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Assessment of Green Banking Performance

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Abstract: Internal and external pressures are pushing the financial system towards an increasing environmentally responsible orientation. Damaging practices of Green – washing require the search for new monitoring ways. But how can one measure the actual degree of greenness of a banking industry? This study aims to create a new methodology framework to measure green performance in the banking industry using multi-criteria methods. We offer a theoretical contribution. First, a set of criteria has been identified at the theoretical level, second, the criteria have been evaluated by practitioners and aggregated using the 'Topsis' method. This index may constitute a basis for ranking banks. The results showed that the most important indicator in evaluating the performance of green banking is the evaluation of green customers, innovations leading to a green economy, green financial products and services, and green education. It leads that both banks and client should become more "green" and apply more green innovations and financial products/services.

Keywords: banking industry, green performance, multicriteria

1. Introduction

Nowadays due to the consequences of climate change, the entire economy needs a core transformation, and the banking industry with the concept of green finance must be ahead in these processes. A green transformation is an approach to development that aims to move society toward sustainability to solve the problems of climate change as well as digital transformation [1] and innovation acceleration [2-3]. It follows, that the main objective of green transforation is to achieve a balance between economy and nature [4]. The financial sector would have to play a primary role in the green transformation [5].

In our days [illegible] are responsible for boosting green transformation, tracking green performance is very important. In addition to increasing environmental awareness of society, tighter regulation forces banks to take more serious actions in the green transformation of economy, which it is obliged to do under increasingly stringent requirements [6] ; Regulation 2021/2139 of the European Parliament and of the Council on the disclosure of sustainability-related information to the financial services sector, Taxonomy [7].

Considerably rising attention in the last decade was dedicated to the banking industry and their participation in transforming the economy to green. The organization's performance is widely analyzed from financial perspectives, but still there are not enough studies on green performance. Environmental or ecological performance is the impact of a company's operations on the natural environment. [8] The stream of academic articles related to green performance in the banking industry is demonstrating some directions. The largest group of articles is searching for answers on how the environmental consciousness of banking policy is validated by customers and helps to earn higher bank profits [5], [8 -11]. The analysis of sustainability or green performance in the banking industry is presented by highlighting some peculiarities of green products [12-14], reporting [15-16], stressing climate change activities [17], ESG strategies[18]. Green

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performance can open a new market for smaller banks as their clients might take a higher risk of green transformation as large banks have large customers, where green transformation might not be as valuable for their financial results [10].

The aim of this paper is to fill the gap in the literature by proposing a new framework for the development of the index in the area of environmental assessment for the banking sector, as this area is still in the development process. The function of this index is to provide bankers, professionals and policymakers with a tool for monitoring the level of green performance of banks, taking into account the green performance of banks as organizations and their participation in the green transformation of the economy.

2. Literature review

The services of the banking industry are not considered to negatively impact the environment, they have the power to redirect investments to a more environmentally friendly way. In the scientific and practitioners' literature, the performance of green banks is analysed from the organisation side of the banks and as a transformer for the green economy. Both parts are interrelated as showing the leading role in environmental transformation. To tackle these issues, the bank industry as many other organisations have adopted Corporate Social Responsibility, sustainability strategies, which present the same values.

As for the opportunity-based approach, the banking sector is applying CSR and sustainability strategies to improve its image as they cover socially sensitive issues that appear to concern consumers and customers who want to contribute to a more humanitarian and socially responsible economy. Both strategies are also used to improve the brand identity as being sensitive and responsible for the surroundings and such an image might positively impact customers who wish to have a green economy attitude. In order to reduce environmental and social risks many banks have been implemented ESG strategy. Most organisations and banking institutions have been matched with these strategies with the 17 SDGs [19]. Both in banking and in other industries, the methodologies used play an important role, helping to constantly improve activities according to the principles of sustainability. The most commonly used methodologies are the Global Reporting Initiative, the United Nations Global Compact, the Environmental, Social and Governance principles [20-21]. Banks have taken several initiatives to maintain environmental sustainability: reducing paper consumption, printing, promoting teleworking and collaboration, waste management, developing and promoting digital banking channels such as online banking, mobile banking and digital payment machines, installing solar-powered, etc., IT banking helps to significantly reduce transportation, financial and environmental costs for consumers and banking institutions, thereby helping maintain environmental sustainability. Several other banks are also taking important initiatives like financing green energy projects, green building practices, etc. e.g. energy efficient lighting, censorship of mother fans, censorship of fan material, duplex printing by major public broadcasters [22]. An important way to promote sustainable banking is to increase consumer acceptance of IT banking over traditional branches [23].

There are also third parties conducting various surveys and collecting public information from various sources. Ratings and scores are assigned based on company results according to sustainability criteria ESG (Bloomberg), Refinitiv Eikon, Thomson Reuters, Dow Jones sustainability and others [24]. The S&P Global Sustainability Index Series includes a variety of indices that track the sustainability performance of companies in various sectors, including the S&P Global Banks Index, which covers banks and other financial institutions that cover aspects such as climate transition, physical, natural capital, waste, and pollution, and other factors of environmental risks [25].

The Refinitiv Eikon database proposes 34 variables related to the environmental aspect, grouped into three dimensions. The resource use efficiency group is measured by variables such as water and energy efficiency policies; environmental management systems; total energy and water consumption; usage rate of renewable energies; green

buildings; and supply chain management and monitoring. Reducing Emissions and Waste (Includes the following elements: Emissions Policies and Targets; Total Carbon Emissions; Emissions to Revenue; Climate Change Opportunities; Waste Management; E-Waste Reduction; Environmental Restoration; Reducing Personnel Transportation Impacts; Environmental Spending and Income Variables such as data on financing of environmental projects, environmental products, environmental assets under management, Equator principles and clean energy products represent an aspect of environmental innovation. The following discussion connects these indicators with the literature on environmental indicators, management and performance in the banking sector [11].

The environmental performance of banks can be viewed from three directions: efficient use of internal resources; benefits of investing into environmentally friendly projects; reduce the risks associated with lending to environmentally risky industries. Banks are therefore directly involved in environmental activities, both within their organization and towards their customers and business partners. These measures can be summarized under the title "green production", although banks are not industrial producers. Specific environmental initiatives can be divided into: (a) Environmental business strategies, such as: concessional loans to innovative and environmentally friendly companies; b) Selection of environmentally harmful projects in the credit evaluation process; (c) environmental philanthropy through donations to environmental causes; (d) voluntary emissions reductions, such as reduced business travel; (e) environmental services through the use of electronic banking applications; f) renewable energy for office buildings ; and (g) the recycling of office waste [26-27].

Authors [15, 28] evaluates the green activity of banks by distinguishing three groups of criteria: development of green products, socially responsible initiative and green transformations in banking processes, assigning relevant indicators such as green credit cards, online banking, green savings account or training of employees on green initiatives. Toma & Stefanelli (2022) ranked Italian banks in terms of their green performance in terms of climate change policy, governance, risk assessment, and impact initiatives. The authors indicated that the position of each bank could vary and the participation could depend on the size and geographic location [17].

(Gai et al. 2023) proposed a rating index that evaluates a bank's corporate governance decisions and internal behaviors related to environmental and social issues as well as areas related to the stability of lending and investment activities [18].

The authors identified a list of relevant indicators for banks and their activities. Four dimensions were chosen: the field of environmental protection; social field; management area; for ESG-related lending and investment areas.

Predecessor articles evaluated the ethical concept of the banking industry and proposed the Social and Ethical Banking Index. The index was constructed that defines the main aspects and their indicators: Transparency; Ethical and social assessment of investment projects and triple bottom line perspective; inclusive and participatory governance, humane and sustainable structure; Awareness raising efforts [28].

After reviewing the theoretical material, criteria for green outcomes in the banking sector were selected for expert evaluation. Ten criteria in this phase: resource management (internal); waste management (internal); Emissions management (internal); Innovations leading to a green economy; internal management; External assessment; Transparency; Green financial products and services; Education – green education; Green customer review set.

3. Methodology and data collected

Basically, expert evaluations are one of the widely developed scientific disciplines, the goal of which is the acquisition, systematic organization, structural processing, and interpretation of knowledge accumulated by a person over a long period of time using mathematical and logical methods. During the direct evaluation of the priority of objects, experts evaluate the factors according to a prespecified numerical scale, which is linked to the comparison – better-worse. It was decided to make a concentrated questionnaire and submit closed targeted questions (defining the width of the ranking and evaluation scale). During the examination of the theoretical aspects presented in the questionnaire, measures and aspects that can promote harmony were highlighted. To avoid questions that are not understood according to the essence of the research and distorted research results, an appendix with guidelines for experts is provided along with the questionnaire. The experts were asked to compare them with each other according to their impact on green transformation, experts rank the measures and aspects presented on a scale of 1 to 10 (where 1 – would have the least influence, 10 – would have the most influence) rank the measures and aspects presented (Table 1). In the second stage of the targeted part, experts evaluate each aspect and measure individually, according to their importance, contributing to coherence from 1 to 5 (where 1 – the least important, 5 – the most important).

Table 1. Alternatives to expert assessment (factors and measures)

X1	Management of Resources (internal)
X2	Waste Management
X3	Management of Emissions
X4	Innovations leading to green economy
X5	Internal Governance
X6	External assessment
X7	Transparency
X8	Green financial products and services
X9	Green education teaching
X10	Green Client Assessment

Source: Developed by the authors based on the analysis of scientific literature.

The research sample – the totality of participating experts – is determined in a probabilistic or nonprobabilistic way. The essence of the probability sampling type is that it is statistically representative if the sample selected from the population is 50,01 % of the population, but this would be complicated by the number of respondents required to be interviewed for the study. The nonprobability basis of the selection type is specific criteria formed by the researcher, according to which suitable and unsuitable respondents are distinguished [10]. Although the research is based on the individual assessment of experts, we can call the selected respondents an expert group.

In this study, when determining the permissible number of experts, we were guided by the methodological assumptions of classical test theory, according to which there is a rapidly decreasing non-linear relationship between the reliability of decisions made and the number of experts who make these decisions.

It has been shown that in expert assessment models, the accuracy of decisions and assessment of a large group of experts, but the assessment accuracy of a group of three experts sometimes significantly exceeds the accuracy of an assessment of one or two experts. By further increasing the group of experts, the accuracy of the obtained estimates increases little by little and becomes the highest in the group of 5-9 experts [30-31]. Assuming the optimal number of experts with which the research becomes rational and reliable is 5-9 experts, 8 experts are selected for the research of this work. Based on expert selection methods and recommendations and combining them into a single set of criteria, we can say that the target working group should be assembled from eight respondents,

considering their academic degree, positions held, and academic qualities, after assessing their experience working in banks and in a scientific environment.

Table 2. Evaluation criteria of experts

Selection criteria	Response evaluation
Does the respondent have an academic degree of at least a master's degree?	YES →suitable. NO not suitable.
Has the respondent worked for at least 5 years in institutions whose activities are related to banks or universities in the field of sustainability?	YES suitable. NO not suitable.
Has the respondent worked for at least 5 years in institutions whose activities are focused on promoting sustainability?	YES suitable. NO not suitable.
Has the respondent prepared presentations, given lectures, participated in expert research, seminars, trainings, or internships related to the promotion of sustainability for at least 5 years?	YES →suitable. NO → non-suitable.

Source: Compiled by the authors based on an analysis of the scientific literature.

According to the set criteria (Table 2) suitable respondents (experts) are selected from various institutions.

4. Results

The assessment analysis of experts consists of four steps: determining the compatibility of the assessments of experts, determining the weights of the indicators and assessing significance using the TOPSIS method. The analysis of the expert evaluations is followed by the summarization of all results and the presentation of conclusions.

Determination of indicator weights

The individual criteria that describe the influence of the research topic on the objective under consideration are not the same. Therefore, when using multi-criteria quantitative assessments, it is very important to consider the importance of the criteria, i.e. to determine their weight. Most currently known and used methods for determining the weights of multi-criteria evaluation criteria are based on expert assessments. The opinions of individual experts often do not coincide and many even be contradictory, so weights as generalised averages of expert opinions can be used in a multicriteria assessment if the consistency of expert assessments is determined, i. e. opinions have been shown to be statistically aligned. Kendall's variance concordance coefficient can be used to determine the compatibility of assessments [32-33] . Beležentis and Žalimaitė (2011) and Bayanati (2022) also confirm that expert assessment is based on the assumption that a decision can only be made with consistent expert opinions [34-35]. After collecting all the data from the expert evaluation, it is necessary to assess the compatibility of the experts' opinions. If the number of experts is less than two, the correlation coefficient can be used to calculate the agreement of opinions (in this particular case there are eight experts), if the number of experts is greater than two, the agreement coefficient gives the degree of expert group agreement.

Determining the compatibility of assessment.

The set of expert evaluations is a matrix $E = ||e_{ij}||$ $(i = 1,\ldots, m; j = 1,\ldots,r)$, here m – the number of compared indicators, r – the number of experts participating in the research. Each j – th expert evaluates each i – th indicator. Only the classification of expert indicators

is suitable for the calculation of the dispersion concordance coefficient. If the experts evaluate the indicators in a different way, they should be preliminarily ranked, i. e. carry out a ranking procedure so that the most important indicator is given a rank equal to one, the second most important, a rank of two, etc. the last in order of important – rank m; where m – is the number of compared indicators.

In the first part of the survey, experts had to determine the weight of the factors and measures presented presented according to their influence on sustainability, assigning a number from 1 to 10, respectively,, 1 would have the least influence, 10 would have the most influence (Table 3), in this case,, the ranking procedure is necessary and is carried out for the corresponding assessment after assigning the opposite value (1).

$$e_{ij} = (e_{max} + 1) - e_{ijS}. \qquad (1)$$

where e_{ij} – the evaluation value after ranking, e_{max} – the maximum evaluation value (in this case 10), e_{ijS} – the initial evaluation value. After performing the ranking procedure, reordered values are obtained that meet the requirements for calculating the dispersion concordance coefficient (Table 4).

Table 3. Initial evaluations before the ranking procedure

Expert code, *j*	Alternative number, *i*									
	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
E1	8	2	7	6	5	10	1	3	9	4
E2	7	8	5	6	1	10	2	3	4	9
E3	9	4	5	10	2	7	1	3	8	6
E4	6	1	5	10	4	7	3	2	8	9
E5	2	1	3	5	6	8	4	9	7	10
E6	4	1	5	7	8	2	6	10	3	9
E7	4	1	5	8	9	3	6	10	2	7
E8	8	9	10	6	7	3	4	5	2	1

Sources: Developed by the authors based on questionnaire data

Table 4. Evaluations after completing the rank

Expert code, *j*	Alternative number, *i*									
	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
E1	3	9	4	5	6	1	10	8	2	7
E2	4	3	6	5	10	1	9	8	7	2
E3	2	7	6	1	9	4	10	8	3	5
E4	5	10	6	1	7	4	8	9	3	2
E5	9	10	8	6	5	3	7	2	4	1
E6	7	10	6	4	3	9	5	1	8	2
E7	7	10	6	3	2	8	5	1	9	4
E8	3	2	1	5	4	8	7	6	9	10

Source: Developed by the authors based on questionnaire data and calculations

After ranking procedure, the variance concordance coefficient defined by M. Kendall can be calculated. The basis of the calculation is the sum of the ranks e_i of each i, the indicator, in relation to all experts (2), in other words, the sum of the squares of the values e_i in deviation from the average rank $\bar{e}$ (4) S (analogy of variance) (3).

$$e_i = \sum_{j=1}^{r} e_{ij}. \ (i = 1, \dots, m) \qquad (2)$$

$$S = \sum_{i=1}^{m} (e_i - \bar{e})^2. \qquad (3)$$

$$\bar{e} = \frac{\sum_{i=1}^{m} e_i}{m} = \frac{\sum_{i=1}^{m} \sum_{j=1}^{r} e_{ij}}{m}. \qquad (4)$$

Theoretically, it is possible for all experts' assessments to be absolutely identical, in which case the experts' opinions could be considered maximally harmonized S_{max} (5), such a case would be considered ideal in the case of compatibility of expert opinions. If none of the evaluations matched, the value of S would be zero. If S is the real sum of squares, calculated according to formula (3), then the concordance coefficient W, when there are no associated ranks, is defined by the ratio of the sum of squares of the average rank S and the maximally agreed opinion of experts' assessment S_{max} (6).

$$S_{max} = \frac{r^2 m(m^2-1)}{12}. \qquad (5)$$

$$W = \frac{12S}{r^2 m(m^2-1)} = \frac{S}{S_{max}}. \qquad (6)$$

If the experts' opinions agree, the value of the concordance coefficient W approaches unity $W\ 1$, if the evaluations differ, the value of W approaches zero $W\ 0$.

When adapting to a specific research case, the compatibility of expert assessment was determined, i.e., the concordance coefficient (Table 5). It is estimated that the sum of all ranks $\sum_{i=1}^{r} e_i = 440$, the average of ranks $\bar{e} = \frac{440}{10} = 44$, the sum of squares of the deviation from the mean rank $S = 954,$, the sum of the maximum squares of deviation $S_{max} = \frac{8^2 10(10^2-1)}{12} = 5280$, so the concordance coefficient $W = 0{,}18$.

Table 5. Calculation of dispersion concordance coefficient

Alternative number, *i*	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	
The sum of ranks, e_i	40	61	43	30	46	38	61	43	45	33	440
Deviation from mean rank $(e_i - \bar{e})$ And average rank, $\bar{e}$	*-4*	*17*	*-1*	*-14*	*2*	*-6*	*17*	*-1*	*1*	*-11*	44
Squares of the deviation from the mean rank $(e_i - \bar{e})^2$ and their sum, *S*	*16*	*289*	*1*	*196*	*4*	*36*	*289*	*1*	*1*	*121*	954
Maximum matched estimates, S_{max}	5280										

Concordance coefficient, *W*	0,18

Source: Compiled by the authors based on calculations

Based solely on this concordance coefficient, it would be difficult to prove whether the opinions of experts are aligned, since the number of indicators considered is more than seven, so it is recommended to evaluate the importance of the concordance coefficient. M. Kendall proved that if the number of indicators $m > 7$, the significance of the concordance coefficient can be determined using the $\chi 2$ Pearson criterion. The random variable (7) is distributed according to the $\chi 2$ distribution with $\nu = m - 1$ degrees of freedom. According to the chosen significance level α (in practise 0,05 or 0,01 is usually used), the critical value is found in the distribution table with $\nu = m - 1$ degree of freedom. If the value of $\chi 2$ calculated in (7) is greater than the critical value of χ^2_{kr}, it is considered that the experts' assessments are in agreement. However, attention is drawn to the fact that when the number of indicators compared m is from three to seven, the $\chi 2$ distribution should be applied with caution, because the critical χ^2_{kr} The value of the distribution may be higher than the calculated one, although the level of agreement of the experts' opinions is still sufficient. In such case, it is possible to apply probabilistic tables of the concordance coefficient (with $3 \le m \le 7$) or S tables of critical values [36].

$$\chi^2 = Wr(m-1) = \frac{12rS(m-1)}{r^2 m(m^2-1)} = \frac{12S}{rm(m+1)}. \qquad (7)$$

In a specific case $\chi^2 = \frac{12*44}{8*10(10+1)} = 29{,}697$ $\chi^2 = \frac{12*44}{8*10(10+1)} = 29{,}697$,, the calculated degree of freedom ν=10-1=11, the significance level α=0,05 chosen, then the critical χ^2_{kr} The value from the difference table is $\chi^2_{kr} = 16{,}92$. After comparing the obtained results, we see that $\chi^2 > \chi^2_{kr}$, which means that the experts' opinions are considered statistically aligned, so it is possible to calculate the weight of each indicator.

Determination of weights.

As in the calculation of consensus of opinions, we will denote the results of expert evaluation by e_{ij} and place the matrix E =||eij|| (i = 1,…, m; j = l,...,r), where m is the number of indicators compared, r is the number of experts participating in the study. When calculating the dispersion coefficient of concordance, we had to perform a ranking procedure (1) for expert evaluations, while calculating the weights, it is necessary to rearrange the results again. The goal of reordering is to assign weights in descending order. This way the highest (first) position gets the highest value. The most accurate result is provided by a linear transformation of the estimates [32-33] (In this case, the criteria weight values can be calculated according to formula 8.

$$\omega_i = \frac{\sum_{j=1}^{r}(m+1-e_{ij})}{\sum_{i=1}^{m}\sum_{j=1}^{r}(m+1-e_{ij})}. \qquad (8)$$

Rearrange and calculating the results of the evaluations, we get the weights of the indicators, when the highest of the weights reflects the most influential indicator and vice versa.

Table 6. Reorganised indicator weights

Indicator number	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}

Rearranged indicator weights, ω_i	0,1091	0,0614	0,1023	**0,1318**	0,0955	0,1136	0,0614	0,1023	0,0977	**0,1250**

Source: Developed by the authors on the basis of calculations

As can be seen in Table 6, innovations leading to a green economy have the greatest weight in the process of green banking performing $(X_4 = 0{,}1318)$. Also an important aspect is $(X_{10} = 0{,}1250)$ green client's assessment. All other aspects and measures follow.

Significance assessment using the TOPSIS method.

In the first stage of the targeted part, experts evaluated aspects and measures by ranking them and comparing them with each other. In the second stage, experts were asked to rate each aspect or measure separately according to their importance, contributing to the promotion of sustainability from 1 to 5, where 1 is the least important and 5 is the most important (Table 7). We will use the TOPSIS (Technique for Order Preference by Similarity to an Ideal Solution) method to process the collected data. The TOPSIS method is one of the multi-criteria methods with profound theoretical and practical significance.

The main principle of this method is to select from the compared objects the one with the smallest distance from the best options and the largest distance from the worst options. The method can be applied to both maximising indicators (whose best values are the largest) and minimising indicators (whose best values are minimum), i.e., there is no need to preliminarily transform minimisation indicators into maximisation ones. The TOPSIS method is popular and often used in practice. The normalisation of the TOPSIS method and the evaluation criteria use the distance between two points.

Table 7. Expert evaluations of individual aspects and measures

Expert code, j	Alternative number, i									
	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
E1	5	3	4	4	2	5	1	3	4	3
E2	5	4	5	5	1	5	1	2	5	5
E3	5	3	4	5	3	5	3	3	5	4
E4	4	4	4	5	3	4	3	4	5	5
E5	2	2	4	5	5	5	5	5	5	5
E6	3	3	4	4	5	3	5	5	4	5
E7	3	3	3	4	5	2	5	5	4	4
E8	5	5	5	4	5	3	3	4	3	2

Source: Developed by authors based on survey data

The TOPSIS method uses vector data normalisation (9).

$$\tilde{r}_{ij} = \frac{r_{ij}}{\sqrt{\sum_{j=1}^{n} r_{ij}^2}}. \qquad (9)$$

here r_{ij} – the evaluation of the j-th expert for the i-th alternative, (i =1, ..., m; j =1,..., n), $\tilde{r}_{ij}$– the normalized value of the i-th indicator of the j-th object TOPSIS method. Next, the best solution (variant) V^* (10) is preliminarily selected, i.e. we find the maximum value of each maximisation indicator (multiplied by the corresponding weights ω_i) and the

minimum value of the minimisation indicator. The worst solution (variant) V^- (11) is also calculated.

$$V^* = \{V_1^*, V_2^*, \dots, V_m^*\} = \{(max_j \omega_i \tilde{r}_{ij} / i \in I_1), (min_j \omega_i \tilde{r}_{ij} / i \in I_2)\} \quad (10)$$

$$V^- = \{V_1^-, V_2^-, \dots, V_m^-\} = \{(min_j \omega_i \tilde{r}_{ij} / i \in I_1), (max_j \omega_i \tilde{r}_{ij} / i \in I_2)\} \quad (11)$$

Consequently, I1 is the set of indices for the maximised indicators, I2 is the set of indices for the minimised indicators, ω_i – the weight of the i-th indicator. The essence of the method, the distances to the best and the worst solutions, i. e. the total distance D_j^* of each compared variant to the best solutions (variants) V* (12) and the distance D_j^- to the worst solutions V^- (13). The evaluation criteria (distances) include the significance (weight) value ω_i of the relevant indicators, which affects the results.

$$D_j^* = \sqrt{\sum_{i=1}^{m} (\omega_i \tilde{r}_{ij} - V_i^*)^2}. \quad (12)$$

$$D_j^- = \sqrt{\sum_{i=1}^{m} (\omega_i \tilde{r}_{ij} - V_i^-)^2}. \quad (13)$$

The main criterion of the TOPSIS method C_j^* is calculated as the ratio of the distance to the worst solutions and the sum of the distances between the best and worst solutions (14) and the best solution (variant) corresponds to the highest value C_j^*.

$$C_j^* = \frac{D_j^-}{D_j^* + D_j^-}, (j = 1, \dots, n) \; (0 \le C_j^* \le 1). \quad (14)$$

Normalised data values are calculated (Table 8).

Table 8. Normalised $\mathbf{r}_{ij}$ values of calculation criteria $\tilde{\boldsymbol{r}}_{\boldsymbol{ij}}$.

	Alternative number, *i*									
	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
Weight, ω_i / Expert code, *j*	0,1091	0,0614	0,1023	0,1318	0,0955	0,1136	0,0614	0,1023	0,0977	0,1250
E1	0,137	0,082	0,110	0,110	0,055	0,137	0,027	0,082	0,110	0,082
E2	0,137	0,110	0,137	0,137	0,027	0,137	0,027	0,055	0,137	0,137
E3	0,137	0,082	0,110	0,137	0,082	0,137	0,082	0,082	0,137	0,110
E4	0,110	0,110	0,110	0,137	0,082	0,110	0,082	0,110	0,137	0,137
E5	0,055	0,055	0,110	0,137	0,137	0,137	0,137	0,137	0,137	0,137
E6	0,082	0,082	0,110	0,110	0,137	0,082	0,137	0,137	0,110	0,137
E7	0,082	0,082	0,082	0,110	0,137	0,055	0,137	0,137	0,110	0,110
E8	0,137	0,137	0,137	0,110	0,137	0,082	0,082	0,110	0,082	0,055

Source: Developed by authors based on survey data and calculations.

Next, it is necessary to calculate the weighted normalised values, because the TOPSIS method does not use normalized $\tilde{r}_{ij}$ values, but weighted $\omega_i \tilde{r}_{ij}$ (Table 9).

Table 9. Weighted normalized values $\boldsymbol{\omega_i \tilde{r}_{ij}}$

Expert code, *j*	Alternative number, *i*

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
E1	0,0149	0,0050	0,0112	0,0144	0,0052	0,0156	0,0017	0,0084	0,0107	0,0103
E2	0,0149	0,0067	0,0140	0,0180	0,0026	0,0156	0,0017	0,0056	0,0134	0,0171
E3	0,0149	0,0050	0,0112	0,0180	0,0078	0,0156	0,0050	0,0084	0,0134	0,0137
E4	0,0119	0,0067	0,0112	0,0180	0,0078	0,0124	0,0050	0,0112	0,0134	0,0171
E5	0,0060	0,0034	0,0112	0,0180	0,0131	0,0156	0,0084	0,0140	0,0134	0,0171
E6	0,0090	0,0050	0,0112	0,0144	0,0131	0,0093	0,0084	0,0140	0,0107	0,0171
E7	0,0090	0,0050	0,0084	0,0144	0,0131	0,0062	0,0084	0,0140	0,0107	0,0137
E8	0,0149	0,0084	0,0140	0,0144	0,0131	0,0093	0,0050	0,0112	0,0080	0,0068

Source: Developed by authors based on survey data and calculations

With the weighted normalised values, it is possible to select the values of the best solutions (variants) V^* and the values of the worst solutions (variants) V^- (Table 10).

Table 10. Values of the best V^* and worst V^- variants

Solutions (options)	Alternative number, i									
	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
V^*	0,015	0,008	0,014	0,018	0,013	0,016	0,008	0,014	0,013	0,017
V^-	0,006	0,003	0,008	0,014	0,003	0,006	0,002	0,006	0,008	0,007

Source: Developed by authors based on calculations

After selecting the best and worst variants, the values of the partial criteria (distances) of the TOPSIS methods are calculated, that is, the distances to the best solutions D_j^* (12) and to the worst solutions D_j^- (13) (Table 11).

Table 11. Distances of individual experts' assessments to solutions D_j^* and D_j^-

Solutions (options)	Expert code							
	E1	E2	E3	E4	E5	E6	E7	E8
D_j^*	0,0218	0,0219	0,0187	0,0177	0,0190	0,0180	0,0189	0,0204
D_j^-	0,0146	0,0190	0,0178	0,0177	0,0218	0,0193	0,0172	0,0174

Source: Developed by authors based on calculations

Based on the data in Table 11, the values of C_j^*14), the main criterion for evaluating alternatives of the TOPSIS method, are calculated (Table 12).

Table 12. Values of the TOPSIS method criterion C_j^* and positions occupied by expert evaluations.

Criterion	Expert code							
	E1	E2	E3	E4	E5	E6	E7	E8
C_j^*	0,4016	0,4646	0,4878	0,5003	0,5338	0,5179	0,4760	0,4608
Place	8	6	4	3	1	2	5	7

Source: Developed by authors based on calculations

As can be seen in Table 12, the best solution of aspects and measures according to the TOPSIS method, by evaluating the weights of each measure, was accepted by expert E5, followed by experts E6 and E4. The evaluations of the selected experts are presented in Table 13.

Table 13. Evaluations of experts who took the highest places using the TOPSIS method.

Expert code, j	Alternative number, i									
	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
E5	2	2	4	5	5	5	5	5	5	5
E6	3	3	4	4	5	3	5	5	4	5
E4	4	4	4	5	3	4	3	4	5	5

Source: Developed by authors based on survey data

Analysing the data collected from experts on the importance of each factor using the TOPSIS method, all data were normalised according to vector data normalisation, then all assessments were weighted, including previously calculated factor weights. Since the main principle of the TOPSIS method is to select from the compared objects the one with the smallest distance from the best options and the largest distance from the worst options, the values of the best V^* and worst V^- options and the distances of individual experts' assessments to the solutions D_j^* and D_j^- were calculated. After evaluating these indicators, the values of the TOPSIS method criterion C_j^* and the places occupied by experts' evaluations were calculated. It was found that the main factor of the aspects and measures according to this method is X10 (green client's assessment). It follows that clients should evaluate the green level of the concrete bank. Other main factors are the following. X4, (innovations leading to a green economy), X8 (green financial products and services), X9 (green education-teaching). Here we also can find the weights of each indicator (Table 14).

Table 14. Reorganised indicator weights and importance

Indicator number	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
Indicator weights, ω_i	0,072	0,072	0,096	0,112	0,104	0,096	0,104	0,112	0,112	0,12
Place	9-10	9-10	7-8	2-4	5-6	7-8	5-6	2-4	2-4	1

Source: Developed by the authors on the basis of calculations

4. Discussion

The study was subject to several limitations.

1. Several methods of expert evaluation can be used to evaluate expert opinion and similar results would likely be obtained, but the TOPSIS method is used for analysis, which is one of the simplest and most reliable methods used for evaluating expert opinion.

2. The more experts interviewed, the more reliable the results are likely to be. In the article, 8 experts are selected for analysis, because based on the results of the literature analysis, this is the optimal number of experts in order to obtain reliable results.

3. Different factors/alternatives can be applied when analyzing the banking activities. Here, 10 groups of indicators have been selected, which best reflect the analyzed topic.

5. Conclusions

The assessment of the green performance of business units is carried out according to the strategy, adjustment of goals, the definition and monitoring of sustainability indicators, and the submission of reports. In addition to traditional green transition activities, the banking sector plays a broader role by financing and investing in renewable

energy and energy efficiency projects, offering environmentally friendly products and services, and working with stakeholders to promote the transition to a green economy. more sustainable. The banking sector has played an important role in promoting the green development goals of the economy, both as an organization (e.g. by implementing various improvements) and by fulfilling its environmental responsibilities by integrating green lending practices into its decisions.

Based on content analysis, we have systemized a set of criteria: Management of Resources (internal); Waste Management (internal); Management of Emissions (internal); Innovations leading to a green economy; Internal governance; External assessment; Transparency; Green financial products and services; Green education-teaching; Green clients' assessment have been chosen for further evaluation by eight experts.

Based on the results of expert questionnaires, the concordance coefficient W = 0,18 was calculated, but based only on this concordance coefficient, it would be difficult to prove whether the opinions of experts are aligned, since the number of indicators under consideration is more than seven, so the significance of the concordance coefficient was evaluated according to the $\chi 2$ Pearson criterion 2. If the significance level $\alpha = 0.05$ and the degree of freedom $\nu = 10 - 1 = 11$, the calculated critical value $\chi^2_{kr} = 16{,}92$, Pearson's criterion $\chi^2 = 29{,}697$, since the latter is greater than the critical value, is accepted, that experts' opinions are statically aligned. After calculating the weights of each factor, it was found that, according to experts' assessment, the biggest weight in the process of green banking performing is ($X_4 = 0{,}1318$) innovations leading to green economy. Also, an important aspect is ($X_{10} = 0{,}1250$) green client's assessment.

As a result, here the main methodology for green banking performance evaluation is proposed and the main indicators with their importance (weight) are presented.

The results of our study can be useful insights for regulators and managers for transforming processes and expanding knowledge of green performance in banking processes, as well as for avoiding ecological simulation (greenwashing). For future studies the full methodology of formulating index can be developed by evaluating various indicators under chosen criteria, following [37-38].

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