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Sustainability performance efficiency in the banking sector

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ABSTRACT

Traditional sustainability reporting is based on an internally developed methodology and does not fully cope with the sustainability performance evaluation, especially from an external perspective. This study aims to fill this gap by offering a tool that may be used to assess the company's performance based on the results presented to external users. For this purpose, a two-stage data envelopment analysis (DEA) is proposed, that enables a comparison of the sustainability performance disclosed in non-financial reports in the banking industry in Poland, Croatia, and Romania. The findings of our study identify differences between the efficiency of sustainability performance in the banking sectors of all three countries. The proposed approach to compare hard-to-compare sustainability performance may significantly contribute to the decision-making process for stakeholders and, therefore, to the advancement of sustainability performance measurement research.

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1. Introduction

Sustainability may be understood as the ability to manage economic, social, and environmental performance (Dai et al., 2022; Liebetruht, 2017), and the stakeholders are attracted to companies that act in a sustainable way with a focus on long-term profitability and competitive advantage. Nevertheless, despite the importance of sustainable development, the existing practice does not sufficiently address sustainability, especially in terms of measuring sustainability performance and its efficiency (Marcelino et al., 2015). Moreover, it usually ignores the external stakeholders' perspective that has access to publicly available data, including sustainability reports. Research in sustainability has been growing at a very high pace over the past years, and it has explored a variety of issues, from sustainability disclosure to measurement

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in green supply chains, from the diffusion of environmental standards to the political use of sustainability metrics (Mura et al., 2018). Some fields expanded significantly over recent years, and others appear to be waning, or their presence is negligible. One of them is the issue of the practical tools that would measure the efficiency concerning sustainability performance. Especially the external evaluation of sustainability performance seems to be the most flawed. While the implementation of a sustainability strategy regards the means to reach certain outcomes and goals, sustainability performance reflects the notion of different consequences of a sustainability process, but as it is confirmed by previous studies (Schulte & Knuts, 2022), it is not analyzed sufficiently.

The lack of a comprehensive view of sustainability performance measurement has led to incomplete framing of the problem, the proposal of partial solutions futile efforts of managers that cannot learn from evaluating their sustainability engagement. A recent systematic literature review by Silva et al. (2019) confirms it and shows stakeholders' dissatisfaction with sustainability performance measurement and assessment approaches. The results of their study confirm that despite recognizing the importance of measuring and assessing sustainability performance and an increasing number of publications on diverse methods that deal with this topic (Searcy, 2012), stakeholders in practice are dissatisfied with existing approaches to the evaluation of sustainability performance (Cone Communications and Ebiquty, 2017; Searcy, 2012). These indicate a research gap that should be filled with a proposal of tools that would streamline the work of managers and offer an approach enabling stakeholders to evaluate sustainability performance efficiency. Our research contributes to filling these research gaps by presenting the DEA approach and its application in the banking sector of selected countries to assess their sustainability performance efficiency. Our work also answers the call of Wagner (2007) and Silva et al. (2019), which raised the need to research tools for integrating the processes for improving sustainability performance, including monitoring, control, and evaluation of their efficiency.

The determinants, like historical circumstances, cultural differences, and institutional and economic discrepancies between developing and developed financial markets, may influence the efficiency of sustainability management in the institutions from this region (Albu et al., 2021), and they are largely neglected in the existing research. In response to that, in this study, we focus on the efficiency of sustainability engagement disclosed in sustainability reports by banks in the so-far generally poorly researched CEE countries. Corporate sustainability performance presented in sustainability reporting does not allow direct evaluation or the comparison of results due to a large amount of non-financial, narrative, loosely related to financial performance data (Bernow et al., 2019). Therefore, it reduces the decision-making utility of this information. Currently, there is a lack of tools and methods, either in practice or in theory, that would provide an objective assessment of the sustainability performance disclosed to stakeholders (Hellstrand, 2017). While there is much research on the development of internal evaluation of sustainability performance management (Liebetruth, 2017), there is a lack of research on how to evaluate these results from the external stakeholders' perspective. Therefore, considering the presented premises, we find an existing research niche in assessing corporate sustainability performance

based on sustainability disclosure dedicated to external stakeholders. The tool proposal presented in this study is a new approach that aims to tackle these constraints.

This study aims to supplement outcomes evaluation by an assessment of the company's sustainability performance presented to the external users in sustainability reports. The paper presents the results of an empirical study of corporate sustainability performance efficiency, measured based on publicly available data disclosed by the biggest public banks from Poland, Croatia, and Romania. We verify the efficiency of sustainability performance disclosed by these banks, assuming the disclosure as a communication tool that explains the success of sustainability performance. As the primary research method, the Data Envelopment Analysis (DEA) is used, a globally recognized tool for measuring enterprise involvement in sustainable practices (Belu, 2009). We apply an additive two-stage DEA estimator in the banking sector in the chosen countries for the period of 2015–2018 to create a composite efficiency index. In this study, we formulate the research hypothesis that it is possible to determine the efficiency of the sustainability performance of banks in selected CEE countries on the basis of disclosure to external stakeholders.

Sustainable performance collected for this study was based on the content analysis regarding disclosures in banks' reports and websites referring to aspects determined according to the Directive 2014/95/EU, ISO 26,000, and GRI guidelines. Thus, the research is dedicated to analyzing the financial inputs and business-organizational performance together with the social-environmental performance of the banks in the analyzed countries. We focus on the banking sector due to the growing importance of sustainability engagement in banking, especially noticeable after the financial crisis in 2008, where sustainability engagement was treated as a way for banks and other financial institutions to earn back the credibility and trust of their clients. The approach proposed in this paper allows external stakeholders (in our case, mainly financial analysts and investors) to comprehend the efficiency of the sustainability strategy that may create bases for making more informed and rational decisions. At the same time, it may help support sustainability management in every organization.

This study's main contribution is that it offers a new tool that helps managers estimate the effectiveness of the results and compare them to other companies. However, it may also be used by external stakeholders, which may evaluate the disclosed sustainability performance. The proposed tool also gives the possibility to compare alternative investment opportunities. It shows how effectively the analyzed company transforms its resources into sustainability achievement. It gives a new perspective on sustainability performance measurement and evaluation, opening the opportunities to review the analyzed data from different angles, and giving them a new significance.

The practical implications of this research are that the proposed tool and its novel application offer a unique opportunity not only to evaluate the sustainability performance but also to stake the potential for the manager to work with the data on performance in perspective of the long-term view and learning from sustainability performance outcomes. The idea of learning has already been widely adopted in the area of manufacturing efficiency and has resulted in improved performance (Xie et al., 2022); therefore, its application should also be considered in other sectors to refine sustainability management. The tool proposed in this paper can increase the

organization's ability to learn and improve rather than purely control. An organization that can learn more rapidly from its experiences and uses that learning to enhance its performance will have a distinct advantage. It aligns with Kirkham and Williams (2020), stating that management governance, methods, and processes should embrace new methods and methodologies to maximize learning in practice. Adopting the proposed tool creates conditions in which the manager's work is not focused on the performance itself but gives it a new context and possible interpretations and use. The results of the proposed approach stress the existence of differences and trends, not the absolute numbers that are hardly measured in the case of intangible outcomes. Future management will probably always be more frequently challenged with social and environmental issues; therefore, they need appropriate tools to empower and improve their work. One of them is that presented in this work.

The conclusions of our study may also lead to the improvement of both internal and external stakeholders' decision-making processes related to the assessment of achieving sustainable development goals. At the same time, the conclusions may lead banks to focus on the efficiency of their sustainability performance and thus support managers operating in that field. They may also influence better reporting practices.

As a novelty, we propose the DEA two-stage approach to measure sustainability management efficiency. According to the authors' best knowledge, empirical studies on sustainability reporting in the banking sector in CEE with the DEA approach used to evaluate sustainability performance are almost non-existent. Moreover, there is a general lack of studies on sustainability performance in CEE banks (Fijałkowska et al., 2017). However, the approach proposed in this article has universal applicability and may be used in other institutions from different sectors and diverse countries. It answers the call for more complex and sophisticated methods of sustainability performance evaluation that translate into increased management control and efficiency. In this way, the newly proposed use of the presented tool can significantly contribute to more successful management. These results contribute to the advancement of sustainability performance measurement research.

2. Literature review

Nowadays, sustainable performance has become a global topic of increased interest for every organization (Dai et al., 2022). As such, organizations are increasingly facing pressure to change manufacturing models from traditional to sustainable, reinforcing the need to assess their sustainability performance (Gupta et al., 2021). At the same time, companies engaged in sustainability activities are expected to think outside the box and above the usual boundaries while developing communication about long-term and short-term social and environmental achievements (Toljaga-Nikolić et al., 2020). The communication on sustainability performance should respond to stakeholder demands (Herremans et al., 2016). However, the existing performance measurement and management based on control systems cannot respond to the increasingly complex expectations of stakeholders and highly uncertain organizational environments (Bourne et al., 2018). Recently, rising economic and business

uncertainty have influence corporate accountability and thus corporate reporting is also expected to be changed (Zyznarska-Dworczak, 2022).

Over the past years, different frameworks and indicators' systems have been proposed to evaluate sustainable performance. The measurement tools were developed in particular for the manufacturing of the product, process, and system levels (Eslami et al., 2019; Huang & Badurdeen, 2017), and current research has mainly explored the construction industry (Stanitsas et al., 2021; Yu et al., 2018), engineering (Yu et al., 2018; Zavadskas et al., 2018), and much fewer service industries like banking (Buallay et al., 2021; Fijałkowska et al., 2018). Although companies have gathered data to present a general picture of their sustainability performance (Handford, 2010), this approach is not enough. Performance measurement and management have been used to help organizations achieve their goals and deliver their mission (Bourne et al., 2018). However, despite considerable progress, managing performance effectively remains a significant organizational challenge (Cappelli & Tavis, 2016).

Until now, the tools used to assess sustainability have varied across different research fields. Several approaches to measuring the sustainability performance of organizations and regions have been proposed. These include the Pressure-State-Response model, the Ecological Footprint and Barometer of Sustainability approaches, the Environmental Sustainability Index, and others (Chang et al., 2013). Phillis et al. (2010) have provided an overview of these approaches. Vollenbroek discussed sustainable development from a process-oriented point of view and suggested that innovation would be an effective tool for sustainable development in the future (Vollenbroek, 2002). The authors suggested that the available data indicate that particular impact indicators exist within specific regions (Olsthoorn et al., 2001; Phillis et al., 2011). Nevertheless, few studies have presented empirical profiles of industry-level corporate sustainability or assessed industry-level changes in sustainability over time. Given that the aim of sustainable development is to achieve a compromise between economic progress and the protection of the environment, this study employs a composite indicator for corporate sustainability that consists of three pillars: the economic, environmental, and social dimensions of performance.

As the topic of sustainable engagement of companies gains momentum, also its performance management, including appropriate evaluation, must be supported by new approaches and tools. To know if sustainability management is successful and, therefore, to understand which processes are more efficient and which need improvement, sustainability performance should be measured in a qualitative and/or quantitative manner.

Previous researchers mainly focused on choosing proper performance indicators (Searcy, 2011). However, other issues that should also be addressed are data, data requirements, attributions of responsibility, communication, and the pragmatic use of these indicators. The efficiency of sustainability performance should have particular importance in those analyses, as it is a crucial goal of a successful strategy. The existing literature, however confirms that the efficiency of corporate sustainability performance is usually ignored (Chen & Delmas, 2011; Mardani et al., 2017; Piatti & Cincinelli, 2015; Van Passel et al., 2007). The reason is probably the lack of an appropriate tool to measure it. Several studies deal with the issue of the efficiency of

sustainability engagement; however, they refer to singular countries and focus exclusively on advanced economies (Halkos et al., 2016). Chang et al. (2013) examine 311 firms from various industries showing significant sectoral differences concerning corporate sustainability performance efficiency. Van Passel et al. (2007) analyze sustainability efficiency in the agriculture industry in Europe. The literature review also proves that the current research has mainly explored the sustainability issues in construction and engineering industries (Stanitsas et al., 2021; Yu et al., 2018; Zavadskas et al., 2018), and much fewer in banking (Buallay et al., 2021; Fijałkowska et al., 2018; Scholtens, 2009), still without focusing on the efficiency of sustainability performance.

Banks have never been perceived as particularly harmful or dangerous to the environment. The connections between sustainable development and banking activities date back to the 1990s (Jeucken, 2010), when banks increasingly began to incorporate environmental requirements directly through their operational activities and indirectly through the products and services they offered (Scholtens, 2009). Nevertheless, before the 2008 financial crisis, banks were not extensively involved in corporate social responsibility or the disclosure of sustainability performance. However, after the financial crisis, banks needed to adjust product prices to new market challenges, reduce costs, and escape from low-margin products and unprofitable business segments. Some are also engaged in socially responsible and sustainable activities and their promotion.

Banks are commonly treated as institutions of public trust, responsible for effectively managing risks associated with their activities and, in particular, securing return on resources entrusted to them by their depositors. Moreover, they perform several socially responsible functions related to efficient capital allocation and savings accumulation. Banks have a unique way of impacting society, i.e., they can be engaged in sustainable development activities themselves, and they can affect other businesses by financing projects. The situation in the banking sector, in both financial and reputational aspects, strongly determines the quality and prospects of the financial services market. At the same time, the reputation of banks depends on many factors—to a high degree in their sustainability engagement. Therefore, many banks engage in activities concerning sustainability, and they report on that. Sustainable business strategies are being implemented in many projects, which has led to a recent expansion of interest in exploring the potential of integrating sustainability dimensions (Toljaga-Nikolić et al., 2020). However, the question remains how efficient the activities are in sustainability engagement.

The existing research on sustainability issues focuses mainly on the Western economies (Palmer & Flanagan, 2016) and Asia regions (e.g., Rasul, 2016), significantly over dominating research concerning Central and Eastern Europe (CEE) countries (Bhatia & Tuli, 2018). The topic of sustainability in CEE countries is not new, and its importance is growing, in particular as part of the integration within the European Union (Peršić & Lahorka, 2018), though the CEE countries with closer links to the west have reached higher levels of corporate transparency (Arsov & Bucevska, 2017). Still, due to a lack of commonly accepted sustainability reporting standards and the inability to compare the information reported worldwide, the

practice of sustainability disclosure is considered inefficient and sometimes ineffective (Fijałkowska et al., 2018). Moreover, managers in developing countries are still lagging in integrating the concept of sustainability into core practices of managing activities (Zyznarska-Dworczak, 2018),

Developing countries have different corporate reporting and accounting systems (Zyznarska-Dworczak et al., 2020), however, managers in these countries are similarly lagging in integrating the concept of sustainability into core practices of managing and reporting activities (Zyznarska-Dworczak, 2018). Consequently, it is vital for both science and practice to develop tools supporting the assessment of their efficiency. Therefore our research refers to banks from Poland, Croatia, and Romania. The growing interest in sustainability reporting in the banking sector is observed in scientific research of each analyzed country (Fijałkowska et al., 2017, 2018; Fijałkowska & Zyznarska-Dworczak, 2017, 2018; Frecea, 2017; Rogośi, 2014; Tamas-Szora & Socol, 2015). None of these studies, however, referred to the efficiency of sustainability performance management.

Based on the literature review presented above, we formulate the following research hypothesis that it is possible to determine the efficiency of the sustainability performance of banks in selected CEE countries on the basis of disclosure to external stakeholders.

3. Methods

3.1. Research assumptions and approach

Concerning performance management as a set of activities that cover planning, monitoring, and controlling and support processes focusing on economic, environmental, and social aspects during the life-cycle, aimed at realizing transparent, fair, and ethical benefits for stakeholders, we assumed that a sustainability reporting could be considered an example of data source for the evaluation of the sustainability performance management of the companies. In our opinion, since the main communication channel of sustainability performance for external stakeholders is sustainability reporting, it must be a key stage in management and requires appropriate control and management. Therefore, it is particularly important to understand how stakeholders can evaluate sustainability performance based on the results made public to them (i.e., in the form of sustainability reports). Based on the management information system, all these requirements could be met also in the sustainability reporting process if it is presented *via* its elements as shown in Table 1.

In our opinion, a sustainability reporting framework may define a precise strategic direction and performance measurement discipline, and thus it may provide a set of tools for managing sustainability performance. Thus stakeholders can receive relevant information connected to each identified management element. For instance, sustainability performance management focuses on information on sustainability, such as social and environmental factors, which are expected to be disclosed in sustainability reports with the detection of sustainability risks, issues, resources, and accounting information (if available) to increase stakeholders' trust.

Table 1. Proposed key elements of the management from the perspective of sustainability reporting.

Elements of sustainability performance management	Details presented for stakeholders in sustainability reports
Identification of sustainability engagement	Key information
Scope description for sustainability reporting (inputs)	The aim of the report Main addresses of the report (key stakeholders of the company) Guidelines giving a foundation for the report preparation Time covered by the report Main topics described Corporate organizational governance Human rights Labor practices Environmental activities Fair operating practices Clients issues Community involvement Business model Risk management
Underpinning values and attitudes, expected behaviours (outputs)	Efficiency in energy use/use of renewable energy CO ₂ emission Water use Air pollution Gender equality/diversity Working conditions Health and safety at work Dialogue with local stakeholders Corruption and bribery issues Codes of ethics Values Procedures against money laundering and terrorism financing (AML/CTF)
Key Issues	GARs
Key Risks	Top issues reporting
Resources (Plan vs. Actual)	Top risks reporting
Accounting	Budget monitoring Plan, actual, revenues, expenses

Source: Based on Taniguchi & Onosato, 2018; Directive 2014/95/EU (European Union, 2014) and ISO 26000 (International Organization for Standardization).

Based on these assumptions and conclusions, we focus on publicly available data from the banking sector in selected CEE countries. We propose to adopt the Data Envelopment Analysis (DEA) tool that can serve as a tool for measuring and comparing the sustainability performance disclosed by the banks in three CEE countries. DEA may be prepared based on the data disclosed by the companies in the sustainable reports and other publicly available data, which is also a great advantage of this approach and may be widely used by diverse stakeholder groups. DEA is a linear programming problem approach for evaluating the relative efficiency of decisions and actions, making units (DMUs) with multiple inputs and outputs (Chen & Zhang, 2009), and it is much more sophisticated than linear regression. DEA was introduced by Charnes et al. (1978) as a response to the need for adequate procedures to assess the relative efficiencies of multi-input multi-output production units. Today it is considered a “powerful methodology” to measure efficiency (Cook & Seiford, 2009), but it is still rarely used to assess sustainability efficiency. The two-stage process has a unique feature in that the first stage’s outputs are the only inputs to the and second

stage (Chen & Zhang, 2009). These models allow us to consider multiple variables and balance multiple objectives in the evaluation process, which is a unique characteristic of this method. As the issue of sustainability is multidimensional and complex, bringing diverse and multidimensional effects, we believe the use of this method is appropriate, however, until now infrequent in the existing research.

3.2. The research model

To verify the hypothesis formulated above, we use a two-stage DEA approach that is a way of efficiency assessment in terms of corporate social, environmental, and financial performance. One of the merits of two-stage network DEA models is that the estimated sub-stage efficiencies help decision-makers to establish the inefficient source and understand the improvement directions for each DMU (Decision Making Unit) under evaluation.

To apply the two-stage approach of DEA, we use the following notation:

$j \in J = 1, 2, \dots, n$ - the index of n DMUs,

$j_0 \in J$ - denotes the evaluated DMU,

$X_j = (x_{ij}, i = 1, 2, \dots, m)$ - the vector of the initial inputs used by DMU $_j$,

$Z_j = (z_{pj}, p = 1, 2, \dots, q)$ - the vector of the intermediate measures for DMU $_j$,

$Y_j = (y_{rj}, r = 1, 2, \dots, s)$ - the vector of the final outputs produced by DMU $_j$,

$v = (v_1, v_2, \dots, v_m)$ - the vector of weights for the initial inputs,

$w = (w_1, w_2, \dots, w_q)$ - the vector of weights for the intermediate measures,

$u = (u_1, u_2, \dots, u_s)$ - the vector of weights for the final outputs,

e_{j_0} - the overall efficiency of DMU $_{j_0}$,

e_{1j_0} - the stage 1 efficiency for DMU $_{j_0}$,

e_{2j_0} - the stage 2 efficiency for DMU $_{j_0}$.

We consider the elementary two-stage DEA system as represented in Figure 1, with each DMU transforming external inputs X into final outputs Y via intermediate measures Z by a two-stage process. In this basic setting, only external inputs to the first stage enter the system, and only outputs to the second stage leave the system.

Supposing there are n DMUs in the system, we would typically define the efficiency of the first stage and second stage to DMU $_j$ as follows:

$$e_j^1 = \frac{wZ_j}{vX_j}, e_j^2 = \frac{uY_j}{\tilde{w}Z_j}. \quad (1)$$

Theoretically, the multipliers w and \tilde{w} for the intermediate measures do not have to be equal in efficiency evaluation. However, DEA researchers have broadly agreed that the same intermediate product Z has the same multipliers associated with it. In this paper, we thus assume $w = \tilde{w}$.

The overall efficiency of the two-stage process is defined by the following relational model (Li et al., 2018), which is the product of the stage efficiencies:

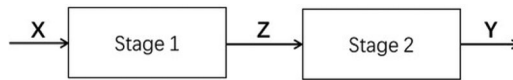


Figure 1. Two-stage system.
Source: own elaboration.

$$\begin{aligned}
 \text{Max } e_{j0} &= e_{j0}^1 \cdot e_{j0}^2 = \frac{\mathbf{u}Y_{j0}}{\mathbf{v}X_{j0}} \\
 &\quad \text{s.t.} \\
 \frac{\mathbf{w}Z_j}{\mathbf{v}X_j} &\leq 1; \quad \frac{\mathbf{u}Y_j}{\mathbf{w}Z_j} \leq 1, \quad j = 1, 2, \dots, n \\
 \mathbf{v}, \mathbf{w}, \mathbf{u} &\geq \varepsilon
 \end{aligned} \tag{2}$$

where ε is a non-Archimedean constant.

Equation (2) represents fractional programming and can be transformed into linear programming by applying the Charnes–Cooper transformation (Charnes & Cooper, 1962).

After achieving the overall efficiency, the stage efficiencies can be calculated *via* Equation (1). Due to the existence of multiple optimal solutions in a linear program, it may lead to non-uniqueness for sub-stage efficiencies when decomposing the overall efficiency into stage efficiencies. By applying the standard two-stage DEA model, we can obtain the efficiency score of each stage and its corresponding rank. It is meaningless to compare the efficiency scores between the two stages. Although the efficiency of stage 1 for DMU_{j0} is greater than that of stage 2, it does not mean that stage 1 performs better than stage 2. However, we can estimate the relative advantages for each stage by rank. For example, the efficiency score of stage 2 is higher than that of stage 1, thus we can judge that stage 2 has advantages relative to stage 1. Therefore, we should bear in mind the relative advantages of the two stages when conducting an efficiency decomposition.

Our research is done in two steps approach: first, the efficiency of the business-organizational goals management is measured. In the next stage of the analysis, we assume that banks are introducing solutions that allow for achieving social and environmental goals in the field of sustainable development. The more social and environmental goals are achieved, the more efficient a bank is. The bank's sustainability performance management efficiency assessment should include all these fields of the institution's development.

The research sample consists of all the publicly listed banks from Poland, Croatia, and Romania. They account for 12 banks quoted on the Warsaw Stock Exchange, 9 on the Zagreb Stock Exchange, and 3 on the Bucharest Stock Exchange. We analyzed all together 96 annual reports of banks: 48 reports of banks from Poland, 36 reports of banks from Croatia and 12 reports of banks from Romania available for the period 2015–2018. All the English-language websites of the banks in our sample were also analysed. The non-financial data has been manually collected through the content analysis of annual reports and sustainability/CSR reports of the analysed institutions, whereas financial data concerning revenues and the level of deposits were derived from EMIS databases. While carrying out the content analysis, we studied the information disclosed by the banks from our sample in 21 different areas. The items to be analyzed were determined according to the Directive 2014/95/EU (European Union,

Table 2. ANOVA test for the efficiency of transforming the initial inputs directly into the achievements of social and environmental goals.

Source	Statistic	df	F(df1,	df2)=	F	Prob > F
Year	0.93	3	3	82	1.93	0.1317
Country	0.81	2	2	82	9.62	0.0002
Year*Country	0.97	6	6	82	0.41	0.8711

Source: own elaboration.

2014), ISO 26000 (International Organization for Standardization) as well as GRI guidelines and covered the issues indicated in Table 2. We conducted content analysis following the approach proposed by Dumitru et al. (2017), which is based on the following scoring system: 0 (no presentation), 1 (narrative presentation), 2 (presentation using key performance indicators (KPIs) or other numerical data), 3 (narrative and numerical presentation, at the same time). We also researched whether the banks in the sample received any awards concerning outstanding achievements recognized by international or national bodies in the field of sustainability or socially responsible behavior. Moreover, we checked if the banks were quoted on a special index of the stock exchanges where highly socially responsible companies are admitted.

In this study, we adopt two kinds of variables signaling the company's sustainability. One is a dummy variable equal to 1 if the bank publishes a sustainability report. The second variable is concerned with the intensity of sustainability disclosure that we calculate, creating indexes concerning three dimensions of sustainability performance: business-organizational, social and environmental. These indexes were composed of indicators calculated based on the information retrieved from the content analysis. Content analysis is a primary research method applied in a semi-objective approach that follows the division of research methods applied to the analysis of narratives in annual reports proposed by Beattie et al. (2004, p. 209). We analyse the data disclosed in the whole period of our research for 2015–2018, for all of the 24 publicly listed banks in three analyzed countries. We create three main dimensions of the sustainability performance of banks. We calculated the indicators that enable the evaluation of sustainability in three main areas by giving weights according to the way/intensity of the information disclosure:

- the first was business-organizational index that is composed of the indicators defining the organization itself, e.g. its corporate governance, risk management, business model, procedures against money laundering and terrorists;
- the second one is a social index composed of the indicators related to social issues e.g. human rights, labor practices, fair operating practices, community involvement, consumer issue, community involvement, gender equality, working conditions, health and safety at work, dialogue with local communities, corruption and bribery, ethical code and values;
- the third one is an environmental index composed of indicators concerning the environment, e.g. environmental activities, efficiency in energy use/use of renewable energy, CO₂ emission, water use, and air pollution.

These indexes assess the overall extent and quality of social and environmental disclosures and, therefore, may also constitute the measures representing the efficiency of sustainability performance management.

4. Results and discussion

The application of the DEA model allowed us to present information on the assessment of banks' efficiency, obtained in individual stages of the two-stage DEA approach. Input data for the first stage included financial ratios: total revenue, the total value of deposits in euros, and additional data concerning employment. These three values were used to determine the size and financial position of the analyzed banks and their potential to engage in sustainability activities. In this view, previous research suggested that better financial performing organizations are more involved in sustainability reporting and actions (Murray et al., 2006). As the output data, the assessment of the degree of achievement of sustainable development objectives was used: it was expressed as the sum of social indicators (social index) and the sum of environmental indicators (environmental index) analyzed separately.

As the intermediate measures, we chose the sum of business-organizational indicators, the level of information on sustainability policy (the presence of the sustainability/CSR report published and/or the existence of the sustainability tab on the banks' website), and the appreciation of sustainability performance recognized by the business and institutional environment (sustainability/CSR awards and prizes, being listed on the CSR index).

Such prioritization of input data, intermediate measures, and output data are intended to reflect the organisation's development. We assume that it is easier for banks to achieve their business-organizational goals first, and only then to achieve social and environmental goals. In the empirical study, the CCR - DEA output-oriented model was used in both stages of the two-stage DEA approach. Moreover, the efficiency obtained from the CCR - DEA output-oriented model directly on the input and output data without the intermediate stage was also estimated. The results of efficiency evaluation obtained directly on input variables (X) and output variables (Y) are shown in [Figure 1](#).

On the other hand, the efficiency evaluation using the two-stage model is shown in [Figure 2](#). The efficiency results were measured with values from 0 to 1, where the fully efficient bank obtains a result equal to 1. This means that for a given input vector there is no bank with a better output vector. In our study, the values shown in [Figure 1](#) inform us about the efficiency of transforming the initial inputs directly into the achievements of social and environmental goals. This efficiency was generally very low in all Polish banks in the analyzed period (except Idea Bank S.A in 2017 and BOS S.A. in 2018). The efficiency at this stage was usually very high in Croatian banks - often arriving very close (10 times in the whole Croatian sample) or precisely to the maximum possible score. In the case of the two smallest Croatian banks (considering financial ratios and employment), their efficiency was very low. Kreditna Banka Zagreb d.d. was medium efficient in 2015, and its efficiency was also very low later. In Romanian banks, this stage efficiency was always very low except for one bank (Patria Bank SA) that obtained the maximum score in 2017 and 2018. In the cases of high scores of this efficiency, the results mean that the high efficiency in the social and environmental dimension was achieved directly using the initial input and was not dependent on the business-organizational construct of the entity.

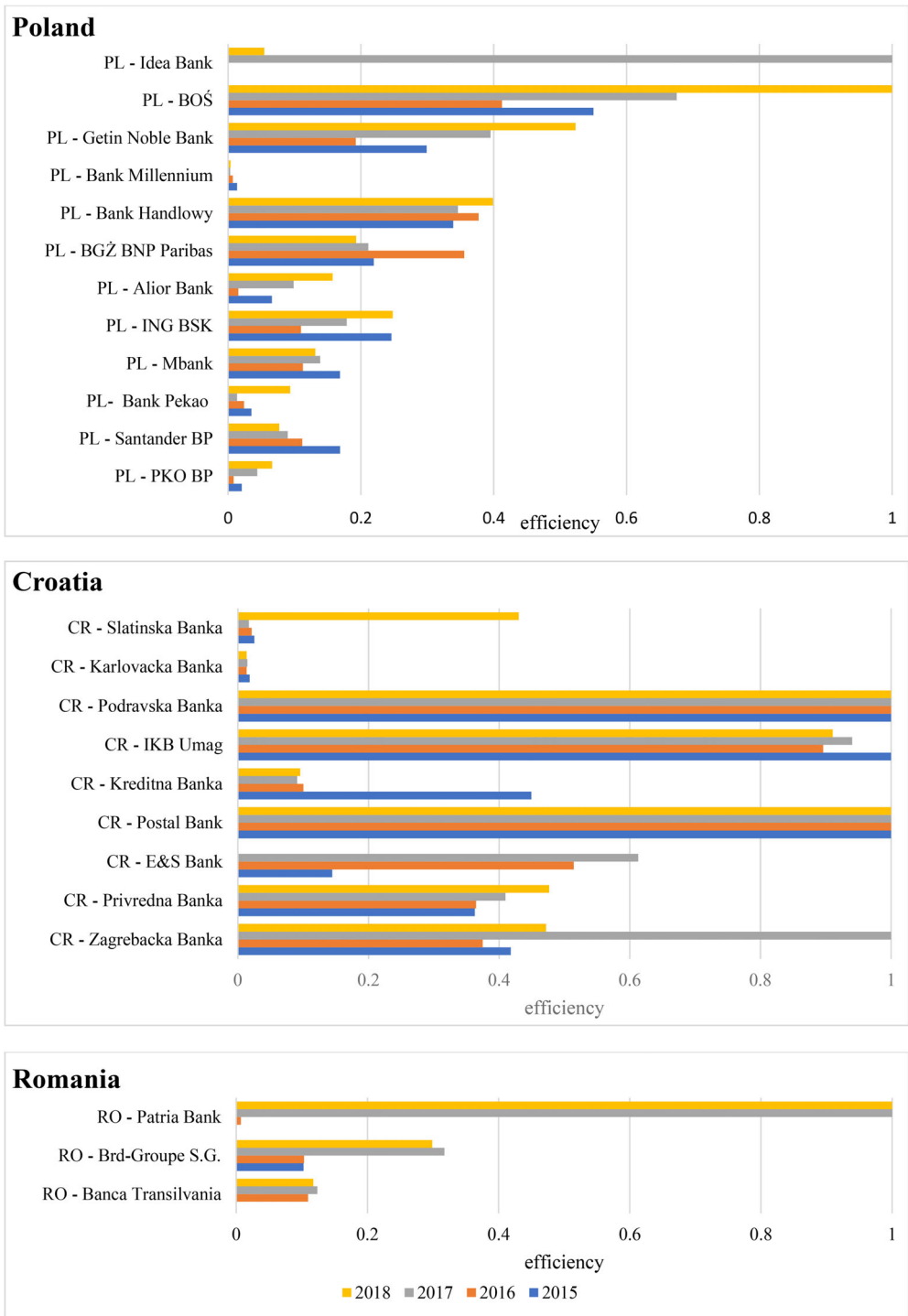


Figure 2. The efficiency obtained from the CCR - DEA output-oriented model directly on the global input and output.
Source: own elaboration.

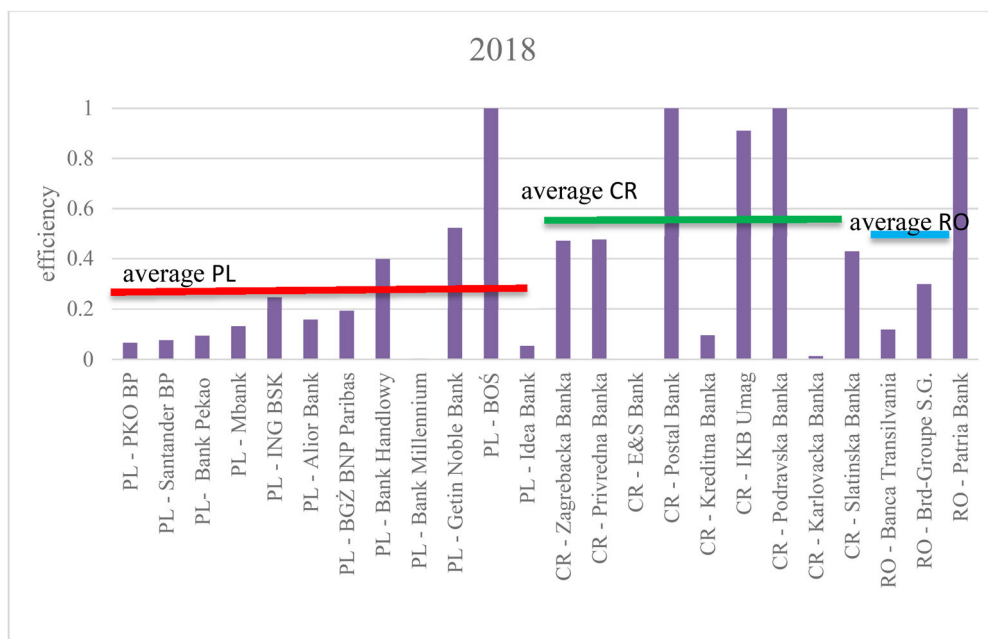


Figure 3. The efficiency obtained from the CCR - DEA output-oriented model in 2018 with average efficiency for each country.
Source: own elaboration.

In order to verify whether the differences between the average efficiency levels are evident in the different years of the analysis performed, or perhaps they are differences related to the countries from which the studied banks come - we use two-way ANOVA for unbalanced data, where the factors are Year (four states for years 2015–2018) and Country (with levels: PL, CR, and RO). The results, using Wilks' lambda are presented in [Table 2](#).

When assessing the effectiveness of achievements of social and environmental goals excluding intermediate steps, significant differences are found between average effectiveness across countries. In this case, no significant differences can be seen between years, nor was there a significant interaction between countries and years (the Year*Country factor is responsible for the interaction between factors).

[Figure 3](#) shows how banks' overall efficiency evolved in 2018. A comparison of the average efficiency in that year, calculated for each country separately, indicates the differences between them. This is an attempt to illustrate the conclusions of the ANOVA test, which indicated significant variation in effects across countries, and was unable to reject the uniformity across years - while considering the average efficiencies across countries and the interaction between factors.

In order to have a better understanding of how the processes inside the bank work, following the initial assumptions, the efficiency assessment was divided into two stages. The results of the efficiency study in each stage are shown in [Figure 3](#) in such a way that the blue bars show the efficiency in the first stage and the orange bars in the second stage.

In the first stage of our research, we analyzed efficiency, which refers to the efficiency of achieving financial and business-organizational goals. The efficiency

Table 3. ANOVA test for efficiency on stage 1 and stage 2, using Wilks' lambda.

Source	Statistic	df	F(df1,	df2)=	F	Prob > F
Stage 1						
Year	0.88	3	3	82	3.8	0.0132
Country	0.43	2	2	82	54.38	0.0000
Year*Country	0.99	6	6	82	0.13	0.9916
Stage 2						
Year	0.90	3	3	82	2.96	0.0371
Country	0.96	2	2	82	1.83	0.1667
Year*Country	0.91	6	6	82	1.37	0.236

Source: own elaboration.

coefficient achieved in the first stage illustrates how banks with specific financial ratios in a given year created their sustainability policy. Values closer to 1, therefore, mean that the bank uses more sustainability policy tools concerning its financial capacity. It was assumed here that a bank with more income, more employees, and a greater impact on the environment (approximated by its strength and size measured by the value of deposits) should be able to use more sustainability tools.

Once again, we run two-way ANOVA to test, if there is a statistically significant difference between mean efficiency in the first and second stages for the banks in different countries and different years. The results are shown in [Table 3](#).

For efficiency in achieving organizational and business goals, significant differences are seen between banks in different countries, and no significant interaction is observed between countries and years. The situation is different when we evaluate the efficiency in step 2 related to the achievement of social and environmental goals treating as input the level of achieved organizational and business development. In this case, differences are visible mainly between individual years of the study. On the other hand, in a given year, banks in different countries, on average, achieve similar efficiencies. Also, for this stage, no significant interaction between factors was found.

Croatian banks were usually most effective in stage 1 (see [Figure 4](#)). In all analyzed years, Slatinska Banka d.d. was considered a benchmark bank - that is, at their level of expenditure (inputs), there was no bank with better results (outputs). This may be partly due to the fact that Croatian banks are characterized by lower income levels, the number of employees, and the size of deposits. At the same time, the level of economic and organizational goals achieved and the tools used in the sustainability policy are pretty similar in all the analyzed banks. Hence, it is slightly easier to achieve greater efficiency in Stage 1 for banks with lower economic ratios.

Following the data presented in [Figure 4](#), we can conclude that among medium-sized banks (taking into account income, employment and deposits), the high-efficiency scores in the first stage were obtained by Polish bank BOŚ S.A in all the years of the analysis. Usually (except in one case), this bank was above median efficiency ratings of stage one. Polish banks generally have surprisingly low business-organizational efficiency in the whole analyzed period. It may be explained by the fact that Polish banks are among the largest banks in Central and Eastern Europe. However, this does not translate into higher effectiveness in achieving economic goals in the case of the largest of them. The fact of obtaining sustainability/CSR awards by Polish banks or being listed on the CSR index does not distinguish these banks from the rest of the research population. Hence, the assessment of the efficiency of Polish banks in stage one is shallow.

However, it can be observed that smaller Polish banks achieve slightly better efficiency at stage one compared to large Polish banks. Good examples of this assessment are Getin Noble Bank S.A. (Warszawa) and BOŚ S.A. We can also observe that Romanian banks evolve and increase the efficiency of their business-organizational outcomes. It may be noticed especially in 2017 and 2018 (see Figure 3).

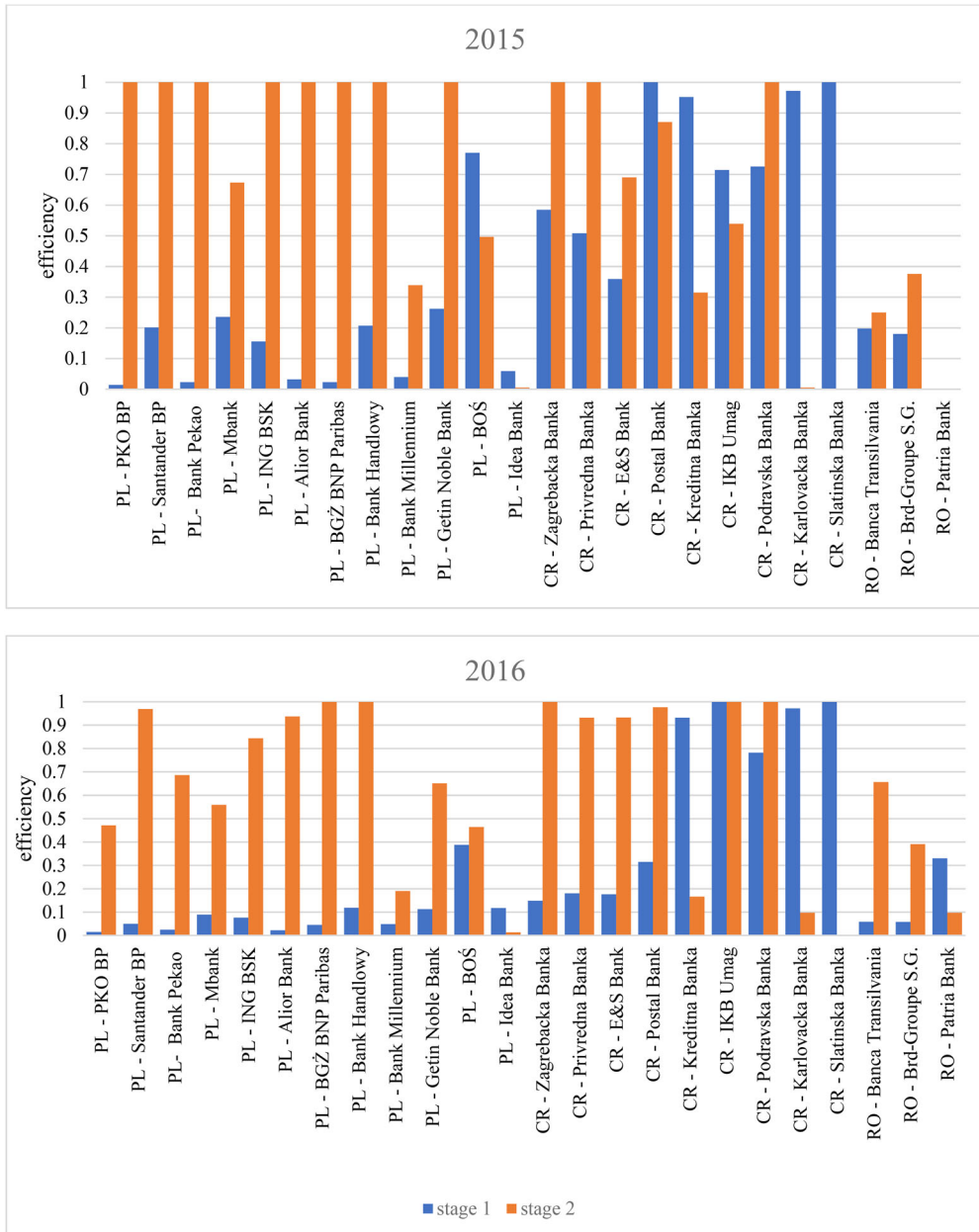


Figure 4. The efficiency obtained from the CCR - DEA output-oriented model on stage 1 and stage 2 in years 2015–2018. Source: own elaboration.

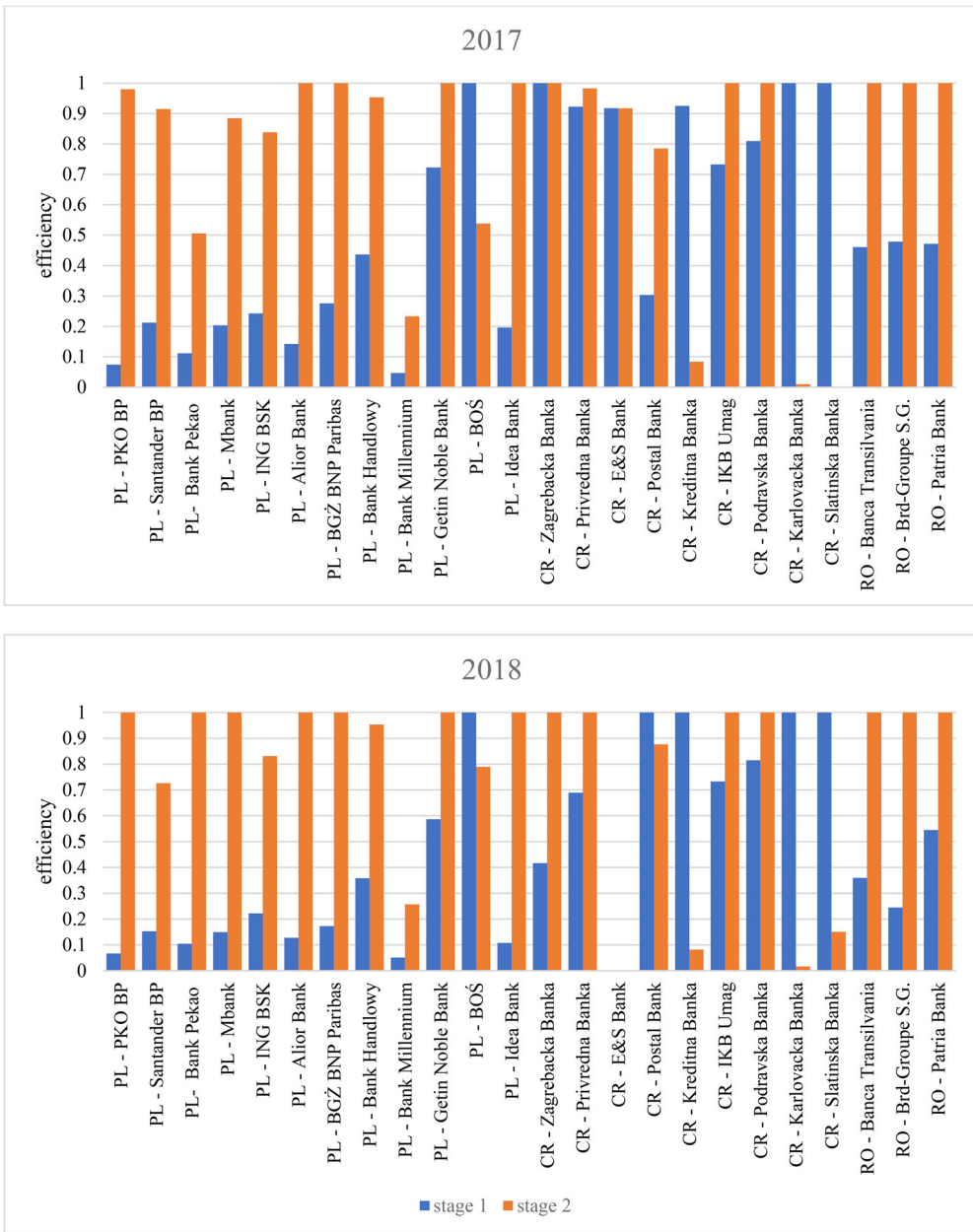


Figure 4. Continued

The second stage of the analysis explains the efficiency of social and environmental performance. As we mentioned, the main differences are observed between years of analysis. The results of the second stage of the applied method prove that the leaders of CSR and sustainability performance efficiency are large Polish banks (see Figure 4). It refers primarily to the observations from the year 2015. These banks had the best scores in the first year of our analysis, but they deteriorated in the next year

(2016) to achieve again outstanding results in the last two years. In 2016, medium-sized Polish and some Croatian banks took better-ranking places. We can see general improvements in efficiency at this stage also in Croatian banks—except two smallest Croatian banks (Karlovačka Banka d.d. and Slatinska Banka d.d., where the efficiency was low, however, between 2015 and 2018, some average increase in efficiency can be noticed). In 2017 and 2018, Polish banks again generally got very high results arriving or getting the maximum score (with only a few examples of banks getting a low level of efficiency—this is the case of Millennium Bank as well as Idea Bank in 2017 and 2018). All Romanian banks achieved equally very low ranks in 2015 and 2016, it seems that by that time, they were not caring much about sustainability performance, and the efficiency of their activities in this sphere was very poor. However, in the next two years, they all got the maximum possible efficiency scores in stage two. This is a signal of a significant improvement in the efficiency of Romanian banks in the field of social and environmental performance. As a rule, Croatian banks' efficiency assessment was higher in stage one than in stage two (except Zagrebacka Banka d.d. and Podravska Banka d.d.). This confirms the efficiency of banks from Croatia in transforming their inputs into high results concerning their economic-organizational effects. Banks of lower rank in the second stage of the applied method are organizations that are better at transforming the achieved economic goals into the achievement of real social and environmental goals than the comparative sample. In the case of Polish and Romanian banks, an opposite relationship can usually be noticed - the efficiency obtained in the second stage is higher.

Throughout the whole analysis, it was only twice when a bank was assessed as efficient, taking into account both steps of the two-stage DEA. It was IKB Umag d.d. in 2016 and Zagrebacka Banka d.d. in 2017. Zagrebacka Banka d.d. was the first and the only bank in the sample to achieve the maximum values of both intermediate and final ratios as well as direct efficiency. In the case of IKB Umag d.d. between 2017 and 2018, its efficiency declined slightly (among other things, due to other banks catching up in the sample), but still, this bank should be assessed as one of the most efficient banks in the whole sample.

The interesting results are also expressed by comparing efficiency in both stages. Banks, of which the efficiency rank in stage 1 was higher than in stage 2, more effectively transformed their resources into the achievement of business-organizational objectives and, in general, are more effective in signalling their sustainability policy concerning the business-organizational dimension of sustainable development than the other dimensions, referring to social and environmental performance. This situation appeared in 3 out of 12 Polish banks in 2015, 2 in 2016, 1 in 2017, and 4 in 2018. There was one bank (BOŚ) that, in all years of analysis, had the efficiency rank in stage one higher than in stage two. In the case of Croatian banks in 2015, most of them got the rank in stage one higher than in stage two (except 3 cases), in 2016 there were 4 banks with that result, and in 2017 and 2018 there were respectively 6 and 4 out of 9 cases like that. In Romanian banks, the situation of the first rank higher than the second one took place in both cases in 2015 and in the case of just one bank in one year, i.e., Patria Banks S.A. in 2016. These results inform that the organization proceeds on a way of development from the business-organizational

targets towards the new directions of performance that refer to social and environmental ones. Banks with a lower efficiency rank in the second stage of the applied method than in the first stage may be interpreted as the organizations that are better at transforming the achieved business-organizational goals into the achievement of sustainable development than the social and environmental goals. It means that even though they do not obtain high efficiency of the intermediate goals management, they have higher results regarding the management efficiency relating to social and environmental dimensions of corporate sustainability. They should reconsider the management of intermediate goals concerning the internal part of their organization. It indicates that these organizations skipped the critical step in their development and concentrated directly on realising the objectives concerning social and environmental issues without considering the organisation's internal needs of sustainable development.

Generally, banks with a high efficiency obtained directly from global inputs and outputs, but achieved high efficiency in the first stage, are in a better position. In their case, improving efficiency generally requires increasing the outputs in stage two and does not risk a significant efficiency deterioration in stage one. An example of a bank that has the potential to significantly improve overall efficiency is Croatian Postal Bank d.d. In 2015, there was a potential to increase efficiency, but not realized by the bank (a decrease in efficiency was recorded in 2016 and 2017 due to the abandonment of some sustainability-related activities visible in the raw data and the failure to appreciate sustainability performance recognized by the business and institutional environment). In 2018, this bank returned to the use of sustainability-related activities and again demonstrates the potential for a sustained increase in efficiency by increasing social (social index) and environmental (environmental index) results. A similar situation regarding the potential for sustainability performance efficiency gains also applies to other Croatian banks: Kreditna Banka Zagreb d.d. and Slatinska Banka d.d. and also the Polish bank BOS S.A.

An example of a poorly conducted sustainability policy may be Zagrebacka Banka d.d., which initially introduced more and more sustainability-related activities in 2015–2016, and in 2017 showed the potential for a permanent increase in overall effectiveness. Unfortunately, in 2018, the bank lowered its economic-organizational indicators and lowered its social index. This was reflected in the lower overall efficiency, which was not prevented by increasing the efficiency in stage two (thanks to, among others, CSR awards for the previous year).

5. Conclusions

The sustainability performance reported to the public may be treated as a result of performance management concerning corporate sustainability that is presented to external stakeholders. In this study, we examine the two-stage DEA method, that enables the company's stakeholders to analyze how efficiently an organization transformed its resources into sustainability achievements. This method also allows the longitudinal analysis and comparisons of the sustainability activities' efficiency. The proposed performance measurement is better conceptualized as a guiding and

learning mechanism than a pure control system. Apart from financial, it also captures non-financial measures that are highly significant in sustainability performance management. The presented approach's novelty lies in using sustainability reporting as a base to assess the efficiency of sustainability performance management. Thus, it provides a basis for evaluating and comparing internal and external stakeholders' publicly disclosed sustainability performance. Such evaluation is precious for managers because it may complete and complement the commonly used internal perspective and thus supports the whole sustainability performance management. The banking sector was chosen as an example to show the applicability of the proposed approach. It was not an incidental choice; however, this tool may be readily applicable in other fields of business. Also, the study may be furtherly adopted in any other country.

The proposed efficiency performance measure is geared towards not only controlling but also trust-based models emphasizing responsibility to reach designated shared goals (Gregory et al., 2013; Williams et al., 2020), which in this case is a responsible business running and more generally sustainability development. In the banking sector, the proposed approach may be of great use and applicability by the external users of banks' non-financial information, e.g., financial analysts and investors. The number of investors that appreciate sustainable actions and decide to involve in sustainable and responsible investment is increasing. The efficiency of sustainability projects is for these groups important. The proposed tool enables them to assess and compare the efficiency and make more informed and rational decisions.

After analysis of the sustainability reports of banks in Poland, Croatia, and Romania, we can prove the significant differences between the banks and their level of development in the field of sustainability that they disclose and the efficiency of sustainability engagement. There are apparent differences between the management efficiency in the banking sectors of all three countries in the study, which may be an important signal for internal and external stakeholders who are concerned about sustainability performance. In our research, we presented clearly how the analysis of the sustainability performance based on the two-stage DEA approach may be helpful in the efficiency assessment and provide greater comparability and how the results may be interpreted. This tool may also be helpful for comparisons of entities from other sectors. The two-stage DEA model application states how different the ranks are and the banks achieved levels of sustainability development from the analysed countries. Based on this analysis the decision-makers can monitor the sustainability efficiency and use it as a benchmark in comparison to assessing the sustainability goal achievements. This proves that the hypothesis of this study is positively verified.

Our study makes several contributions to the literature and practice. It contributes to the literature on performance measurement by giving a new perspective on sustainability performance measurement, a topic that has not been deeply investigated. This paper indicates a new application of the DEA approach to evaluating and comparing the sustainability performance that may constitute a helpful assessment tool for a broad group of interested parties. It is an alternative form of external disclosure analysis that is highly more sophisticated than the common and highly simplified keyword counting carried out by many researchers. The proposed approach takes into account the inputs and outputs of the sustainability engagement; therefore, the

picture of the effectiveness of the banks' management is significantly greater than a simple word-count—the traditional approach that is the most widespread. This research also sheds light on the banking sector's reporting practices in the field of non-financial disclosure information.

It is essential to highlight that the proposed tool has universal applicability. Our research is an example of its practical use and understanding, but companies may widely use it from different sectors and diverse countries. It may also be used in longitudinal analysis. This approach also contributes to the external perspective of the management outcomes assessment.

The landscape of sustainability-performance management is changing rapidly as legislation emerges and companies adopt new practices and structures to communicate their engagement and impacts. Companies start realizing the benefits of a sustainability policy that balances multiple business goals once clearly developed and implemented. In the future, managers will need to strengthen their focus on sustainability issues even more than today. The environmental and social impact that the companies exert, the various stakeholders' engagement, and the expectations towards companies will present new challenges and opportunities for innovation, productivity gains, and longer-term operational efficiencies. Management will have to face this new situation; they will need to be able to deal with them. They will also need to focus on learning in order to stream their engagements. Improved performance measures will become fundamental in demonstrating the tangible benefits of management. A significant challenge will surely be the evaluation of sustainability achievements; therefore, the proposed tool may be of great importance and utility to managers. Moreover, this utility is also important to external stakeholders of information disclosed by organizations. The presented approach could help them make appropriate performance management decisions.

Based on the above research results, this study also has several practical implications. The methodology of this study may be readily applicable to other companies. Other sectors in diverse countries may treat use this approach as a universal tool for the sustainability efficiency assessment of the company's performance based on the results presented to external users.

The conclusions derived from the analysis may lead to improving decision-making processes related to achieving sustainable development goals and its disclosure by banks in corporate reporting. They may also help evaluate and compare the banking sector in the international context. The findings are also crucial for a better understanding of the importance of corporate sustainability reporting as a source of information on the efficiency of sustainability performance management, provided the appropriate tools, like DEA those proposed in this paper, are used. They may help understand the further directions of the performance management development and may be necessary for the decision-makers in determining the sustainability reporting.

In addition to measuring the efficiency of achieving outputs at assumed inputs, the DEA method also allows for identifying direct role models. Each of the inefficient banks has in this method a clear indication of the efficient banks, which are the closest in the input-output structure and that may be treated as benchmarks. Regarding management, based on the DEA application proposed in this paper, it is possible to

state by how much outputs should be increased and which bank was able to achieve expected outcomes and, therefore, may constitute a benchmark for others.

In the future, we may expect intensified pressure on the engagement of business organizations, including banks, in sustainability activities and, therefore, also in efficient management. There will also be a growing interest in the evaluation and performance measurement of these issues expected both by internal and external stakeholders. There is a need to develop new tools and approaches that allow assessment of performance management and comparability of an entity's results over time, as well as between different organizations, diverse sectors, and various countries. The proposed approach may be treated as an attempt to answer these calls. However, potentially other tools and approaches could be conceptualized and empirically tested, and we see it as the path avenue for future research.

This article unavoidably has some limitations, which reveal opportunities for further study. In this article, the data analysis refers to a limited number of banks in chosen countries. So further studies can focus on diverse sectors and countries, still applying the approach described in this research.

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Data availability statement

The data supporting this study's findings are available from the corresponding author upon reasonable request.

Disclosure statement

The authors report there are no competing interests to declare.

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