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{bmatrix} \quad (1)$$

Step 2: Decision Matrix Normalization.

The normalized decision matrix $R = (r_{ij})_{m\times n}$ is constructed by transforming the attribute dimensions into non-dimensional attributes, as illustrated below.

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}}, i = 1,2,...,m, j = 1,2,...,n \quad (2)$$

$$R = (r_{ij})_{m\times n} = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1n} \\ r_{21} & r_{22} & \cdots & r_{2n} \\ . & & & . \\ . & & & . \\ . & & & . \\ r_{m1} & r_{m2} & \cdots & r_{mn} \end{bmatrix} \quad (3)$$

*Step 3: Weighted Normalized Decision Matrix (**T**) Construction.*

$$\mathrm{T} = (t_{ij})_{m\times n} = (w_j r_{ij})_{m\times n}, i = 1,2,...,m \quad \text{where } w_j = \frac{W_j}{\sum_{j=1}^{n} W_j}, j = 1,2,...,n \tag{4}$$

$\sum_{j=1}^{n} w_j = 1$ and W_j is the original weight given to the indicator, $w_j, j = 1,2,...,n$

$$\mathrm{T} = \begin{bmatrix} w_1 r_{11} & w_2 r_{12} & \cdots & w_n r_{1n} \\ w_1 r_{21} & w_2 r_{22} & \cdots & w_n r_{2n} \\ . & & & . \\ . & & & . \\ . & & & . \\ w_1 r_{m1} & w_2 r_{m2} & \cdots & w_n r_{mn} \end{bmatrix} \tag{5}$$

Step 4: The Positive/Best Ideal (A_b) Solution and The Negative/Worst Ideal (A_w) Solution Determination.

$$A_b = \{\langle \min(t_{ij} \mid i = 1,2,...,m) \mid j \in J_- \rangle, \langle \max(t_{ij} \mid i = 1,2,...,m) \mid j \in J_+ \rangle\} \equiv \{t_{bj} \mid j = 1,2,...,n\}, \tag{6}$$

$$A_w = \{\langle \max(t_{ij} \mid i = 1,2,...,m) \mid j \in J_- \rangle, \langle \min(t_{ij} \mid i = 1,2,...,m) \mid j \in J_+ \rangle\} \equiv \{t_{wj} \mid j = 1,2,...,n\}, \tag{7}$$

where,

$J_+ = \{j = 1,2,...,n \mid j$ associates with the criteria having a positive impact, and

$J_- = \{j = 1,2,...,n \mid j$ associates with the criteria having a negative impact.

Step 5: The Separation Measures for Each Alternative from the Best Ideal Solution and Negative Ideal Solution Calculation.

The separation measures for each alternative is the best/worst calculated as follows:

$$d_{ib} = \sqrt{\sum_{j=1}^{n} (t_{ij} - t_{bj})^2}, i = 1,2,...,m \tag{8}$$

$$d_{iw} = \sqrt{\sum_{j=1}^{n} (t_{ij} - t_{wj})^2}, i = 1,2,...,m \tag{9}$$

Step 6: The Relative Closeness to the Ideal Solution for Each Alternative Calculation:

For each alternative, the relative closeness to the ideal solution s_{iw} is computed as follows.

$$s_{iw} = \frac{d_{iw}}{d_{ib} + d_{iw}}, 0 \le s_{iw} \le 1, i = 1, 2, ..., m \quad (10)$$

$s_{iw} = 0$ if and only if the alternative solution has the worst condition whereas $s_{iw} = 1$ if and only if the alternative solution has the best condition.

Step 7: Rank the alternatives.

The alternatives are ranked in descending order according to the relative closeness coefficient, s_{iw} with the highest values s_{iw} representing the best alternative.

RESULT AND DISCUSSION

Error! Reference source not found., **Error! Reference source not found.** and **Error! Reference sou rce not found.**, present the multi-criteria decision-making matrix, normalized decision matrix and weighted normalized decision matrix respectively. In this study, equal weights are then allocated to the ten criteria, as each ratio holds the same level of importance and linguistic terms are not considered. Total weights must be one. Hence each criterion is set as 1/9 (Bulgurcu, 2012). The distances of all options from the positive ideal solution (d_{ib}) and the negative ideal solution (d_{iw}) are presented in Table 5.

Table 2. Multicriteria Decision Making Matrix

Company Code	Current Ratio	P/E Ratio - Close	Gross Profit Margin	Return On Equity - Total (%)	Operating Profit Margin	Earnings Per Share	Dividend Yield	Total Debt % Common Equity	Total Debt % Total Assets
C1	2.44	23.45	14.35	9.98	10.86	0.1	1.74	1.74	24.61
C2	1.05	9.02	25.19	17.28	21.54	0.25	1.21	1.21	63.62
C3	2.1	6.12	57.03	10.76	50.34	0.06	0	0	35.7
C4	2.62	7.78	45.7	17.64	32.94	0.19	2.01	2.01	4.79
C5	1.41	6.13	21.35	8.23	21.35	0.01	0.86	0.86	5.95
C6	1.48	4	65.06	16.14	34.2	0.56	2.57	2.57	11.34
C7	2.23	14.5	20.52	13.5	10.27	0.05	1.88	1.88	0.99
C8	2.83	31.74	19.95	15.39	10.52	0.04	0.44	0.44	36.99
C9	1.24	63.01	1.73	0.75	-0.03	1.01	5.45	5.45	26.76
C10	1.64	13.38	30.7	11.46	16.31	0	8.4	8.4	23.58
C11	1.76	28.99	28.97	14.91	10.76	0.02	0	0	21.98
C12	15.18	4.99	5.73	9.27	-395.19	0.5	0	0	1.7
C13	1.08	5.16	17.34	19.78	5.19	0.14	0	0	26.1
C14	2.15	31.91	22.23	8.9	13.37	0.02	0	0	35.16
C15	2.61	-6.81	-6.41	-15.1	-14.73	0	0	0	69.65
C16	0.89	5.09	2.7	9.15	2.7	0	3.33	3.33	7.81
C17	2.55	7.47	25.95	16.92	13.35	0.11	4.49	4.49	2.07
C18	0.69	-1.8	-0.74	-28.01	-1.32	0	0	0	39.28
C19	2.88	32.82	15.6	13.89	8.56	0.03	0.4	0.4	5.29

C20	0.45	9.93	34.23	10.92	17.02	0.04	0	0	68.52
C21	1.46	5.96	26.22	16.7	18.57	0.17	5.51	5.51	12.05
C22	1.03	8.81	35.4	9.07	13.01	0.11	0	0	42
C23	2.07	17.62	41.31	37.4	25.38	0.02	1.96	1.96	30.55
C24	0.76	-1.81	-1493.09	-28.55	-1493.09	0	0	0	47.3
C25	1.97	5.05	15.94	20.33	8.95	0.1	2.48	2.48	3.25
C26	1.21	0.94	65.8	790.78	31.31	0	0	0	37.6
C27	1.01	9.42	37.71	14.39	30.18	0.41	2.01	2.01	22.64

Source: DataStream

Table 3. Normalized Decision Matrix

Company Code	Current Ratio	P/E Ratio - Close	Gross Profit Margin	Return On Equity - Total (%)	Operating Profit Margin	Earnings Per Share	Dividend Yield	Total Debt % Common Equity	Total Debt % Total Assets
C1	0.13714	0.23557	0.00956	0.01255	0.00702	0.07153	0.12439	0.12439	0.14363
C2	0.05902	0.09061	0.01677	0.02172	0.01392	0.17882	0.08650	0.08650	0.37130
C3	0.11803	0.06148	0.03797	0.01353	0.03252	0.04292	0.00000	0.00000	0.20835
C4	0.14726	0.07816	0.03043	0.02218	0.02128	0.13590	0.14369	0.14369	0.02796
C5	0.07925	0.06158	0.01422	0.01035	0.01379	0.00715	0.06148	0.06148	0.03473
C6	0.08319	0.04018	0.04332	0.02029	0.02209	0.40055	0.18373	0.18373	0.06618
C7	0.12534	0.14566	0.01366	0.01697	0.00663	0.03576	0.13440	0.13440	0.00578
C8	0.15906	0.31885	0.01328	0.01935	0.00680	0.02861	0.03146	0.03146	0.21588
C9	0.06970	0.63298	0.00115	0.00094	-0.00002	0.72242	0.38962	0.38962	0.15618
C10	0.09218	0.13441	0.02044	0.01441	0.01054	0.00000	0.60051	0.60051	0.13762
C11	0.09892	0.29123	0.01929	0.01874	0.00695	0.01431	0.00000	0.00000	0.12828
C12	0.85322	0.05013	0.00382	0.01165	-0.25531	0.35764	0.00000	0.00000	0.00992
C13	0.06070	0.05184	0.01155	0.02487	0.00335	0.10014	0.00000	0.00000	0.15233
C14	0.12084	0.32056	0.01480	0.01119	0.00864	0.01431	0.00000	0.00000	0.20520
C15	0.14670	-0.0684	-0.00427	-0.01898	-0.00952	0.00000	0.00000	0.00000	0.40649
C16	0.05002	0.05113	0.00180	0.01150	0.00174	0.00000	0.23806	0.23806	0.04558
C17	0.14333	0.07504	0.01728	0.02127	0.00862	0.07868	0.32099	0.32099	0.01208
C18	0.03878	-0.0181	-0.00049	-0.03521	-0.00085	0.00000	0.00000	0.00000	0.22925
C19	0.16188	0.32970	0.01039	0.01746	0.00553	0.02146	0.02860	0.02860	0.03087
C20	0.02529	0.09975	0.02279	0.01373	0.01100	0.02861	0.00000	0.00000	0.39990
C21	0.08206	0.05987	0.01746	0.02099	0.01200	0.12160	0.39391	0.39391	0.07033
C22	0.05789	0.08850	0.02357	0.01140	0.00840	0.07868	0.00000	0.00000	0.24512
C23	0.11635	0.17701	0.02751	0.04702	0.01640	0.01431	0.14012	0.14012	0.17830
C24	0.04272	-0.0182	-0.99420	-0.03589	-0.96459	0.00000	0.00000	0.00000	0.27605
C25	0.11073	0.05073	0.01061	0.02556	0.00578	0.07153	0.17729	0.17729	0.01897
C26	0.06801	0.00944	0.04381	0.99416	0.02023	0.00000	0.00000	0.00000	0.21944
C27	0.05677	0.09463	0.02511	0.01809	0.01950	0.29326	0.14369	0.14369	0.13213

Table 4. Weighted Normalized Decision Matrix

Company Code	Current Ratio	P/E Ratio - Close	Gross Profit Margin	Return On Equity - Total (%)	Operating Profit Margin	Earnings Per Share	Dividend Yield	Total Debt % Common Equity	Total Debt % Total Assets
C1	0.00411	0.00792	0.00330	0.00179	0.00162	0.00494	0.00776	0.00776	0.00359
C2	0.00177	0.00304	0.00579	0.00309	0.00320	0.01234	0.00540	0.00540	0.00928
C3	0.00354	0.00207	0.01310	0.00192	0.00749	0.00296	0.00000	0.00000	0.00521
C4	0.00442	0.00263	0.01050	0.00316	0.00490	0.00938	0.00897	0.00897	0.00070
C5	0.00238	0.00207	0.00491	0.00147	0.00318	0.00049	0.00384	0.00384	0.00087

C6	0.00250	0.00135	0.01495	0.00289	0.00509	0.02764	0.01146	0.01146	0.00165
C7	0.00376	0.00489	0.00472	0.00242	0.00153	0.00247	0.00839	0.00839	0.00014
C8	0.00477	0.01071	0.00458	0.00275	0.00157	0.00197	0.00196	0.00196	0.00540
C9	0.00209	0.02127	0.00040	0.00013	0.00000	0.04985	0.02431	0.02431	0.00390
C10	0.00277	0.00452	0.00705	0.00205	0.00243	0.00000	0.03747	0.03747	0.00344
C11	0.00297	0.00979	0.00666	0.00267	0.00160	0.00099	0.00000	0.00000	0.00321
C12	0.02560	0.00168	0.00132	0.00166	-0.05880	0.02468	0.00000	0.00000	0.00025
C13	0.00182	0.00174	0.00398	0.00354	0.00077	0.00691	0.00000	0.00000	0.00381
C14	0.00363	0.01077	0.00511	0.00159	0.00199	0.00099	0.00000	0.00000	0.00513
C15	0.00440	-0.0023	-0.00147	-0.00270	-0.00219	0.00000	0.00000	0.00000	0.01016
C16	0.00150	0.00172	0.00062	0.00164	0.00040	0.00000	0.01485	0.01485	0.00114
C17	0.00430	0.00252	0.00596	0.00303	0.00199	0.00543	0.02003	0.02003	0.00030
C18	0.00116	-0.0006	-0.00017	-0.00501	-0.00020	0.00000	0.00000	0.00000	0.00573
C19	0.00486	0.01108	0.00358	0.00248	0.00127	0.00148	0.00178	0.00178	0.00077
C20	0.00076	0.00335	0.00787	0.00195	0.00253	0.00197	0.00000	0.00000	0.01000
C21	0.00246	0.00201	0.00603	0.00299	0.00276	0.00839	0.02458	0.02458	0.00176
C22	0.00174	0.00297	0.00813	0.00162	0.00194	0.00543	0.00000	0.00000	0.00613
C23	0.00349	0.00595	0.00949	0.00669	0.00378	0.00099	0.00874	0.00874	0.00446
C24	0.00128	-0.0006	-0.3431	-0.00511	-0.22214	0.00000	0.00000	0.00000	0.00690
C25	0.00332	0.00170	0.00366	0.00364	0.00133	0.00494	0.01106	0.01106	0.00047
C26	0.00204	0.00032	0.01512	0.14147	0.00466	0.00000	0.00000	0.00000	0.00549
C27	0.00170	0.00318	0.00867	0.00257	0.00449	0.02024	0.00897	0.00897	0.00330

Table 5. Positive Ideal $\left(A_b\right)$ and Negative Ideal $\left(A_w\right)$ Solutions

Company Code	Current Ratio	P/E Ratio - Close	Gross Profit Margin	Return On Equity - Total (%)	Operating Profit Margin	Earnings Per Share	Dividend Yield	Total Debt % Common Equity	Total Debt % Total Assets
Positive Ideal $\left(A_b\right)$	0.0256	-0.0023	0.01512	0.14147	0.00749	0.04985	0.03747	0.0000	0.0001
Negative Ideal $\left(A_w\right)$	0.00076	0.0213	-0.34310	-0.00511	-0.22214	0.00000	0.00000	0.0375	0.0102

Table 6. Distance of the Alternatives from The Positive Ideal Solution (d_{ib}) and Negative Ideal Solution (d_{iw})

Company Code	(d_{ib})	(d_{iw})	S_{iw}
C1	0.152391966	0.413891132	0.73089085
C2	0.149660234	0.417271011	0.73601696
C3	0.153655533	0.425999529	0.73491902
C4	0.148870091	0.421997192	0.73922119
C5	0.154474628	0.416561388	0.72948356
C6	0.145123398	0.426545205	0.74614069
C7	0.15221465	0.415162317	0.73172219
C8	0.153542022	0.415222229	0.73004277
C9	0.148776999	0.41310124	0.73521488
C10	0.154905109	0.418119666	0.72967118
C11	0.154372775	0.417182324	0.72990745
C12	0.161817351	0.385306887	0.70424021
C13	0.151778023	0.414858304	0.73214209
C14	0.155453241	0.416025329	0.72798063
C15	0.159976489	0.408736341	0.71870427
C16	0.153714051	0.410987672	0.72779603
C17	0.149784505	0.416341586	0.73542201

C18	0.162077122	0.410807591	0.71708597
C19	0.15399262	0.414306422	0.72902889
C20	0.154866049	0.418848352	0.73006421
C21	0.149423774	0.416918151	0.73615979
C22	0.153774229	0.418816072	0.73144109
C23	0.148576051	0.420329374	0.73883875
C24	0.455044051	0.043517125	0.08728543
C25	0.150052942	0.414232181	0.73408311
C26	0.066986356	0.450678105	0.87059889
C27	0.147387082	0.42052013	0.74047331

Table 7. Ranking of Transportation companies

Company Name	Company Code	Rank
Barakah Offshore	C26	1
Hibiscus Petr	C6	2
Mega First Corp	C27	3
Dayang Enterprise	C4	4
Steel Hawk Bhd	C23	5
Petra Energy Bhd	C21	6
Yinson Holdings	C2	7
Deleum Bhd	C17	8
Petron Malaysia	C9	9
Bumi Armada Bhd	C3	10
Carimin	C25	11
Wasco	C13	12
Bm Greentech	C7	13
Uzma Bhd	C22	14
Dialog Group Berhad	C1	15
T7 Global Bhd	C20	16
Solarvest Hold	C8	17
Pekat Grou	C11	18
Lianson Fleet	C10	19
Velesto Ene	C5	20
Samaiden Group	C19	21
Kinergy	C14	22
Malaysia Marine	C16	23
Cypark Resources	C15	24
Hengyuan Refining Co	C18	25
Coastal Contracts	C12	26
Knm Group Bhd	C24	27

Equation (10) is used to determine the relative closeness to the the ideal solution (S_{iw}) of each alternative. Table 5 displays the relative closeness distances of each decision alternative to the ideal solution (S_{iw}) The overall financial performance of the companies is assessed by ranking these values in descending order.

Table 7 presents the ranking of 27 renewable energy companies in Malaysia based on their relative closeness to the ideal solution (S_{iw}) as calculated using the TOPSIS method. This ranking reflects the overall financial performance of each company in 2024. Companies with higher ideal solution (S_{iw}) values are considered to be financially stronger, as they are closer to the ideal solution across the selected financial ratios.

According to the results, **Barakah Offshore** (C26) secured the top position, followed by **Hibiscus Petroleum** (C6) and **Mega First Corporation** (C27), indicating strong financial performance. Their strong positions suggest financial stability and efficiency, making them potentially attractive options for investors seeking well-performing companies in the renewable energy sector.

On the other hand, **KNM Group Bhd** (C24), **Coastal Contracts** (C12), and **Hengyuan Refining Co** (C18) which ranked lower in the analysis, show comparatively weaker financial performance. Investors may consider conducting further evaluation to better understand the underlying factors before making any investment decisions.

Overall, Table 7 enables stakeholders to evaluate and compare the financial positions of various renewable energy companies. It offers valuable insights for investors by highlighting each company's relative closeness to the ideal solution, helping to identify those with strong financial performance and promising growth potential.

CONCLUSION

Measuring company performance is crucial for continuous improvement. The study offers a practical, replicable framework for evaluating financial efficiency in the renewable energy sector. The findings indicate that **Barakah Offshore** (C26) is the top performing company among the studied companies, due to its significant financial turnaround, marked by a shift from net loss to RM44 million profit in annual report for financial year 2024, a gross profit margin increase from 19% to 61%, and exceptional ROE and ROA levels exceeding 400% and 13.3%, respectively. This research holds significance as it provides useful insights for investors, policymakers, and corporate decision-makers seeking data-driven tools for strategic planning and sustainability-oriented investment decisions.

CONFLICT OF INTEREST

The authors affirmed that there is no conflict of interest in this article.

CO-AUTHOR CONTRIBUTION

All authors contributed substantially to the development of this study. Author 1 conceptualized the study, performed the data analysis, and drafted the initial manuscript. Author 2 contributed to the methodology design, literature review, and critical revision of the manuscript. Both authors have read and approved the final version of the manuscript.

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