The Dimensions of Environmental Performance: A Systematic Review for a Common Yardstick

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ABSTRACT

Many studies conducted during the last decade have suggested environmental performance benefits. However, not many studies have attempted to synthesize these studies and present a broader picture of the conceptualization of this performance. Therefore, this study aimed to systematically analyze environmental performance dimensions and propose a conceptual framework based on the prior literature. The PRISMA statement was used as a guideline for this systematic reviews, structuring data collection, and identifying research gaps from studies over the period 1990–2022. The analysis included 36 papers from the Web of Science and Scopus databases. Four dimensions of environmental performance were identified: managerial, operational, based on outcomes, and according to the global context. The analysis identified 129 codes grouped into the four dimensions. However, the study results varied because of the multidimensionality of the concept and the context in which the organizations operate. The findings convey key insights into the current state of scholarly investigation on environmental performance. The results also showed multiplicity in the choice of indicators and environmental performance variables (inputs, outputs, stakeholder relations, impacts, eco-innovations). Research directions were suggested to improve the understanding of the conceptualization of environmental performance, recommend a unified model, and advance future research in this increasingly important and expansive area.

Keywords: *Environmental Performance, Systematic Review, Organization, Environmental Performance Dimensions, Environmental Performance Determinants.*

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INTRODUCTION

Over time, researchers, institutions, and practitioners have increasingly focussed on the environmental performance of organizations. This reflects a growing awareness of the negative impacts that business activities or lifestyles can have on the environment and the need to work to mitigate this impact (Mastrandrea et al., 2024). Methods for measuring and improving the environmental performance of organizations are continuously being developed, and businesses are encouraged to adopt more sustainable practices to preserve natural resources for future generations.

From a practical standpoint, the environmental conditions at the international, national, and local levels are alarming. However, according to estimates from the International Energy Agency (AIE, 2021), industries account for approximately 21% of global GHG emissions, whereas cities account for approximately 70%. The environmental impact of high levels of GHG emissions, waste, air pollution, water quality degradation, contamination of groundwater and surface water, biodiversity loss, etc., can be very negative for the environment and human health (Chu & Karr, 2017; Manisalidis et al., 2020).

The literature on environmental performance is extensive within both scientific and academic fields. Numerous studies have examined this subject and mobilized different indicators to measure environmental performance, such as : Pollution generated by the company (Jaggi & Freedman, 1992; Klassen & Whybark, 1999; Madsen, 2008; Spicer, 1978); GHG or carbon emissions (Aragon-Correa & Rubio-López, 2007; Busch & Hoffmann, 2011; Earnhart & Lizal, 2007); Reporting to be completed by companies (Clarkson et al., 2004; Dooley & Lerner, 1994; Hamilton, 1995; Sarkis & Cordeiro, 2001); Environmental communication by the company in its annual report (Blacconiere & Patten, 1994; Freedman & Patten, 2004; Wu et al., 2010) ; Management indicators such as the number of complaints, number of incidents and accidents, total environmental investments, total environmental costs, number of staff environmental ideas, total environmental costs, and total environmental investments (Brouwer & Van Koppen, 2008) ; Product/process indicators (equivalent to operational performance indicators as categorized by ISO 14031 :1999) : energy use, material use, specific emissions to air, quantity of wastewater discharged, quantity and composition of waste, collection of waste for recycling/recovery, inputs and outputs, environmental efficiency from data envelopment analysis,etc. it was noted that Data were collected mostly from the Thomson Reuters ASSET4 ESG databases, the Council on Economic Priorities, the GRI, the MSCI KLD index, and the Toxic Release Inventory databases.

Given the multidimensional nature of the environmental performance concept (Trumpp et al., 2015; Turki, 2009), several aspects and indicators have been proposed in the literature on this subject. While each study proposed a set of indicators and components according to the type of environmental problem in question and, above all, according to the sector of activity being studied, the fact remained that, to our knowledge, none of them have been able to propose a synthetic

grid capable of measuring the environmental performance of all types of organizations.

At the time of writing this manuscript, we identified several research gaps. Therefore, the reviews published on environmental performance that we were aware of in recent years were as follows: One critical review (Dragomir, 2018), two bibliometric reviews (Blass et al., 2020; Burki et al., 2022) , and five systematic reviews (Tuni et al., 2018; Pera, 2020; Ameer & Khan, 2022; Jassem & Azmi, 2022; Miroshnychenko et al., 2022).

Dragomir (2018) proposed a new conceptualisation of Corporate Environmental Performance (CEP) based on a comprehensive and critical review of three decades of research, which examined the measurement methods of 172 empirical studies relying on CEP as an explanatory or dependent variable in structural modelling or data envelopment analysis. The two bibliometric reviews tried to outline emerging research themes and theoretical clusters on the EP for future research. Thus, the bibliometric reviews established focus on a specific area, namely, environmental performance measurement in hospitals from 1987 to 2017 (Blass et al., 2020) and environmental performance in business-to-business relationships research (Burki et al., 2022).

Based on a systematic review, Tuni et al. (2018) discussed environmental performance measurement for green supply chains. Pera's (2020) research focussed on a review of the existing literature on sustainability behaviour and environmental performance of urban systems. Ameer and Khan (2022) synthesized the literature regarding the drivers of free entrepreneurial orientation in organizations. However, Jassem et al. (2022) conducted a systematic review of sustainability-balanced scorecard architecture and environmental performance outcomes of business organisations. Finally, the research realised by Miroshnychenko et al. (2022) critically reviewed and meta-analyzes the environmental performance of family firms.

Nevertheless, none of the previously mentioned studies attempted to provide a complete understanding of the construct of environmental performance. Only Dragomir (2018) discussed the conceptualisation of EP, but the results focus on guidelines for researchers on how to choose adequate instruments when introducing CEP in empirical research. Therefore, they discussed the reliability and validity of instruments used in the literature. All papers were based on quantitative methodology and indicators.

The aim of this study was, therefore, to carry out a systematic review, based on established criteria, to bring together all the research studies proposing environmental performance measurement grids from a single perspective suitable for all types of organizations. In short, we aimed to answer the following question: What are the dimensions of an organization's environmental performance, and how can they be achieved? The three underlying questions reflected the central question of our research:

- What are the main characteristics of studies exploring the views of organizations' environmental performance?
- What are the dimensions and determinants of environmental performance based on systematic analysis?
- What are the barriers and recommendations in these studies for advancing environmental performance integration in organizations?

The combination of our research context, problem, and approach led us to structure our paper as follows: First, an overview of the environmental performance of organizations is presented to give an idea of the multitude of studies on this subject, the multidimensionality of the concept, and the difficulty of conceptualizing said performance. Then, the methodological framework is described, including the relevance of a systematic review, the review protocol, study selection using inclusion and exclusion criteria, data extraction and analysis, data synthesis, as well as coding and quality assessment. Finally, the mapping of the relevant literature, its main findings on the dimensions of organizational environmental performance, as well as obstacles and recommendations for achieving good environmental performance, are analysed, enabling these results to be discussed and a framework for environmental performance valid for any type of organization to be proposed.

AN OVERVIEW OF THE ENVIRONMENTAL PERFORMANCE OF ORGANIZATIONS

Increased Interest of Researchers in Environmental Performance

Researchers across disciplines are increasingly concerned about the environmental impact of activities, leading to a surge in interest in environmental performance. The study of environmental performance encompasses various aspects such as waste management, energy efficiency, greenhouse gas emissions reduction, biodiversity protection, and resource sustainability. The increased interest in environmental performance is also driven by the need to address global challenges such as climate change, environmental degradation, and biodiversity loss while developing sustainable solutions by studying best practices for environmental performance.

The number of manuscripts with the title Environmental Performance exceeded 921,000 on Google Scholar, 4,062 on Scopus, and 2,965 on Web of Science. The total number of publications per year in the two peer-reviewed databases is presented in Figure 1. The number of publications increased which justified the enthusiasm of researchers for this theme. All references were declared by the authors in one or more disciplines (subject area). Several disciplines dominated and corresponded to environmental sciences, engineering, sustainable sciences, and management and social sciences.

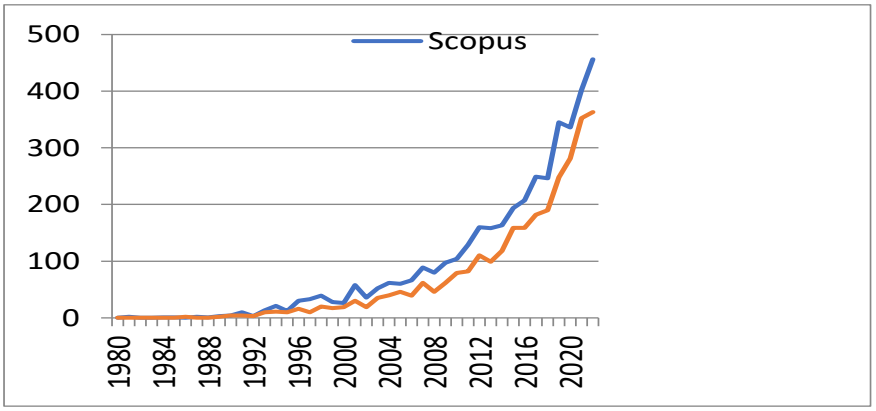


Figure 1: Evolution of Environmental Performance References Per Year

Source: Authors

To obtain a comprehensive overview of the research topics that scholars had researched on environmental performance and the mlearning. This host analyzed variables in the selected studies a visualization of the links between keywords using nodes and edges (nodes represent keywords and edges represent co-occurrence relationships between keywords) using VosViewer software was deployed, which helped to understand the relationships between different keywords and main themes in each field that may be missed in traditional text analysis.

The word cloud showed the frequency at which words were detected by their size and visual prominence. The word cloud was included below (Figure 2). Words shown to occur at the greatest frequencies comprised environmental performance, environmental management, environmental impact, life cycle, sustainable development, performance assessment, life cycle assessment, carbon dioxide, sustainability, environmental protection, global warming, decision making, environmental management systems, standards, pollution, ISO 14001, quality, environmental technology, environmental economics, and other technical aspects of the environment such as emission control, waste management, recycling, energy utilisation, gas emission, and energy efficiency.

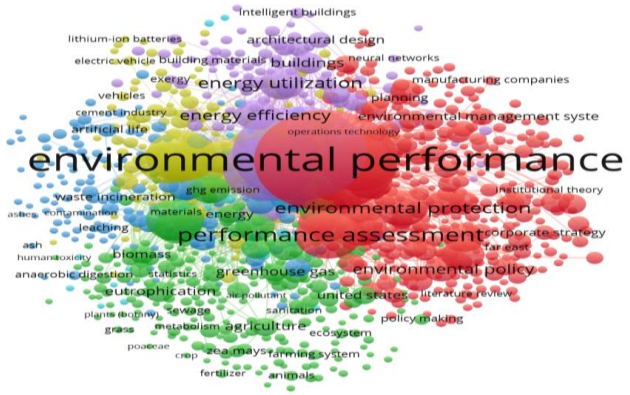


Figure 2: Co-Occurrence Network of the Keywords in the Research Domain
Source: Own Elaboration with Vosviewer Software

Environmental Performance: A Complex and Multidimensional Concept with Challenges in Conceptualization and Measurement

The concept of environmental performance has attracted the interest of organizations around the world in recent decades. This EP was viewed in many ways, and its perception seems to be largely determined by pro-environmental motivations, such as market pressures (Jiang & Bansal, 2003), institutional pressures (Christmann, 2004; Dechant et al., 1994; Hunt & Auster, 1990; Sharma, 2000), economic pressures (Porter & Van Der Linde, 1995), and legitimacy pressures (Pfeffer & Salancik, 1978).

Like any performance, environmental performance is a largely indeterminate, complex, contingent ,and subjective concept (Janicot, 2007), and in the field of environmental management, it remains generally unclear (Boiral 2010; Boiral & Henri, 2012). It is clear that environmental performance is a construct, as mentioned by Bisbe et al. (2007), "A construct is a theoretical creation that can be defined in conceptual terms but cannot be observed and therefore anchored to observable reality by means of indicators". An overview of the different definitions found in the literature confirmed its complexity, from authors who considered only one dimension in EP to those who considered EP as a multidimensional concept.

Table 1: Definitions of Environmental Performance from the Literature

Authors	Definitions
Tibor and Feldman (1996)	« *EPs are the outcomes that organizations hope to achieve by undertaking a period of time during which they seek to understand the aspects of their activities, products, and services that may present significant environmental risks and impacts* »
Judge and Douglas (1998)	« *Effectiveness of a firm's commitment to reach environmental excellence»*

Klassen and Whybark (1999)	*« Qua level Aznar élève à la demande de M ntity of a plant's pollutants »*
Burgos-Jiménez and Cespedes-Lorente (2001)	« *Reduction of company's environmental damage* »
Wagner and Schaltegger (2003)	« *Performance of a firm with respect to environmental aspects* »
Elsayed (2006)	« *Results a firm's responsiveness toward the environment* »
Salo (2008)	« *Financial value of a firm's management of its environmental* »
Lenciu and Napoca (2009)	« *Level of firm's activities with respect to environmental impacts* »
López-Gamero and al. (2009)	« *Output of management of the environment* »
Clemens and Bakstran (2010)	« Environmental *impacts* »
Montabon and al. (2007)	« *A mechanism through which an organization includes environment-related matters in its operational activities as required by acceptable standards* »
Turki (2009)	*« The EP is the result of the company's managerial and technical efforts in environmental protection and in the variation of ecological pressures »*
Yang and al. (2011)	*« Performance of an organization with respect to environmental responsibility »*
Walls and al. (2012)	*« Outcome of a firm's strategic activities that manage environmental impacts »*
Denning and Sharstri (2000)	*« The EP of companies is assessed on its compliance and respect of the environmental legislation in force »*
Green and al. (2012)	*« The ability of an organization to reduce air emissions, effluent emissions, solid waste, and the use of toxic materials resulting from the organization's operating processes »*
ISO 14031 (2013)	*« Results of an organization's management of its environmental aspects »*
Nutsugah et al. (2021)	*« Environmental performance refers to the formulation, implementation, evaluation, and analysis of a firm's operational processes (planning, organizing, leading, and controlling) aimed at enhancing positive environmental gains as well as minimizing negative environmental impacts of the firm's environmental inputs (materials, energy, and water) and outputs (emissions, wastes, and effluents) »*
International Standard Organisation (2015)	*« The measurable results of the environmental management system, in relation to the organization's control of its environmental aspects, based on its environmental policy, objectives, and targets »*
Dragomir (2018)	*« Corporate environmental performance is a measure of environmental impact, resource consumption, and related financial elements, along with the efforts towards the reduction of such impact and the implementation of preventive measures »* *« The measurement of corporate environmental performance is an integrated managerial process that demands technological capabilities, strict compliance, employee training, supply chain management and stakeholder communication ».*

Source: Authors

Environmental performance is defined by organizations in different ways, and their determination is subject to how they are defined by each organization, as it depended on (1) organization-specific elements such as size, location, and nature of organizational processes (Brouwer et al., 2008), (2) the exercise le délit de la semaine activities under varying economic, technological and regulatory conditions, (3) the lack of a universally accepted approach to the assessment of different environmental impacts, and (4) the lack of agreement in studies attempting to identify relationships between pro-environmental behaviors such as EMS improve environmental performance (Gomez & Rodriguez, 2011; Nawrocka & Parker, 2009; Webb et al., 2006) .

Thus, Turki (2009) proposed to classify the definitions of the said concept into two categories: A category that considered EP as a unidimensional concept (takes into account the negative externalities produced by companies and the degree of resource use) and a category that considered it as a multidimensional concept that suggested that a company is environmentally efficient when it has an EMS following the ISO14001 standard, except that according to Turki (2009) it was considered very general given the large number of environmental indicators that can be found, whether managerial and/or technical.

According to scholars, environmental performance indicators can be classified into two distinct categories:

Quantitative indicators: Academic research presented these environmental indicators as quantities established from observable or calculable quantities, valued in physical, chemical ,or biological units, reflecting in various possible ways the environmental impacts caused by a given activity (Tyteca, 1996).

Organizational indicators: EP was measured by the environmental practices implemented by companies (Wood, 1991), contingent on the EMS deployed by companies (Klassen & Whybark, 1999). In this framework, academic research represented EP through management indicators that tracked the efforts made by companies to reduce the environmental impact of their activity (López-Gamero et al., 2009; Schultze & Trommer, 2012), such as the deployment of EMSs, the integration of environmental objectives into business planning, eco-design, product life cycle analysis, the development of green products, voluntary participation in environmental programs (López-Gamero et al., 2009), environmental innovations and changes in production processes (Christmann, 2000), adoption of an EMS (Melnyk et al., 2003), certification (Goh Eng et al., 2006), and EMSs set up to manage these environmental strategies and improve performance (Schultze & Trommer, 2012).

Given the lack of compromise regarding the components of EP, which makes it difficult to develop a standard model capable of encompassing all possible environmental aspects, this study provides a systematic overview of the different models cited in the literature.

METHODOLOGY

To answer our research question in a complete, systematic, objective, reliable, and reproducible manner, we conducted the paper selection process according to the PRISMA statements (Moher et al., 2009). There were several reasons for opting for a systematic review approach. Indeed, systematic reviews provide the following advantages:

- Synthesize qualitative and quantitative evidence from studies that have investigated the conceptualisations of organisational environmental performance with rigour and reliability (Thomas & Harden, 2008);
- Cover the entire spectrum of the notion of environmental performance because there is a huge amount of literature in different research areas, including the need to structure them, while decreasing the possibility of missing any documents or information;
- Be limited to inclusion and exclusion criteria that served as the basis of such a review, and the final choice was therefore reproducible (Petticrew & Roberts, 2006), reduced bias in the selection of included studies, and assessed the quality of available data;
- Developed a review protocol describing the article selection criteria, search strategy, data extraction, and data analysis procedures;
- Use of a transparent and reproducible methodology that facilitates the understanding and validation of the results. Therefore, systematic reviews were often considered the most reliable and useful form of research in health and social sciences;
- Be one of the best sources of information for decision-making and the formulation of practical recommendations, as it was considered more reliable and more generalizable than other types of review.

Review Protocol

This systematic review began with a preliminary literature search of previous work on the topic to refine the research idea (Siddaway et al., 2019). We formulated the research question in a clear and precise manner using the PICO criteria (Pollock et al., 2014). It was as follows: « For all types of organizations, what were the tangible and intangible dimensions for achieving environmental performance? ». Following the research question, a search strategy to identify the largest possible number of studies was achieved. We systematically searched two electronic databases, Web of Science and Scopus, because they offered comprehensive coverage, advanced search and discovery features, trusted sources, the largest data pool, and were published in a peer-reviewed system. To identify as many eligible studies as possible, the research was limited to the years 1990 and 2022, and the year 1990 was chosen because it was the year in which a scientific and practical interest in environmental performance began to emerge.

Only articles written in English and French were included because their dominance in the literature. Search terms were modified together with informatics and combined with Boolean operators as follows. The terms "environmental management" OR "environmental performance" OR "environmental practices" OR "environmental success" OR "environmental indicators" OR "environmental measurement" OR "environmental determinants" as article titles in WoS and Scopus databases. In the end, 11946 research studies were generated from the Scopus database and 8684 from WoS. After elimination of duplicates, 8826 research were retained. We downloaded all published articles, and the references in each article were exported to Zotero software to facilitate inventory management and referrals. Identification and first screening of the articles were performed using the information available in the title and abstract.

Study Selection using Inclusion and Exclusion Criteria

To ensure quality, limit bias, anticipate errors and failures, and ensure the accuracy and completeness of the results the literature search process began with the creation of inclusion criteria to determine the conditions under which an article would be included or excluded from the analysis (Pollock et al., 2014). This was done to avoid any impact on the generalizability and relevance of the review. The studies were resolved by discussion between two independent researchers and with the help of a third researcher in case of disagreement on inclusion or exclusion. After the first selection, both reviewers read through the articles to decide whether they were eligible or not. In addition, another check was issued for the references of the relevant articles to find other articles following the inclusion criteria. During the revision process, other papers were identified and included.

Table 2: Inclusion and Exclusion Criteria

Characteristics	Inclusion Criteria	Exclusion Criteria
Databases	Scopus and Web of Science	Other databases, non-serious journals, and predatory journals
Temporal horizon	Article published between 1990 and 2022	All papers published before December 1989 and after December 2022
Language of publication	English and French	Spanish and other languages not included in the criteria
Quality criterion	Article published in peer-reviewed journals, book-chapters, guidelines and reports.	Books, Memoirs, and Unpublished theses as an article
Type and design of research	Article based on rigorous and clearly described methodology (conceptual, qualitative, quantitative, or mixed) and reports or guidelines applied and improved by various researchers	Any theoretical, conceptual, and empirical research without a defined methodology and/or without articulation between data and ideas

Place of intervention	Work on the environmental performance of organisations, including all types of organisations (e.g., private companies, public bodies, non-profit organisations)	Workers' behavior, practices, and emissions Environmental performance of plants and products
Unit of analysis	Organisational (organisation as a whole, departments, branches)	Individual
Originality	New contribution	Not original: Reworking an existing model (testing the model in a different environment) Analyses of specific resources or impact
Goal with the EP	Studies that specifically propose a conceptual framework for EP, on the basis of sound theoretical grounds	Studies related to strategies, benefits, environmental management systems, certification, and impact on a specific area
Barriers and recommendations	At least one barrier or practical suggestion for promoting of EP	No future recommendations, discussions, or leads

Source: Authors

After screening the titles and abstracts of the articles, 8491 articles that did not meet the criteria were removed. We retained 335 studies for full-text reading, and the eligibility criteria were applied to each study. Figure 3 shows the entire workflow that led to the final paper selection. Final decisions to include or exclude were made only after the entire article had been read. After this stage, 36 articles were retained.

It was noted that the paper also considered other publications due to their significance and influence. We relied on additional sources such as standards and reports from international institutions produced by organizations, which may not be indexed by the selected databases, but have been utilized and cited by numerous researchers. Additionally, we included relevant research papers that were cited in the included papers but were not indexed serious databases.

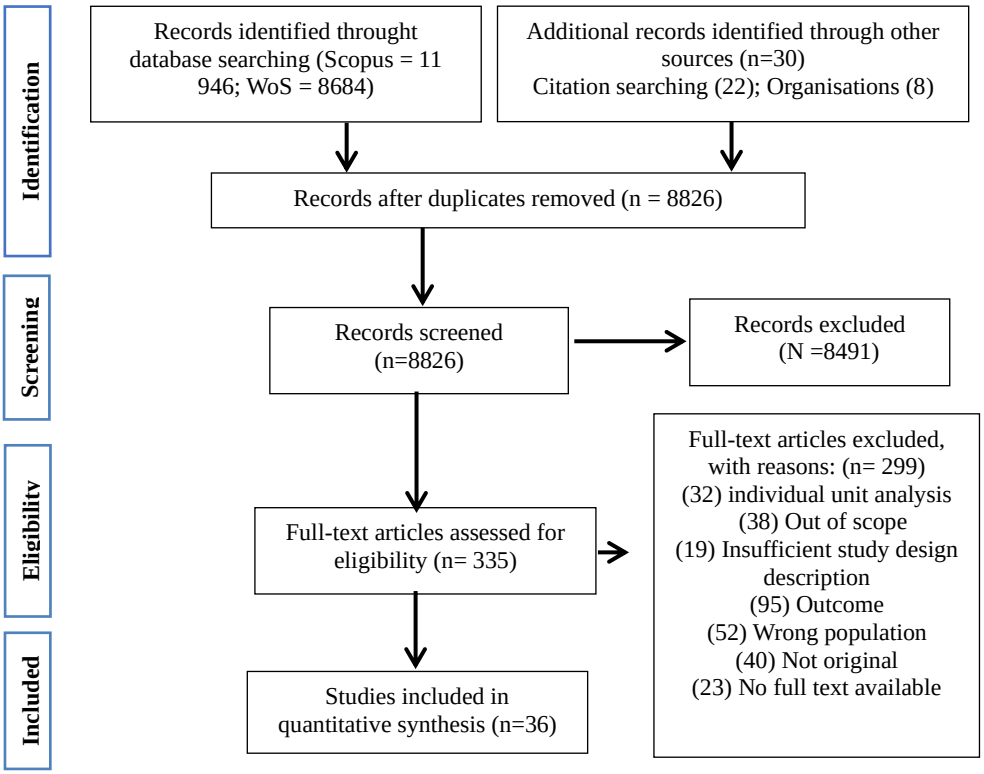


Figure 3: Research Methodology According to the PRISMA Structure
Source: Authors

Data Extraction and Analysis

The final step of the systematic review was to extract and analyse the relevant data from the selected papers. Data were entered into a previously prepared data extraction sheet independently by two authors in Microsoft Excel, and the definitions of each item in the extraction form were clarified to ensure reliability in the coding process.

Data were extracted and covered three topics based on our research questions: background information, dimensions or conceptualisation of environmental performance, barriers and proposed recommendations according to the study's authors. Background information included the authors, title of the study, year of publication, country, type of document, study design and approach, data collection tool, and objectives. In a general way and according to the sequence of the sections of the selected studies, the dimensions or the conceptualisation were systematically extracted from the results sections, and the authors' barriers and proposed recommendations were taken from the discussion sections. Any discrepancies in data extraction were iteratively discussed until a consensus was reached.

Data Synthesis and Coding

Similar to data extraction, the reporting of results was divided into three steps. Primarily, the researchers analysed literature trends using the “general information” columns of the Microsoft Excel sheet. The following points were targeted: trends in the literature, type of document, graphical distribution, research method, data collection tool, and approach. The extracted data were categorised and quantified using means and frequencies.

Second, a thematic analysis was conducted on the dimensions of environmental performance because it was considered most appropriate for answering this study’s research questions. According to Gavard-Perret and Helme-Guizon (2012), "a set of communication analysis techniques aimed, through systematic and objective procedures for describing the content of messages, to obtain indicators (quantitative or not) allowing the inference of knowledge relating to the conditions of production/reception (inferred variables) of these messages". Then, the authors’ barriers and proposed recommendations were analysed in the same way.

According to the two possible approaches for conducting a thematic analysis (deductive and inductive approach "open coding") (Strauss & Corbin, 1990), and to avoid subjectivity, guarantee quality, reliability and efficiency, eliminate the risk of error, ensure the accuracy and completeness of the data and organise the data, we opted for the inductive approach for data coding. This is an approach in which themes emerge through reading and analysis. In this sense, this approach made it possible to use verbatim reports to identify themes or the repetition of ideas to form categories into which the data will be appended. The aim was to gradually build a "thematic tree’ with central themes bringing together complementary (sub-themes) and divergent themes. This thematic tree was completed only at the end of the data analysis process. To achieve this, NVivo 11 data analysis software was used to create a database of items, code them, and perform the analyses.

We independently coded a 20 % sample of responses in the dataset for both questions in Nvivo. We met to discuss, refine, collapse, and define codes to create a codebook. The codebook was then used to recode the 20 % sample. We refined and validated the coding to ensure that the codes accurately reflect the content of the data. Coding was validated by comparing it with the coding of other team members or using inter-coder reliability measures. Any new emergent codes were added, and the codebook was refined and finalised. We then independently coded all responses to both questions. On completion, the final datasets were merged, and discrepancies were identified, reviewed, and resolved by consensus. Open coding in an iterative fashion created a codebook of categories and subcategories of reasons for disciplinary review. Each case was then coded by two authors. Disagreements were discussed and reconciled as a group. The final codebook included definitions of each code, inclusion criteria, exclusion criteria, and examples (The codebook is available upon request from the corresponding author).

The interrater reliability was measured using Cohen’s kappa coefficients for the abstract and title screening phase and the full-text screening phase, which were

found to be very satisfactory for both (respectively, 0.94 [0.99–0.89] and 0.84 [0.90–0.78]). Discrepancies in abstract and title screening and full-text screening were clarified through discussion.

Quality Assessment

Depending on the type of study analysed and the research question addressed, and among different bias assessment tools (MMAT, NOS, rob 1.0, RoB 2.0, QUADAS-2, and etc.), we chose the guidelines from the Mixed Methods Appraisal Tool (MMAT) as a methodological quality of all studies (Hong and al., 2018). The MMAT provided a systematic and comprehensive evaluation of the design, implementation, and reporting of mixed methods studies. By following the MMAT guidelines, we could critically appraise studies using quantitative, qualitative, and mixed methods included in mixed systematic reviews. The tool presented a set of criteria and screening questions to assign an overall quality score.

For other non-empirical research, we also used the Joanna Briggs Institute Critical Appraisal Tools as they incorporate text and opinion while adapting it by checking clarity, originality, relevance, applicability, use of evidence, theoretical framework, rigour, and accuracy. Each tool had its strengths and limitations, and using two or more tools provided a more comprehensive assessment of the quality of the study.

RESULTS

No studies were excluded based on the quality threshold. Thirty-six studies met the inclusion criteria in the current review ((1) Wood (1991); (2) Wells et al. (1992); (3) (Eckel et al. (1992);(4) KPMG (1992) ;(5) Wolfe & Howes (1993);(6) James (1994) ;(7) Metcalf et al. (1995) ;(8) Lober (1996); (9) Tyteca (1996); (10) Azzone et al. (1996); (11) Ditz and Ranganathan (1997); (12) Rikhardsson (1998); (13) Young and Welford (1998); (14) Ilinitch et al. (1998);(15) Judge and Douglas (1998);(16) Thoresen (1999); (17) Jung and al. (2001); (18) Berkhout et al. (2001) ; (19) Tyteca et al. (2002); (20) Curkovic (2003); (21) Lefebvre et al. (2003); (22) Doonan et al. (2005) ; (23) Tam et al. (2006) ; (24) Global Reporting Initiative (2006); (25) Henri and Giasson (2006); (26) Rao et al. (2006); (27) Xie and Hayase (2007); (28) Turki (2009); (29) Moneva and Ortas (2010); (30) Schultze and Trommer (2012); (31) ISO 14031 (2013) ;(32) Trumpp et al. (2015); (33) Escrig-Olmedo et al. (2017);(34) Dragomir (2018); (35) Panya et al. (2018); (36) Nutsugah et al. (2021)).

Research on the conceptualization of environmental performance had been emerging since the 1990s, the lasted dates from 2021. All studies were published in English except for the one by Turki (2009), which was in French. Seven studies were conducted in the USA (16.6%), six in the UK, five in Canada, and three each in Spain, the Netherlands, Germany, and Belgium, as well as one in other countries.

Thirty studies (83%) were articles, of which the Journal of Business Strategy and the Environment and Journal of Cleaner Production were the most frequent, with three reports, two guidelines, and one book chapter. The research methodologies varied between 11 quantitative, seven conceptual, seven qualitative, and six mixed methods. The approaches used by the researchers were diverse, ranging from structural equation modeling (7 studies), case studies (5 studies), narrative research (4 studies), and principal component analysis (3). As a source of data, 27% were based on surveys and literature reviews, 10.8% on reports, and 8% on databases. Table 4 summarises the information on the included studies.

Table 3: Descriptive Characteristics of Studies Included in the Review

Characteristics	Number of studies (reference number) *	Percentage
Year published		
1990-2000	16 (1-16)	44%
2000-2010	12 (17-28)	34%
2010-2022	8 (29-36)	22%
Graphical distribution		
USA	7 (1,2;7;8;14;15;20)	16.6 %
Spain	3 (18;29;33)	7.15%
Philippines	1 (26)	2.38%
Canada	5 (3,5;21;22;25)	11.90%
Netherlands	3 (4;18;24)	7.14%
UK	6 (6;10;12; 13;18;19)	14.28%
Belgium	3 (9;18;19)	7.14%
Italy	2 (10;18)	4.76%
Australia	1 (11)	2.38%
Switzerland	1 (31)	2.38%
Norway	1 (16)	2.38%
South Korea	1 (17)	2.38%
Germany	3 (18;32; 30)	7.14%
Hong Kong	1 (23)	2.38%
Japan	1 (27)	2.38%
Tunisia	1 (28)	2.38%
Romania	1 (34)	2.38%
Thailand	1 (35)	2.38%
South Africa	1 (36)	2.38 %
Type of document		
Article	30 (1-3,5-10;13-17;19-23;25-30;32-36)	83%
Book-Chapter	1 (12)	2.8%
Guideline*	2 (4;31)	5.5%
Report*	3 (11;18;24)	8.3%

Journals		
Academy of Management	1 (1)	3.3%
Environmental Quality Management	1 (2)	3.3%
CMA the Management Accounting	1 (3)	3.3%
Magazine	1 (5)	3.3%
Total Quality Environmental	5 (6;10;19;27;33)	16.7%
Management	1 (7)	3.3%
Business Strategy and the	1 (8)	3.3%
Environment	1 (9)	3.3%
Journal of Environmental Health	1 (13)	3.3%
Journal of Managerial Issues	1 (14)	3.3%
Journal of Environmental	1 (15)	3.3%
Management	4 (16; 17;26;34)	13.4%
Greener Management International	1 (20)	3.3%
Journal of Accounting and Public	1 (21)	3.3%
Policy	1 (22)	3.3%
Journal of Management Studies	1 (23)	3.3%
Journal of Cleaner Production	1 (25)	3.3%
European Journal of Operational	1 (28)	3.3%
Research	1 (29)	3.3%
R&D Management	1 (32)	3.3%
Ecological Economics	1 (35)	3.3%
Building and Environment	1 (30)	3.3%
CMA Management	1(36)	3.3%
Gestion (Cairn)		
Industrial Management and Data Systems		
Journal of Business Ethics		
Kasetsart Journal of Social Science		
Journal of Management Control		
International Journal of Productivity and Performance Management		
Research method		
Conceptual	7 (1;6;8;10;16;28;30)	22.6%
Qualitative	7 (2,3,5, 12; 13;25;34)	22.6%
Quantitative	11 (7;9;15;17;20;21;22;26;29;35;36)	35.5%
Mixed	6 (14;19;23;27;32;33)	19.3%
Approach		
Grounded theory	1 (34)	2.8%
Systematic review	1 (30)	2.8%
Narrative research	4 (2;10;19;32)	11.1%
Case study	5 (3;5;12;13;25)	13.9%
Comparability	1 (7)	2.8%
Data envelopment analysis (DEA)	2 (9;17)	5.5%
Principal Component Analysis (PCA)	1 (14)	2.8%
Structural Equation Modeling	7 (15;20;22;26;32;35;36)	19.4%
Principal component analysis	3 (19;22;27)	8.3%
Multiple regression	1 (21)	2.8%
Logit model	1 (21)	2.8%
F-test	1 (23)	2.8%
Partial Least Squares (PLS)	2 (29;36)	5.5%
Fuzzy MCDM	1 (33)	2.8%
Unspecified	5 (1,6;8;16;28)	13.9%

Data source		
Survey	10 (7;15;20;21;22;23;26;27;35;36)	27%
Interviews	2 (8;13)	5.4%
Reports	4 (5;8;14;17)	10.8%
Literature Review	10 (1;6;14;23;27;28;32;33;34;30)	27%
Databases	3 (29;32;33)	8%
Unspecified	8 (2;3;9;10; 12;16;19;25)	21.6%

Source: Authors

*Guidelines and reports are not included in the side boxes because they have no research method or approach.

The number of articles published per period was characterized by a significant fluctuation. The publications on conceptualization and/or measurement of environmental performance were poor compared with the mass of work presented on this topic, and the average was one work per year (see Figure 4).

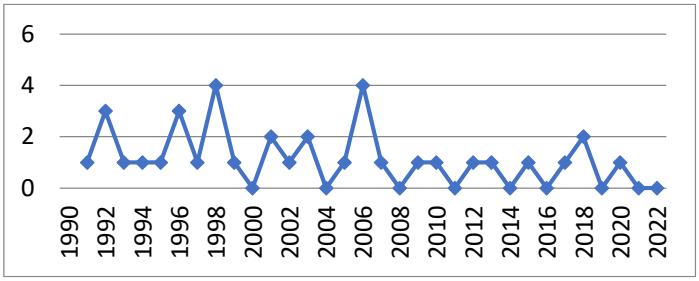


Figure 4: Number of Articles Per Year

Source: Authors

50% of researchers spoke about the specifics of the concept. The first observation noted was that for researchers and specialists in this field, environmental performance was a complex and difficult-to-define concept. Indeed, it was considered to be fuzzy (Lefebvre et al., 2003), meaning vague, multidimensional (Trumpp et al., 2015; Turki, 2009), and challenging to pin down due to the diversity of criteria and indicators involved. The ability and possibility to measure EP depended on the following:

i. Availability, quality, and feasibility of data and information (Berkhout et al., 2001; Tyteca, 1996; Tyteca et al., 2002).
ii. Nature and differences in environmental impacts hinder comparison (Berkhout et al., 2001; Tyteca et al., 2002).
iii. Lack of a single framework or standard approach for environmental measurement (Berkhout et al., 2001; Tyteca et al., 2002).
iv. Confidentiality and lack of information and data in the public and private sector (Lober, 1996; Tyteca, 1996).

v. Environmental issues are complex and often difficult to quantify (Berkhout et al., 2001).
vi. Differences between companies' environmental problems and the difficulty in quantifying them (Tyteca et al., 2002).

The authors used different denotations to refer to the same dimensions (Trumpp et al., 2015). Some authors discussed the dimensions in a general manner, while others addressed sub-dimensions. The examination of existing conceptualizations revealed one unambiguous fact: environmental performance appears to consist of four main dimensions, namely a management dimension, an operational dimension, an outcomes-based dimension, and a global context dimension.

The results showed that the researchers gave great importance on managerial and operational dimensions without any predilection for them. Therefore, despite the role of the contextual dimension, the role of stakeholders, and the outcome of the said performance, they received only minor attention from these researchers (Table 4).

Table 4: Summary of the thematic EP dimensions in the included studies

No.	Authors (year)	Environmental performance dimensions			
		Managerial dimension	Operational dimension	Outcomes-based dimension	Global context dimension
1	Wood (1991)	√	√	√	
2	Wells et al. (1992)	√	√	√	
3	Eckel and al. (1992)	√	√		
4	KPMG (1992)	√	√		
5	Wolfe and Howes (1993)	√		√	
6	James (1994)	√	√	√	
7	Metcalf et al. (1995)	√			
8	Lober (1996)	√	√	√	
9	Tyteca (1996)		√	√	
10	Azzone et al. (1996)	√	√		√
11	Ditz and Ranganathan (1997)		√		
12	Rikhardsson (1998)	√	√		
13	Young and Welford (1998)	√	√		
14	Ilinitch and al. (1998)	√	√	√	
15	Judge and Douglas (1998)	√	√		
16	Thoresen (1999)	√	√		
17	Jung and al. (2001)	√	√	√	
18	Berkhout and al. (2001)		√		
19	Tyteca and al. (2002)	√	√		
20	Curkovic (2003)	√		√	
21	Lefebvre and al. (2003)	√	√		
22	Doonan and al. (2005)		√		
23	Tam and al. (2006)	√	√		
24	Global Reporting Initiative		√		

	(2006)				
25	Henri and Giasson (2006)		√	√	
26	Rao and al. (2006)	√	√	√	
27	Xie and Hayase (2007)	√	√	√	
28	Turki (2009)	√	√	√	
29	Moneva and Ortas (2010)	√	√		
30	Schultze and Trommer (2012)	√	√		
31	ISO 14031 (2013)	√	√		√
32	Trumpp and al. (2015)	√	√		
33	Escrig-Olmedo and al. (2017)	√	√		
34	Dragomir (2018)	√	√	√	
35	Panya and al. (2018)	√	√	√	√
36	Nutsugah and al. (2020)	√	√		

Source: Authors

The managerial dimension referred to the strategic level of environmental performance. Based on the ISO 14001 standard, which served as the international reference for EMS (De Villiers et al., 2011), four sub-dimensions were identified, following the PDCA process, consisting of four stages: planning, implementing, verifying/evaluating, and acting/improving. Broadly speaking, the managerial dimension emphasized strategic activities and aspects related to the natural environment.

The operational dimension directly focused on environmental aspects such as air pollution, water pollution, electricity usage, waste generation, and more. It involved measuring the impact, inputs, regulatory compliance, production processes, etc., related to environmental aspects.

Outcomes-based dimension referred to the benefit resulting from the two dimensions, managerial and operational, which was observed in both qualitative, intangible outcomes such as stakeholder satisfaction and improved relations, as well as quantitative, tangible outcomes such as reductions in the organization's negative impacts, financial gains, and so on.

Global context dimension or what was known as Determinants, played a key role in the measurement and conceptualization of EP because they allowed us to understand the factors that influenced a given phenomenon and to better identify the relationships between variables and outcomes. Thus, among the 36 studies, only three mentioned the role of these determinants:

- Economic context, technological aspects, and X inefficiency (Tyteca, 1996);
- Firm’s characteristics: size, technology policy, TQM, and intention to become iso 14001 certified (Lefebvre and al., 2003);
- Product’s characteristics: if it is a good or service: consumer good, final product, product sold, foreign markets, product price, and customized product (Lefebvre et al., 2003);

- Drivers of change: pressure groups, legislation, and opportunities (Lefebvre et al., 2003);
- Internal to the organization: internal management employee: willing to implement iso 14001 certification, participation in the development of an environmental policy, commitment of top management, and pressure from shareholders and customers (Doonan et al., 2005);
- Externally to the organization: legal (regulations), economic (investors and creditors, customers, input providers), and social (NGOs community) (Doonan et al., 2005).

Based on these statements, the determinants of environmental performance were grouped into 4 categories: i. Organization's characteristics (Size, type, age, technology policy); ii. State characteristics (regulation and economic context); iii. Product characteristics (good or service); iv. Local human awareness and characteristics stakeholders' pressions.

These four dimensions were deemed to be interrelated because the managerial dimension provided the organization with the necessary capabilities to improve the operational dimension. The operational dimension captured the quantifiable results of the managerial dimension (Xie & Hayase, 2007). The success of these two dimensions then yielded positive results on several levels (outcomes) , depending on the global context of the organization. A summary giving an overview of the objective of each study included in the final stage, with a description of all dimensions of environmental performance selected by researchers, is presented in Appendix I.

On the other hand, the authors of the studies included in this review had identified several recommendations for implementing efficient environmental performance. These recommendations were considered as being of primary importance for achieving performance. Summarised in Table 5, the recommendations were classified into two categories. The first category included recommendations relating to dimensions, sub-dimensions, and indicators, and the second included recommendations related to the choice and characteristics of indicators.

Table 5: Author's Recommendations for the Establishment of an Efficient Environmental Performance

	Number of studies	Recommendations	Reference numbers
Recommendations related to dimensions, sub-dimensions, and indicators			
Policies and objectives	9	- Making policies effective (Claire, concise and measurable)	3
		- Developing policies and objectives	3
		- Develop a clear and explicit environmental policy	4
		- Establish measurable environmental objectives and targets	4
		- Linking measures to strategic objectives (the more that	6

		companies use customer and financial measures more her achieve a good EP and business)	12
		- Use an implementation method to ensure that project objectives are met if the organization is seeking an EP measurement system	31 21
		- Use of measurable environmental objectives to evaluate EP	21
		- Be fully aware of environmental requirements on the international stage	35
		- Strategies aimed at achieving true env. Objectives should track the progress of all actors in the blockchain	35 35
		- Setting up sustainable environmental policies	4
		- Having environmental pilot projects and guidelines. - Precautionary environmental management	7
		- Integrating environmental management into business planning and investment decisions	
		- Implement an environmental department	
Stakeholders	8	- Consult stakeholders to identify relevant environmental issues	3 4
		- Encourage collaboration and participation of external stakeholders in the company's environmental initiatives	5
		- Involve people to build commitment - Open communication of information to all stakeholders	7 31
		- Involving stakeholders in the EP assessment process	33
		- The need to consider CPs in the decision-making process is intrinsically linked to environmental importance	30
		- Stakeholders are not only interested in the current environmental impacts of a company but also in the future	33
		- Integration of the different sensitivities and objectives of each market player, development of a consensus on sustainability, and assessment of promoting public participation	35
		- Focus on the customer: Keeping customers satisfied means performing well.	
Continuous improvement	3	- Establishment of a document improvement (sets 10 percent per year goal for reductions in the use)	2
		- Establishing processes for continuous improvement of EPs	4
		- Continual improvement	13
Environmental audit	3	- Focus on how to perform the first audit in particular	3
		- Establishment of audit systems	7
		- The auditing activities must consider (pre-auditing; auditing; post-auditing)	23
		- The organizations should focus on 5 sub-indicators: complaints-warming, noncompliance records of inspection, non-conformance reports, and reports of marginal cases put under observations	23

Reporting	6	- Customized environmental reporting systems	3
		- Regularly communicate environmental results to internal and external stakeholders	4
		- Disclosure of environmental-related performance data	6
		- Software developed to expedite the reporting process or at least has a structured reporting mechanism	7
		- Requiring publication for some categories of industries and enterprises	11
		- Facilitating standard formats for EP reporting	11
		- Collect data on a more regular basis with fewer variables	19
Monitoring	4	- Creating on-going monitoring	3
		- Set up a monitoring system for EPs	4
		- Plan, control, and monitor decision situations affecting product and process EPs	16
		- Regularly monitor and evaluate PMI to exercise target and highlight any adverse trends in the process of environmental control	23
Product and services	2	- Assessing the environmental impacts of products and services	4
		- Product life cycle management must consider the following:	21
		Green design: design of all products, repair, disassemble, recycle, manufacture …	
		Green manufacturing: minimize waste, reduce pollution emissions, and ensure appropriate storage	
		Green marketing and distribution: inform customers, marketing packaging, regular packaging	
		Green disposal: establish recycling procedure and procedure of danger	
Attitude and behavior development	5	- Encourage employee involvement in company environmental initiatives	4
		- Employee training, those actually responsible for recognizing hazardous situations	7
		- Building a sustainable culture (improve knowledge of the environment, raise awareness to change behavior)	35
		- Commitment of the Executive Board	5
Scorecard	2	- Balancing the scorecard (the EP is good, the higher the number of measurement categories)	6
		- Using a Scorecard to collect environmental information	12
Information system	8	- Setting up an SI infrastructure for environment-related performance measurement	6
		- Having a better information base	18
		- Establishing information technologies for the capture, processing, and communication of information on the EP	12
		- Measuring and communicating EP	14
		- Expanding public access to EP information	11

		- Invest in effective communication strategies to promote EP and gain competitive advantage	36
		- Communication of the company's EP to all stakeholders	31
		- Multidimensional aggregation of information to avoid information loss	33
EMS	4	- EMS in line with iso 14001 must be written, detailed environmental policy, proactive envi policy, documented procedures, envi audit, monitoring envi costs and benefits)	21 31
		- Assessing the costs and benefits of implementing an EMS	18
		- Uncertain benefits of EMS	35
		- Strong sustainable EMS	
Aspects et impacts	3	- Identification and assessment of an organisation's significant environmental impacts	31
		- Identify significant environmental aspects of activities, products, or services and evaluate them regularly	31
		- For EOP, it is necessary to select significant indicators that correspond to the specific environmental aspects of the companies under study.	32
		- Assess and manage the environmental risks associated with the company's activities	4
Others	5	- Compliance issue	7
		- Decreasing cost and increasing revenue (green economy, monitoring, use of a voluntary approach)	35
		- Environmental learning organization	35
		- Leading the way in environmental innovations that put the industry on the path to sustainable developement	21
		- Measuring sustainability	6
		- Knowing the level of greening required to achieve sustainability	8
Recommendations related to the choice and characteristics of indicators			
Standardization of measures	4	- Standarirising measures	6
		- Standardise the information about the management variable	19 14
		- Interpret existing EP measures with caution	30
		- To be valid (closely related to environmental impacts; fully covers the construct; provides forward-looking information)	30
		- Reliable (quantifiable; externally verifiable; directly comparable)	
Data quality and collection	5	- The data used must be accurate, precise, reliable, objective, and independently verifiable.	8
		- Validity and reliability of the measure/source from which the CEP indicators were extracted (aggregated or non-aggregated).	34
		- Collate the data into a single period to make the results more objective	28

		- Test using a larger sample and a more appropriate methodology.	27
		- Testing in different countries and regions with different environmental cultures and laws.	27
		- Be careful when assuming that historical information is sufficient; it may not truly satisfy your criteria for quality data.	5
Indicator selection	6	- Propose useful indicators to measure each dimension of EP (number of audits; the number of employees dedicated to each activity ; monetary cost of resources,)	10
		- Choose measures that are relevant to the specific context and industry of the company being studied	34
		- Use of multiple measures to capture the multidimensional nature of the CEP	34
		- Adapt the model to the particularities of the company. Before each operation, it is advisable to identify the indicators that can be used (delete the liquid discharges if the company does not have them)	28
		- Use measures consistent with the definition of CEP, which emphasizes the reduction and prevention of environmental harm	34
		- Check any available external databases with quantitative CEP data	34
		- Use reliable measures and valid measures that have been tested in previous studies	34
		- Consider the data source and the level of aggregation when the selected measure	34
		- Comparability of indicators over time to identify trends	13
		- Comparability of the use of indicators between a company/company or activity/activity	13
		- Degree of thoroughness and conciseness of the information	27
Implementation	7	- Making EP measurement a standard business practice	11
		- Recognizing firms that demonstrate improved performance and greater disclosure	11
		- Establishing an environmental assessment framework based on indicators relevant to the company's activities	31
		- Supporting an extension of transparency	18
		- Adapted the model for all departments, not just the top management or the environment department	28
		- Need to avoid offsetting good and bad outcomes	33
		- Relevance, measurability, and comparability over time	16
		- Choice of indicators with fixed targets	13
		- Discuss the results between services and improve the model	28
Other	1	- Make your measures reliable and consistent: the data should be based on actual performance and accessible and understandable.	5
			5

	- The benefits of obtaining information should outweigh the costs of collection.	5
	- Measure what is under your control: global warming is too big, but your carbon monoxide/dioxide emissions can be measured and controlled.	5
	- Ask who is looking at the information and why: the usefulness of a specific measure depends on the vision or environmental goals of the organization (as in TQM, the information-goal connection is explicit, and progress is tracked continuously)	5
	- Reflect on stakeholder priorities while keeping in mind your organizational goals	5
	- Measures should be easily understood and few	

Source: Authors

In addition, some of this research has discussed the expressions of the indicators, data used for environmental performance indicators can be expressed as absolute or relative measurements and can be aggregated and/or weighted according to use and application (Jasch, 2000). Depending on the results, indicators were categorized as follows:

i. Absolute indicators: the real value of the company e.g., tons of raw material, emissions, taken from input-output analysis (Thoresen, 1999; Young & Welford, 1998).
ii. Relative indicators, where input figures are referenced to other variables such as production in tons, revenue, number of employees, and office space in m^2; e.g., water per hectoliter beer, detergent per m^2 (Thoresen, 1999; Young & Welford, 1998).
iii. Indexed indicators, where figures are expressed as a percentage for a total, or as a percentage change to values of previous years (Escrig-Olmedo et al., 2017).
iv. Aggregated depictions, where figures of the same units are summed over more than one production step or product life cycle, it may be aggregated (Thoresen, 1999; Young & Welford, 1998) or weighted (Thoresen, 1999).
v. Weighted evaluations, which attempt to depict figures of varying importance using conversion factors (Thoresen, 1999; Young & Welford, 1998).
vi. Normalised/standardized (Thoresen, 1999).

DISCUSSION

This mixed-methods systematic review explored the dimensions required to measure EP, given the quantity and quality of the research available on EP, the aim of which was to analyse and synthesise in a standardised and objective manner the relevant scientific literature, without denying the recommendations suggested by the authors to achieve this performance. To reduce bias as much as possible, a rigorous method

of research and selection of bibliographical information was used. By following the PRISMA statement steps, 36 significant contributions were deduced that had conceptualised EP, of which only one was dedicated to the public sector. Several steps were taken, starting with the development of the research question and protocol, followed by an identification of the eligible articles on the basis of a full reading of the manuscript and according to inclusion and exclusion criteria, and ending with synthesis and discussion of the results. Each stage of the process was checked for errors.

The results showed that despite the interest shown in environmental performance over the years, resulting in a huge number of publications, research focussed on conceptualisation is experiencing a certain stability, with English-speaking countries such as the USA, UK and Canada being the most captivated by this issue, followed by Europe. The papers were published in various journals indexed in the two chosen databases. However, on the basis of the grey literature and on reading the references of the eligible manuscripts, we had identified two guidelines and three reports that were of significant value in research in this field. In terms of substance, the methodologies used were diverse, ranging from conceptual, mixed, qualitative and quantitative, with no particular preference. In terms of data sources, the two that stood out most were surveys and literature reviews.

At the time of the redaction of this manuscript, to the best of our knowledge, this was the first paper to conceptualise EP from a systematic review. This original contribution brought a new and innovative perspective to the subject, making it very interesting for readers interested in environmental research. A great deal of research had attempted to measure and evaluate environmental performance, but without focussing on a unified conceptualisation, which made the results difficult to compare. Therefore, the presentation of different categorizations for measuring environmental performance suggested several comments:

- A quasi-absence of frameworks valid for the public sector, all grids were mobilised in the private sector through different works, except for the work of Panya et al. (2018), which was based on the ISO 14001 standard and management-oriented evaluation models to assess the environmental management performance of local governments in Thailand.
- Results indicated that a company's environmental performance correlated with the sector or geographical location in which it operated (Berkhout et al., 2001);
- Regarding environmental performance, it was essential to consider both technical and managerial aspects. Although technical aspects were fundamental to improving a company's environmental impact, they alone cannot guarantee effective environmental management. Management activities must therefore also be properly organised to ensure adequate environmental management (Turki, 2009).
- 58% of researchers focussed on negative externalities produced and generated by companies.

- An interest was shown in the company's relations with PPs. These relationships can have a significant impact on a company's environmental performance (Doonan et al., 2005; Lefebvre et al., 2003). Positive relations with stakeholders could help to improve the organization's environmental performance by providing a better understanding of stakeholders' needs and expectations. For example, a company can work closely with its suppliers to identify greener solutions for its materials and products. Similarly, by listening to the concerns of its customers and local communities, a company can improve its environmental practices and strengthen its reputation as a responsible player.
- The notion of "Does it pay to be green?" also manifests itself in the manuscripts by addressing the financial outcomes (Henri & Giasson, 2006; Jung et al., 2001). Research suggest that implementing responsible environmental practices can be financially beneficial for a company and good for the environment. Indeed, by adopting responsible environmental practices a company can reduce its operating costs. Furthermore, improved environmental performance can generate financial gains for the company. For example, better waste management can reduce treatment costs and the regulatory fines associated with pollution. Similarly, eco-responsible practices can improve energy efficiency and reduce operating costs.
- 8% of the studies discussed the environmental condition and/or context component, which, according to Turki (2009) was difficult to operationalise.
- The researchers based their conceptualization of environmental performance on several theories, inspired by the OECD model, the evaluation model of Stufflebeam (1994), the natural resource-based view and planning performance literature (Judge & Douglas, 1998), the organizational effectiveness model (Lober, 1996), strategies such as total quality management and time-based completion (Curkovic, 2003), and the resource-based theory and dynamic capability (Nutsugah et al., 2021).
- Attention was paid to the validity and reliability of the measurement (Dragomir, 2018; James, 1994; Schultze & Trommer, 2012; Turki, 2009; Wolfe & Howes, 1993). The validity of EP measurement can be assessed by examining whether the measurement covers all the important elements of EP. Measurements must be able to capture the different dimensions of the EP, such as air quality, water quality, biodiversity, and waste management. In addition, the measurement validity of EP can be assessed by examining whether the measurements used correspond to current environmental standards and regulations. The reliability of EP measurement can be assessed by examining whether the measurement produces consistent or stable results in different contexts and on different time scales.

- The nature and sources of data were important factors to consider when measuring and assessing EP. Environmental data can be collected from different sources, such as field observations, measurements from monitoring devices, administrative, data and stakeholder surveys, and international databases. Data can also be collected at different levels, such as local, regional, and national. The nature of the environmental data was also important. Data can be qualitative or quantitative; measurements can be direct (field measurements) or indirect (model-based estimates). Data can also be primary (collected specifically for the analysis in question) or secondary (collected for other reasons and used for the analysis in question). A certain degree of precision in these elements will impact the EP achieved, hence the importance of choosing the appropriate source and nature of data to assess environmental performance. The data must be reliable, valid, and relevant to the analysis.
- Difficulties in calculating and accessing environmental data were reported, which may be due to the high cost of data collection, the complexity of the data, the limited access and confidentiality of reports and organisations, the absence of reporting for certain countries, industries, and organisations, the fragmentation of data and the limited quality of the data available.
- In terms of purpose, most of these analytical grids were designed to enable companies to meet both their obligations to report environmental information to external stakeholders and their desire to manage their EP internally (Xie & Hayase, 2007). These grids made it possible to take management decisions in terms of environmental strategy and to identify the successes and failures of these approaches (Azzone et al., 1996).

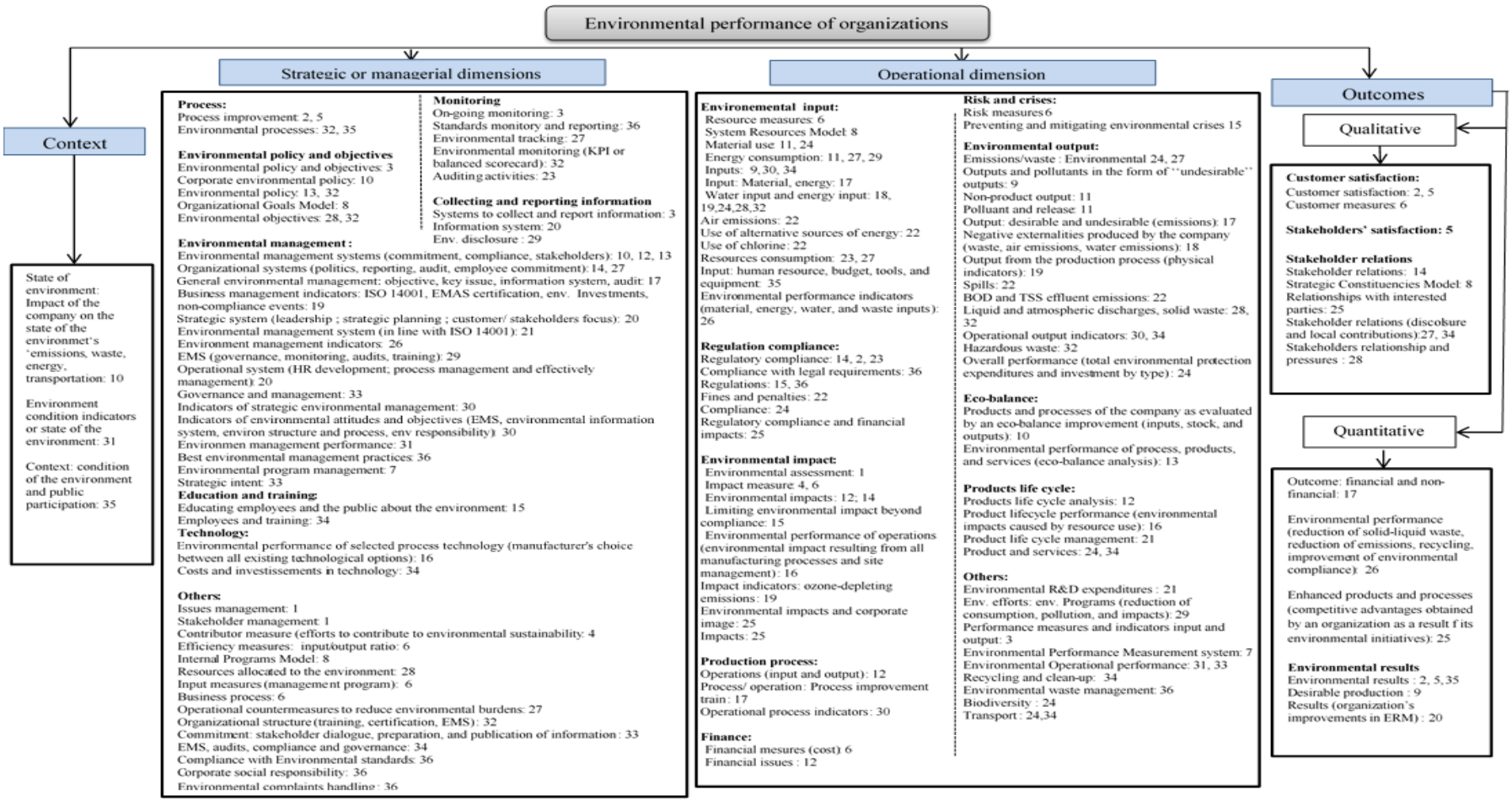
It is clear that the variation in these models and the related intrinsic and extrinsic elements demonstrated the complexity of the conceptualisation of EP. As there are no widely accepted blueprints that can be considered, and to propose a generic model, we categorised the different dimensions and sub-dimensions according to the managerial, operational, contextual, and outcome dimensions (Figure 5).

Environmental Performance Depends on the Context in Which the Organization Operates

4.65% of codes were assigned to the contextual dimension (Azzone et al., 1996; ISO 14031, 2013; Panya et al., 2018). For the researchers, to implement an environmental performance management system, it was necessary to study the problems, opportunities, needs, and strengths of each sub-dimensions of organisation context, which would make it possible to map out feasible environmental objectives over the medium and long term.

The characteristics of organisations, such as size, type, age, and technology policy, determine their environmental performance. Large organisations may require more sophisticated and detailed environmental performance measures to assess their overall environmental impact, whereas small organisations may focus on simpler and more targeted environmental performance measures. The type of organisation can also influence the choice of environmental performance measures. For example, organisations in the manufacturing sector may have greater environmental impacts than those in the service sector, which may require more detailed and specific environmental performance measures. The age of the organisation may also influence the choice of environmental performance measures. Older organisations may have more established environmental management practices and more comprehensive environmental data, which may make it easier to implement more sophisticated environmental performance measures. Finally, the organisation's technology may influence the choice of environmental performance measures because of the impact of technologies on environment. This is how organisations that adopt clean and sustainable technologies may have lower environmental impacts.

Figure 5: Frequency of Organisation's Environmental Performance Sub-Dimension



Source: Authors

Environmental performancewas determined by the characteristics of products, whether goods or services. For goods, the choice of EP measures may depend on the raw materials and manufacturing processes used to produce the good, as well as its use and disposal at the end of its life. For services, the choice of EP measures may depend on the environmental impacts associated with the provision of the service. For example, for a transport service, environmental performance measures may include the impact of greenhouse gas emissions associated with the use of fossil fuels, as well as the impact of waste generated by vehicles at the end of their life.

Local human consciousness and stakeholder pressures were key determinants of EP (Panya et al., 2018). Local human consciousness referred to the values, beliefs, and attitudes of people within a local community towards the environment. These values could influence organisations in terms of their impacts on the environment; therefore, organisations that are perceived to harm the environment may face local opposition. Stakeholder pressure degree also influenced EP, stakeholders were interested in an organisation's current and future environmental impacts, and the organisation cannot be sustainable if it did not consider the stakeholders' preferences (Tregidga et al., Kearins, 2014). Consumers may prefer to buy environmentally friendly products and services, investors may demand sustainability and EP reports, and regulators may impose stricter environmental standards (Schultze & Trommer 2012). Environmental groups could also pressure companies to improve their EP by publicising the environmental impacts of their activities. Companies that were perceived to have a negative impact on the environment can face negative repercussions, while those that adopted sustainable environmental management practices could improve their reputation and acceptance in the local community.

Moreover, the study of performance and management practices differed from one state and region to another. Geography, climate, and natural resources, all played a part in the success or failure of the strategy adopted by decision-makers, which could then either promote an organisation or hinder its development (ISO 14031, 2013).

Finally, state characteristics, such as regulation and economic context, were also key determinants of EP. Companies operating in strict regulatory environments may have an incentive to adopt more sustainable environmental management practices to comply with regulatory standards and avoid fines and penalties. The economic context can also influence organisations' environmental performance. Companies operating in competitive markets may face increased pressure to reduce costs, which may lead them to reduce their investment in sustainable environmental management practices. At the same time, organisations operating in markets where sustainability was increasingly valued may be encouraged to adopt sustainable environmental management practices in response to consumer and stakeholder demands.

Environmental Performance is Linked to the Environmental Management Dimension

In the environmental field, the strategic dimension of which 38.75% of codes were assigned, referred to the application of an environmental strategy that involves setting objectives and determining the environmental resources that will enable environmental performance to be achieved, while including the following according to the results: monitoring (Eckel et al., 1992; Nutsugah et al., 2021; Tam et al., 2006; Trumpp et al., 2015; Xie & Hayase, 2007), technology (Dragomir, 2018; Thoresen, 1999), education and training (Dragomir, 2018; Judge & Douglas, 1998), process (Panya et al., 2018; Trumpp et al., 2015; Wells et al., 1992; Wolfe & Howes, 1993), and collecting and reporting information (Curkovic, 2003; Eckel et al., 1992; Moneva & Ortas, 2010).

From the 50 codes relating to the strategic/managerial dimension and according to the vision of the studies included, the said dimension can be expressed according to a process. The first step towards EP was the choice of environmental policy and objectives (Azzone et al., 1996; Eckel et al., 1992; Lober, 1996; Trumpp et al., 2015; Turki, 2009; Young & Welford, 1998), which should be guided by a clear understanding of the organization's environmental impacts, applicable environmental regulations, stakeholder expectations, and financial considerations. The policies and objectives selected must be relevant, measurable, ambitious, reliable, and valid. Thereafter, an effective environmental structure (ISO 14031, 2013; Trumpp et al., 2015) is essential and can include defined environmental responsibilities, environmental planning, training, awareness programs, environmental monitoring and assessment processes, and clear lines of environmental communication. The environmental structure must be adapted to the needs of the organisation to ensure effective and efficient environmental management.

Thirdly, an effective environmental process included the identification and assessment of environmental impacts, environmental planning, implementation of plans, environmental monitoring and evaluation, and continuous improvement. The environmental process was cyclical and needs to be updated regularly to ensure effective and efficient environmental management. Some researchers have identified eco-innovations, and modifications to production processes to make them less polluting, as a measure of EP (Christmann, 2000), so efforts in eco-innovation and technologies can help companies to reduce their environmental impact, improve their environmental performance and strengthen their sustainability.

Another crucial sub-dimension was required, namely environmental control and monitoring (Eckel et al., 1992; Nutsugah et al., 2021; Tam et al., 2006; Trumpp and al., 2015; Xie & Hayase, 2007), which remained essential to EP's success. They referred to review procedures and corrective actions that must ensure continuous improvement in environmental performance. Finally, a successful performance was closely dependent on the disclosure relationship between the organization and its various stakeholders, and an organization with a strategy based on the publication of

this information instantly legitimizes the degree of credibility of its political actions, hence the need for reporting and information systems (Curkovic, 2003; Eckel and al., 1992; Moneva & Ortas, 2010).

Environmental Performance is Achieved Through the Operational Dimension

All the studies included dealt with the operational dimension of EP of which 46.50% of codes were assigned, the key elements being: inputs (Berkhout et al., 2001; Ditz & Ranganathan, 1997; Doonan et al., 2005; Dragomir, 2018; Global Reporting Initiative, 2006; James, 1994; Jung et al., 2001; Lober, 1996; Moneva & Ortas, 2010; Panya et al., 2018; Rao et al., 2006; Schultze & Trommer, 2012; Tam et al., 2006; Turki, 2009; Tyteca, 1996; Tyteca et al., 2002; Xie & Hayase, 2007), outputs (Berkhout et al., 2001; Ditz & Ranganathan, 1997; Doonan et al., 2005; Dragomir, 2018; Global Reporting Initiative, 2006; Jung et al., 2001; Schultze & Trommer, 2012; Trumpp et al., 2015; Turki, 2009; Tyteca, 1996; Tyteca et al., 2002), and impacts (Henri & Giasson, 2006; Ilinitch et al., 1998; James, 1994; Judge & Douglas, 1998; KPMG, 1992; Rikhardsson, 1998; Thoresen, 1999; Tyteca and al., 2002; Wood, 1991). These studies measuring environmental performance agreed that the consumption of resources such as the quantities of water and energy consumed and the use of equipment are the main measurement indicators, followed by outputs and environmental impacts, which were closely linked and had a significant influence on environmental performance.

Regulation compliance is another important sub-dimension of environmental performance measurement (Doonan et al., 2005; Henri & Giasson, 2006; Ilinitch et al., 1998; Judge & Douglas, 1998; Nutsugah et al., 2021; Tam et al., 2006; Wells et al., 1992), as it measured an organisations' ability to comply with current environmental standards. Organisations that succeeded in complying with environmental regulations while adopting more sustainable practices can improve their environmental performance and reputation.

An organisations' ability to manage environmental risks and respond effectively to crises can significantly impact its environmental performance (James, 1994; Judge & Douglas, 1998). Organisations that had robust contingency plans to deal with unforeseen events can minimise environmental impacts and disruption to their business activities.

The operational dimension also included process (Jung et al., 2001; Rikhardsson, 1998; Schultze & Trommer, 2012), eco-balance (Azzone et al., 1996; Young & Welford, 1998), and product life cycle analysis (Dragomir, 2018; Global Reporting Initiative, 2006; Lefebvre et al., 2003; Rikhardsson, 1998; Thoresen, 1999). Eco-balance enabled the environmental impact of a product to be analysed throughout its life cycle, while process analysis enabled production processes to be optimised to reduce the organisation's environmental impact. By combining these two analyses, organisations can identify the critical stages in a product's life cycle that had the greatest environmental impact and implement measures to reduce this impact while optimising production processes.

The Environmental Performance Trajectory is Moving Toward Outcomes

The outcomes represented 10.85% of codes, thirteen studies dealt with the question of the results and outcomes of the efforts put in place by the organisation. The first outcome may be reflected in customer and consumer satisfaction (James, 1994; Wells et al., 1992; Wolfe & Howes, 1993), while the latter may be considered as an indirect result or outcome of environmental performance. For example, if a company reduced its environmental footprint by cutting greenhouse gas emissions, using recyclable materials, or minimising waste production, this can help to improve customer and consumer perceptions of the company. Studies have shown that consumers were increasingly aware of environmental issues and are more inclined to buy products or services perceived to be environmentally friendly (Dragomir, 2018; Henri & Giasson, 2006; Ilinitch et al., 1998; Lober, 1996; Turki, 2009; Xie & Hayase, 2007). A company that adopted environmentally friendly production practices can strengthen its relationship with customers and suppliers, who may be more inclined to work with a company committed to sustainability.

By adopting sustainable practices, organisations can reduce the costs associated with waste management, energy consumption or water management which can contribute to improving their financial profitability in the long term. This improved on the principle of how it pays to be green, arguing that being green certainly requires a financial investment, but it will be profitable for the company in terms of return on investment (Curkovic, 2003; Jung et al., 2001; Panya et al., 2018; Tyteca, 1996).

Achieving environmental performance also resulted in direct outcomes such as reduced greenhouse gas emissions, reduced water consumption, reduced waste production, improved air and water quality, enhanced products and services, and environmental compliance (Jung et al., 2001; Rao et al., 2006).

Finally, this systematic review confirmed the importance of both quantitative and qualitative factors in environmental performance. On the whole, there were no sustainable results without a flagship point, namely continuous improvement. Continuous improvement played a crucial role in achieving the environmental performance of organisations. It helped to reduce costs, improve energy efficiency, comply with environmental regulations, enhance reputation, and take social and environmental responsibilities seriously**.**

Barriers and Recommendations in Enhancing the Environmental Performance of Organizations: A Call by the Authors

The findings of this study shed light on several barriers that may impede the successful implementation and achievement of environmental performance.The obstacles were primarily linked to the lack of study and understanding of the overall context in which the organization operates, the unfamiliarity with local regulations, environmental conditions, the level of vigilance of various stakeholders, and the characteristics of each activity of the organization. The incorrect definition of

environmental policy and objectives by the organization without prior study, the absence of a department responsible for monitoring and controlling various environmental activities and aspects, and the lack of an information system and balanced scorecard to capture and control different operational sub-dimensions are all elements that constitute barriers to achieving environmental performance.

Furthermore, based on the insights gained from the study, several recommendations were proposed to overcome these barriers and enhance the practical implications of the researches. The included studies focused on various managerial sub-dimensions. The researchers emphasized the importance of developing a feasible and effective policy and objectives, considering different stakeholders, pursuing continuous improvement, conducting audits and controls, preparing reports, and fostering a pro-environmental attitude within the organization. It was also necessary to consider the indicators required to measure each dimension and sub-dimension. These indicators should be easy to implement, standardized, valid, reliable, understandable, and controllable. It is also essential to test them before implementation and ensure ongoing monitoring and control.

This line of thinking led to the construction of a conceptual model valid for different fields of study (Figure 6) that reflected the several dimensions for achieving environmental performance by studying the global context of the organisation in the first phase, while adopting the principle of continuous improvement approach.

Figure 6: Abstract Model of Environmental Performance
Source: Authors

Limitations and Avenues of Research

Like any research method, there were limitations both in terms of the methodology and the application in particular. This study had several limitations.

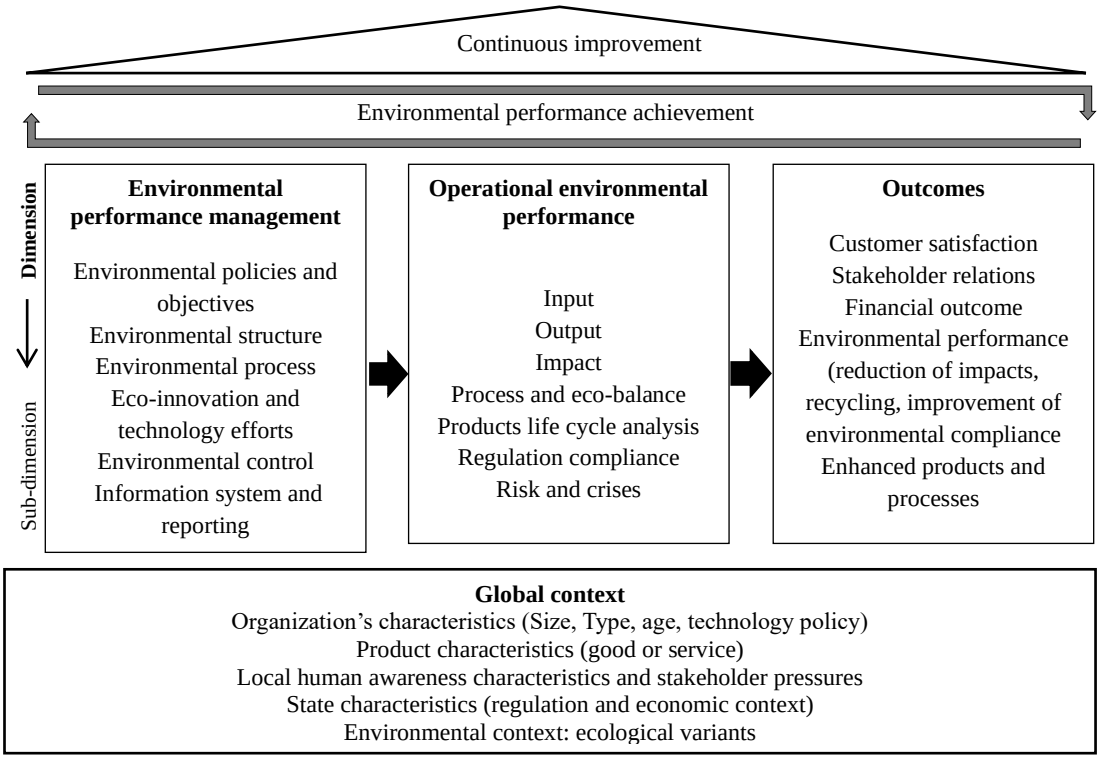
Sample selection bias refers to potential distortions that may occur because of the criteria used to select studies and define the study population. These may be caused by a poorly designed search protocol. we used broad inclusion and exclusion criteria to gather as many studies as possible; however, this attempt led us to have a huge amount of data to extract and synthesise. Thus, there may have been potentially unidentified or under-interpreted specific constructs in the review. The choice of research equation may also affect the results because for some researchers, the term environmental performance may be developed differently and have other meanings, which will have an impact on the amount of work raised during the first stage of the study.

Inclusion and exclusion criteria are essential to ensure the quality and validity of the review. However, there are limitations to consider when choosing these criteria that will impact the results, including data availability, publication bias, population variability, selection bias, and time and resource constraints. Next, we addressed inconsistent coding or data interpretation, which can occur among researchers who may understand and extract data in different ways. The team of researchers worked in close collaboration on each stage of the data selection process and discussed any scenarios of uncertainty to arrive at a unanimous decision on what to include. Limiting the search to one language or a limited set of languages, English and French for this search, may have excluded relevant studies published in other languages. This may have led to language bias, where the results of the review may be influenced by the language of the included studies.

The definitions and indicators used by the authors were harmful to the expected aims. For example, when James (1994) talked about inputs, his definition of the concept was perceived differently from what is recognised, i.e. the consumption of resources and materials.

Moreover, as a descriptive literature review, quantitative evidence for a unified conceptual framework for environmental performance cannot be presented to the reader. In addition, among the 36 manuscripts included, a large number were backdated.

However, the redeeming feature of this review was that it brouht together a collection of studies that showed the conceptualisation of environmental



performance and its effectiveness. The results of this study suggested possible directions for future research:

- Use longitudinal studies to measure EP to assess changes in EP, identify long-term trends, evaluate the effectiveness of environmental interventions, and identify the factors that influence EP.
- Focus on the context and integrate it into future conceptualization by measuring it via qualitative and quantitative variables.
- Propose and conduct research in different sectors, non-industrial, public organisations, and local authorities.
- Focus on emerging countries because most research was conducted in developed countries and regions.
- Conduct inter-sectoral and inter-territorial comparative studies.
- Finally, it would be interesting in future studies to adjust the models and use the proposed model in different fields of studies to test whether qualitative and quantitative methods.

CONCLUSION

Undertaking this research was driven by three major concerns: i. To categorize previous research on the phenomenon under study; ii. To identify the most controversial dimensions of environmental performance; iii. To relate the various obstacles encountered by researchers in studying EP and determine the conditions for success in achieving EP.

Using a rigorous and scientific approach, specifically a systematic review, and employing a refined analysis through the appropriate choice of inclusion and exclusion criteria, our search focused on 36 articles. The main findings of our research are summarized below:

- While the literature on environmental performance (EP) continues to expand, research focused on identifying its dimensions is receiving decreasing attention. Instead, researchers are often content with adhering to established standards such as ISO 14001 and EMAS, without introducing any innovative approaches. It is worth noting that there is a modest but discernible interest in studying the dimensions of EP, which varies depending on the geographical context. Specifically, there is a stronger interest among North Americans and Britons compared to other Europeans or Asians.

In addition to this varying interest, there is a notable diversification of research in terms of methodological approaches, data sources, types of data, types of documents, and publication journals.

- Our systematic review had identified four key dimensions of environmental performance measurement: the managerial dimension, operational dimension, outcome-based dimension, and global context dimension. It is important to note that these dimensions have been prioritized differently by various authors. However, recent literature indicated that the selection of these dimensions is influenced by contingency factors (global context dimension) such as organizational characteristics, product characteristics, state characteristics, and human consciousness. Researchers employ diverse approaches when choosing among these dimensions.
- The obstacles encountered by researchers who have studied EP can be summed up in the limited and confidential access to empirical data and the difficult choice of salient EP indicators. As for the conditions for success in achieving and improving EP, researchers have prescribed two major orientations. A first category of researchers insists on the need to feed or filter the various dimensions of EP; a second category, on the other hand, pleads for sufficient and satisfactory precision in the indicators selected (indicators that must be measurable, quantifiable, comparable, standardized, precise, etc.).

The scientific impact of this research lies in its ability to generate new knowledge and open up new perspectives in the field. We consider the systematic review to be extremely robust (Denyer & Tranfield, 2006), providing a comprehensive and global mapping of the various dimensions of EP in organizations.

In addition, our research provides a standard model applicable to all types of organizations. Finally, our research promotes a better understanding of the dimensions, sources of knowledge, and obstacles faced by organizations in implementing EP.

The insights provided in this article constitute a source of practical recommendations for practitioners.

Firstly, for practitioners, several recommendations can be formulated, whether in the formulation of clear, precise, and achievable environmental strategies and policies according to the cultural, legal, social, and economic context in which they prevail, the allocation of sufficient resources, the elaboration of an adapted structure, the assurance of control, audit and information sharing, etc., while keeping the principle of continuous improvement for the achievement of EP.

Secondly, both industry and policymakers can use our model as a reassuring roadmap for the design and implementation of EP.

Thirdly, public authorities can be sufficiently enlightened about the new criteria for environmental public policymaking adapted to different types of organizations.

Fourthly, the results of our research invite decision-makers and practitioners to identify the best practices with a view to drawing inspiration from them.

The model we have designed serves as a real benchmark, or at least a valuable barometer, for assessing the EP of organizations.

Finally, the development of our research model can win over financial decision-makers with a view to financing green projects that conform to it, in the sense that it is intended to be comprehensive and complete.

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APPENDIX I: SUMMARY OF THE MAIN CHARACTERISTICS OF THE INCLUDED STUDIES

No.	Authors (year)	Main objective of the study	Measurement and dimensions of environmental performance
1	Wood (1991)	Define corporate social performance (CSP) and reformulate the CSP model to build a coherent, integrative framework for business and society research.	(1) Environmental assessment (2) Stakeholder management (3) Issues management
2	Wells et al. (1992)	Explain why and how process improvement, environmental performance, and customer satisfaction should be measured to achieve total quality environmental management, with examples of leading company practices.	(1) Process improvement (2) Environmental results (3) Customer satisfaction
3	Eckel et al. (1992)	Discuss, describe, and develop a framework for a "System for Environmental Performance Measurement", and express the need for environmental audits, consultations with stakeholders, input indicators, and output indicators.	(1) Environmental policy and objectives (2) Performance measures and indicators (3) Systems to collect and report information (4) On-going monitoring
4	KPMG (1992)	Helping companies adopt a responsible and sustainable approach to environmental management by providing guidance and tools for measuring, evaluating, and improving their environmental performance, the report provides a framework for measuring environmental performance using a holistic approach that considers environmental aspects, impacts, and risks.	(1) Impact measures (emission, waste generation, and resource consumption) (2) Contributor measure (efforts to contribute to environmental sustainability: ie. investments in renewable energy, EMS, and employee training programs)
5	Wolfe and Howes (1993)	Describe a system for identifying, tracking, and reporting environmental efforts by examining the experience of Ontario Hydro	(1) Process improvement (management commitment, training, envir. Investment, employee awareness, systems, etc) (2) Environmental results (energy use, cost reduction, reported annually or monthly) (3) Customer/stakeholders satisfaction
6	James (1994)	Discuss current environmental performance measurement practices addressing the categories the approaches in Europe and North America.	(1) Impact measures (2) Risk measures (3) Emissions/waste (4) Input measures (5) Resource measures (6) Efficiency measures (7) Customer measures (8) Financial measures
7	Metcalf et al. (1995)	Overview of the environmental program management of "best in class" companies, and detailing their components for an effective environmental performance measurement system.	(1) Environmental program management ; (2) Environmental Performance Measurement system
8	Lober (1996)	Seeking to go beyond the simple characterizations of corporate greenness by answering "What criteria might be used to	(1) Organizational Goals Model (EMS ; TQEM ; auditing ; complaints ; pollution prevention, etc)

		define and measure a company's environmental performance and how might these criteria be organized?	(2) System Resources Model (employee involvement ; resource use) (3) Internal Programs Model (4) Strategic Constituencies Model (relationship with all stakeholders and communication of environmental activities)
9	Tyteca (1996)	Looking for one (or a few) instrument(s) that allow accounting for the various possible environmental impacts of industrial activities, compare analogous units in a set, and suggest an indicator as a unique figure, in which all the information on the impacts is captured. This might require the adoption of adequate weight coefficients, which is the approach adopted by several authors in the literature. However, there is an alternative perspective that attempts to adopt, which consists of exploiting the ideas of the productive efficiency theory.	(1) Inputs (2) Desirable production (3) Outputs and pollutants in the form of ‘‘undesirable’’ outputs.
10	Azzone et al. (1996)	Defining an integrated framework for environmental performance indicators that can help managers design effective environmental reports. This article addresses the limitations identified in the analysis of the structure of current environmental reports and provides a conceptual framework for the main aspects that should be considered in such reports. In addition, the article provides recommendations and remarks on the topic.	(1) State of the environment (2) Corporate environmental policy (3) Environmental management systems (commitment, compliance, stakeholder) (4) Products and processes of the company as evaluated by an eco-balance improvement (inputs, stock, outputs)
11	Ditz and Ranganathan (1997)	Demonstrating how EPIs are already being used inside firms to drive improvements in resource efficiency, while increasing profitability, it also shows that the full potential of corporate EPIs is realized only when they serve decision-makers both inside and outside company walls.	(1) Material use (2) Energy consumption (3) Non-product output (waste created before treatment, recycling, or disposal) (4) Pollutant release
12	Rikhardsson (1998)	Propose a concept for corporate environmental performance that combines financial and non-financial elements. It discusses and describes various types of environmental information systems that can be used to manage environmental performance information. Furthermore, it identifies possible strategies for a company when designing an environmental performance information system and touches on several important implementation issues.	(1) Management (politique, EMS, audit and review) (2) Operations (inputs and outputs) (3) Environmental Impact (4) Products life cycle analysis (5) Financial issues
13	Young and Welford (1998)	This paper presents an environmental performance measurement framework based on field trials conducted in the UK. Benchmarking was performed using the case studies to form an environmental performance index.	(1) Environmental policy (2) Environmental management system (commitment, compliance, stakeholders) (3) Environmental performance of processes, products, and services (eco-balance analysis)

14	Ilinitch et al. (1998)	Define corporate environmental performance using theoretical and empirical approaches and consider how well existing measures operationalize the construct.	(1) Organizational systems (politics, reporting, audit, employee commitment) (2) Stakeholder relations (3) Regulatory compliance (4) Environmental impacts
15	Judge and Douglas (1998)	This study empirically examines the antecedents and effects of incorporating the environment into the strategic planning process, uing planning-performance literature and the resource-based perspective	(1) Complying with environmental regulations (2) Limiting environmental impact beyond compliance (3) Preventing and mitigating environmental crises (4) Educating employees and the public about the environment
16	Thoresen (1999)	This study focuses on the central aspects related to the construction and use of EPIs for environmental performance evaluation in industrial companies. The suggested indicator structure connects the lifecycle performance of products, process technology, and manufacturing operations to environmental conditions on a local, regional, or global scale.	(1) Product lifecycle performance (environmental impacts caused by resource use) (2) Environmental performance of selected process technology (manufacturer's choice between all existing technological options) (3) Environmental performance of operations (environmental impact resulting from all manufacturing processes and site management)
17	Jung et al. (2001)	Addresses a measurement of corporate environmental performance and its application to the analysis of efficiency in the petroleum firms using a Gscore.	(1) General environmental management: objective, key issue, and audit (2) Input : Material, energy (3) Process/operation: Process improvement training (4) Output: desirable and undesirable (emissions) (5) Outcome : financial and non-financial
18	Berkhout et al. (2001)	Reporting on the experience gained in the scope of a European Community-funded research project called MEPI (Measuring Environmental Performance of Industry).	(1) Waste (2) Air emissions (3) Water emissions (4) Water input (5) Energy input
19	Tyteca et al. (2002)	Develop quantitative indicators for the environmental performance of manufacturing firms, applying these indicators to deepen our understanding of the causes of changes in industrial environmental performance and assessing the effectiveness of different policy instruments in improving firms' overall environmental performance.	(1) Physical indicators: energy and water inputs, waste generation, CO2, SO2, NOx and VOC emissions to air, COD/BOD, N, phosphate, heavy metals emission to water, dust emissions, and AOX. (2) Business management indicators: ISO 14001, EMAS certification, env. investments, non-compliance events; (3) Impact indicators: ozone-depleting emissions
20	Curkovic (2003)	Develop and empirically validate constructs, measures, and scales central to the concept of environmentally responsible manufacturing ERM, assess the implications of the findings for ERM research, and provide recommendations for future extensions.	(1) Strategic system (leadership; strategic planning; customer/stakeholders focus) (2) Operational system (HR development; process management and effectively managed) (3) Information system. (4) Results (organization's improvements in ERM)
21	Lefebvre et al. (2003)	Assess the environmental performance of firms in each industry, investigate the relative importance of determinants of environmental performance across and within industries, and evaluate the relative impacts of firms' environmental performance on innovativeness and competitiveness.	(1) Product Life Cycle Management (2) Environmental management system (in line with ISO 14001) (3) Environmental R&D expenditures

22	Doonan et al. (2005)	Examine the relative role of various types of external and internal pressures, as environmental managers themselves perceive them, and their relationship with environmental performance	(1) BOD and TSS effluent emissions (2) Spills (3) Use of chlorine (4) Fines and penalties (5) Air emissions (6) Use of alternative sources of energy
23	Tam et al. (2006)	Identify performance measurement indicators (PMIs) for environmental performance assessment (EPA) in the construction industry. This paper explores the relative importance of PMIs in checking, reviewing, monitoring, and evaluating the environmental performance of organizations.	(1) Regulatory compliance (fines and penalties; complaints; warmings; noncompliance records) (2) Auditing activities (non-conformance reports; reports of marginal cases put under observations) (3) Resources consumption (energy consumption; timber consumption; paper and water consumption)
24	Global Reporting Initiative GRI (2006)	Providing a framework for organizations to report on their sustainability performance. The guidelines aim to assist organizations in identifying and prioritizing material sustainability topics and provide guidance on how to report on these topics consistently and transparently. The guidelines also promote the comparability and credibility of sustainability reports across different organizations and sectors.	(1) Materials (2) Energy (3) Water (4) Biodiversity (5) Emissions, effluents, and waste (6) Products and Services (7) Compliance (8) Transport (9) Overall performance (total environmental protection expenditures and investment by type)
25	Henri and Giasson (2006)	Defining and measuring environmental performance using multiple indicators and an index within a case study.	(1) Enhanced products and processes (competitive advantages obtained from an organization as a result of its environmental initiatives) (2) Relationships with interested parties (interaction between a company and its various outside stakeholders including clients, suppliers, and governments) (3) Regulatory compliance and financial impacts (level of response to environmental standards required by laws and regulations as well as the economic consequence of the environment) (4) Environmental impacts and corporate image (the negative externalities of a company's activities on its environment and its overall reputation)
26	Rao and al. (2006)	Present how environmental indicators were established and implemented for small and medium enterprises (SMEs) in the Philippines and show that the indicators significantly correlate with the environmental performance of the SMEs. This study also proposes a structural equation model that links environmental indicators and environmental performance.	(1) Environment Performance Indicators: Input indicators relative to material; energy; water and waste (2) Environment Management Indicators: Environmental investment; environmental cost and training/staff on environmental issues (3) Environmental performance: Reduction of solid/liquid waste; reduction of emissions; recycling; improvement of environmental compliance
27	Xie and Hayase (2007)	Develop a model for third-party environmental performance evaluation (EPE) that can be used to measure the	(1) Environmental management performance: - Organizational system (policy, EMS, target, audit, training)

		environmental performance of companies. This paper also proposes the use of the environmental intensity change index (EICI) to enable third-party EPE to be comparable across companies from different (sub)sectors. This paper tests the validity of the model and EICI through empirical tests.	- Stakeholder relations (disclosure and local contributions) - Operational countermeasures to reduce environmental burdens - Environmental tracking (2) Operational performance indicators: - Inputs (resources and energy used or consumed) - Outputs (wastes and pollutants generated)
28	Turki (2009)	Develop a user-friendly environmental performance business model based on a literature review that leads to an environmental index.	(1) Strategic component: objectives and resources (2) Operational component: water consumption, energy consumption, liquid discharges, atmospheric discharges, and solid waste (3) Relationship component: Government, associations, ecological, customers, shareholders, staff, and suppliers pressures
29	Moneva and Ortas (2010)	Provide more debate to the literature on the relationship between the degree of corporate environmental performance (CEP) and that of corporate financial performance (CFP) and analyze the possible link between the CEP and CFP of Companies from a Multidimensional Perspective.	(1) Env. disclosure (report, website, policies and principles, quantitative data) (2) Env. management system (governance, monitoring, audits, training) (3) Env. programs (reduction of water consumption / air emissions / water pollution / impact of waste / energy consumption) (4) Energy consumption (electricity, gas, oil)
30	Schultze and Trommer (2012)	Analyze the measurement of environmental performance (EP) in quantitative empirical research. The paper reviews and classifies existing EP measures, analyzes their validity and reliability, and provides a clear conceptualization of EP as a multidimensional construct representing the extent to which companies meet the environmental expectations of their stakeholders.	(1) Operational input indicators (2) Operational output indicators (3) Operational process indicators (4) Indicators of strategic environmental management (5) Indicators of environmental attitudes and objectives (EMS, environmental information system, environ structure and the process, env responsibility)
31	ISO 14031 (2013)	Provides guidelines for the design and use of environmental performance evaluation (EPE) within an organization. It applies to all organizations, regardless of their type, size, location, and complexity.	(1) Environmental performance indicators - Management indicators: efforts to reduce or mitigate environmental impacts - Operational indicators: potential constraints on the environment (2) Environmental condition indicators or the state of the environment
32	Trumpp and al. (2015)	Provide a clear definition and framework for the construct of corporate environmental performance and test its validity through factor analysis using publicly available data.	(1) Environmental management performance (EMP) - Environmental policy - Environmental objectives - Environmental processes - Organizational structure (training, certification, EMS) - Environmental monitoring (KPI or balanced scorecard) (2) Other environmental operational environment POE (energy consumption, water consumption, greenhouse gas (GHG) emissions, total waste, and hazardous waste)
33	Escrig-Olmedo and	Develop a framework for assessing corporate environmental performance	(1) Three dimensions related to the EMP - Strategic intent: assesses whether or not

	al. (2017)	(CEP) that is comprehensive and consistent with sustainable development for both society and companies. This study addresses the challenges of evaluating CEP, including the qualitative nature of indicators, the difficulty of choosing statistical techniques for aggregation, and the need to incorporate stakeholders' preferences in assessment models. This paper proposes the use of the fuzzy multi-criterion decision-making (MCDM) method to address these challenges.	an organization seeks to address environmental issues in its strategy - Governance and management : formalization of management systems that define policies, procedures, or mechanisms for measuring overall performance - Commitment : stakeholder dialog, preparation, and publication of information (2) One dimension related to EOP, operational performance :(assess whether a company is effective in implementing its environmental strategies, management systems, and commitment mechanisms)
34	Dragomir (2018)	Propose a new conceptualization of corporate environmental performance based on a comprehensive and critical review of three decades of dedicated research. This study compiles a comprehensive list of quantitative CEP indicators, employs content analysis to critically review empirical contributions using the CEP variable, and provides guidelines for researchers on choosing valid and reliable CEP measures.	(1) Environmental impact (the primary activities) - Suppliers - Inputs - Outputs, incidents, and biodiversity impact - Recycling and clean-up - Prodcut and transport (2) Support systems (the secondary activities) - EMS, audits, compliance, and governance - Employees and training - Costs and investments in technology, fines, and penalties - Disclosure and stakeholder engagement
35	Panya and al. (2018)	Evaluate the performance of the environmental management of local governments (EMLG) in Thailand and examined the relationship between specific management factors (context, input, and process) and output.	(1) Context: condition of the environment and public participation. (2) Input : human resources, budget, tools, and equipment (3) Process : planning, implementation, monitoring and evaluation, and review and improvement (4) Product : management results or environmental management performance regarding solid waste, wastewater, excreta, pollution, land use, and water source management
36	Nutsugah and al. (2020)	Examine the relationship between a company's environmental performance (EP) and its overall firm performance (FP) and determine the role of integrated marketing communication (IMC) in mediating this relationship. This study establishes the mechanism through which EP affects FP and the firm-level capability that can facilitate the conversion of EP to FP.	(1) Compliance with environmental standards (2) Best environmental management practices (3) Compliance with legal requirements (4) Environmental waste management (5) Environmental complaints handling (6) Corporate social responsibility (7) Standards monitoring and reporting