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Article

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Review

Indicators and Tools for Measuring Performance in the Public Education System: Bibliometric Perspectives on BSC, KPI, SPM, M&E, and EPSA

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Abstract

This study examines how performance measurement frameworks, including the Balanced Scorecard (BSC), Key Performance Indicators (KPIs), Strategic Performance Management (SPM), Monitoring and Evaluation (M&E), and the European Public Sector Award (EPSA), have been discussed and applied in public education. The research problem addressed is the challenge of understanding the impact and integration of these frameworks in educational management. To address this problem, we conducted a bibliometric analysis of 2626 academic publications from 2020 to 2025 (WOS), mapping the literature quantitatively and qualitatively. Three major themes emerged from a network of keyword co-occurrences: (1) performance measurement frameworks and methods, (2) technical/engineering performance indicators, and (3) strategic management and organizational performance in education. The findings indicate that the successful implementation of performance measurements in education requires the selection of relevant and balanced indicators and the promotion of an organizational culture of continuous improvement. These insights highlight prevailing trends (such as the prominence of the BSC and the widespread use of KPIs) and provide lessons from international practice to guide decision-makers to improve education. Highlighting the link between the theoretical definition of indicators and their practical application provides policymakers and educational managers with an overview of research in the field of performance management in public education.

Keywords: institutional accountability; performance evaluation; strategic performance management; educational performance; public policy; educational management; institutional transparency



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1. Introduction

An analysis of the literature on performance measurement in public education reveals that certain issues have not been adequately addressed. One major omission is the lack of integration between various frameworks, such as the Balanced Scorecard (BSC), Key Performance Indicators (KPIs), Strategic Performance Management (SPM), Monitoring and

Evaluation (M&E), and the European Public Sector Award (EPSA), in the context of public education. To date, academic studies have mainly examined these frameworks in isolation, focusing on single-model applications or case studies. For instance, numerous papers have examined the implementation of BSC or KPI-based accountability in schools as standalone topics. Mendes Junior and Alves (2023) observe that, despite the abundance of studies on BSC in education, obtaining an overview of its use remains challenging, underscoring the fragmented nature of the research. Similarly, individual case studies, such as the application of the BSC to fifteen performance indicators in Romanian schools (Enache et al., 2021), explicitly acknowledge their limited scope and lack of generalizability. Taken together, these studies demonstrate that academic discourse is fragmented across frameworks, with few interconnections between BSC, KPI, SPM, M&E, and EPSA research streams. What has been overlooked is a coherent perspective: a comprehensive synthesis of how these performance models contribute to, or differ in their contribution to, shaping public education outcomes is currently lacking. This gap is both practical and academic. Without integrating these correlations, the literature provides an incomplete picture of performance management in education and leaves fundamental questions about the connections between these models and their combined impact unanswered.

Thus, we can use a bibliometric analysis of the relevant literature to highlight correlations and best practices in performance management in our work.

A ministry of education could use multiple tools in tandem: a Strategic Performance Management plan articulated through a Balanced Scorecard (BSC) that is supplemented with relevant Key Performance Indicators (KPIs), all supported by a robust Monitoring and Evaluation (M&E) system to track progress. In such a scenario, the EPSA (European Public Sector Award) can be referred to as an external incentive that encourages the mainstreaming of these practices by highlighting success stories

The adoption of BSC- and KPI-based governance in education is framed by the logic of New Public Management, which diffuses practices from the private sector to the public sector, emphasizing results, accountability, and performance. In addition, we interpret the coexistence of BSC, KPIs, SPM, and M&E through the prism of performance regimes in complex governance frameworks, where measures, routines, and incentives interact to shape organizational behavior. This framework clarifies why these patterns have spread and helps interpret bibliometric clusters beyond description, linking observed patterns to accountability theory and strategy execution in public organizations.

By quantitatively mapping the research landscape and qualitatively examining the themes, we aim to answer the following research questions:

- RQ1: How have these performance measurement models been discussed and evaluated in the academic literature?
- RQ2: What trends and patterns are emerging regarding their implementation in public education?
- RQ3: What lessons do international experiences offer to policymakers and practitioners who want to improve educational outcomes through better performance management?

The rest of the paper is structured as follows: Section 2 is the literature review, Section 3 details the research methodology (including data collection and analysis techniques), Section 4 presents the results of the bibliometric analysis and discusses the conclusions (including the limitations of the study), and Section 5 concludes with implications and an agenda for future research.

2. Literature Review

We provide basic definitions of these performance measurement models as understood in the literature.

The Balanced Scorecard (BSC) is a strategic management framework introduced by Kaplan & Norton in the early 1990s to translate an organization's vision into a balanced set of performance indicators (Kaplan & Norton, 1992). It expands traditional financial measures with additional perspectives (such as customer, internal process, and learning and development perspectives) to provide a comprehensive picture of organizational performance. In the education sector, the BSC has been adopted by ministries, school districts, and universities as a tool for aligning educational goals with strategic objectives and holistically tracking progress. The BSC helps educational managers translate their mission (e.g., improving learning outcomes, research quality) into measurable indicators across multiple dimensions (Coskun & Nizaeva, 2023). Research shows that educational institutions implement the BSC to improve accountability and strategic orientation; for example, universities have used BSCs to increase transparency and monitor performance against strategic plans. Taylor and Baines (2012) documented how four UK universities adopted the Balanced Scorecard to support strategic planning and governance needs, finding that the BSC helped integrate departmental objectives with institutional strategy and improved the Monitoring and Evaluation of policy implementation. This highlights the role of the BSC as a strategy-based performance assessment approach in education (Al Jardali et al., 2020), enabling institutions to clarify their vision (Camilleri, 2020) and continuously improve their performance (Multan et al., 2023).

Key Performance Indicators (KPIs) are specific, quantifiable indicators used to compare a performance against its strategic objectives. In public education, KPIs often include measures such as student performance scores, graduation rates, student–teacher ratios, budget utilization, or stakeholder satisfaction levels (Pietrzak et al., 2015). Many school systems and higher education institutions globally have defined sets of KPIs to monitor progress on key priorities such as academic quality, equity, and operational efficiency. For example, school districts in the United States and Europe regularly publish KPI dashboards (e.g., test scores, attendance, and financial indicators) to inform policymakers and the public about their performance. Greatbanks and Tapp (2007) note that focusing on a concise set of well-chosen performance indicators (usually “seven to nine key performance measures in the form of a customized dashboard”) provides motivation for public organizations to achieve their goals and improves the clarity of performance reporting. However, implementing Key Performance Indicators (KPIs) in the education sector can be difficult, as they are an essential tool for evaluating and improving a school's effectiveness (Andrews, 2014).

Strategic Performance Management (SPM) in the public sector refers to the systematic process of defining strategic objectives, aligning resources and activities to these objectives, and continuously monitoring results to inform decision-making (Nicolae & Neagu, 2009). SPM is, in essence, the integration of performance measurements with strategic planning, ensuring that performance indicators drive strategy execution. In education, Strategic Performance Management may involve setting long-term goals (e.g., improving national literacy rates or integrating diaspora students into the national education system in their country of origin (Ignat, 2017)) and using frameworks such as the BSC or KPI sets to manage progress toward these goals. Case studies on SPM have shown successful applications of it in ministries of education and large school systems where for example, Balanced Scorecard indicators have been modified to fit public education goals (Greatbanks & Tapp, 2007). However, research also warns that performance management in the public sector does not automatically translate into improved performance.

Monitoring and Evaluation (M&E) is a well-established approach, particularly in public policy and international development contexts, focusing on tracking program implementation (monitoring) and assessing their results and impact (evaluation). In the education sector, M&E frameworks are used to evaluate policies and programs; for example, a national literacy initiative or education reform program would include an M&E plan to regularly monitor progress indicators and subsequently evaluate overall success against objectives. M&E provides feedback loops that help decision-makers identify what works, ensure accountability for results, and inform future strategy (Corsino & Fuller, 2021). According to the OECD, robust Monitoring and Evaluation plays a fundamental role in improving equity and inclusion in education (Kusek & Rist, 2004). By systematically collecting and analyzing data on educational inputs, processes, and outcomes, M&E enables evidence-based adjustments to policies and resource allocations. A results-based M&E system, as highlighted by Kusek and Rist (2004), helps education managers move beyond anecdotal evidence to clearly demonstrate achievements or shortcomings. International agencies and governments around the world have institutionalized M&E in education projects to convince donors and stakeholders that funds are being used effectively and that objectives are being met. However, integrating M&E into public education management can face obstacles such as limited data systems, staff capacity, and sometimes political resistance to transparency (Hatry, 1999).

The European Public Service Award (EPSA) is a unique European initiative that recognizes outstanding achievements and innovations in public administration. Although not a performance measurement framework, the EPSA acts as a catalyst for performance improvement by highlighting and disseminating successful practices within governments. Organized by the European Institute of Public Administration, the EPSAs are a Europe-wide award scheme open to public sector organizations at all levels. It rewards projects that address pressing public challenges with innovative solutions and demonstrate tangible results in service delivery and management. In doing so, the EPSA provides positive incentives for agencies (including educational institutions and authorities) to invest in innovation and continuous improvement. The award has created a rich repository of case studies (“best practices”) from which other public administrations can learn (Heichlinger & Bosse, 2021). For example, previous EPSA-winning projects have included initiatives to modernize school systems, digitize public services, and improve national governance (Popescu et al., 2024). Through the EPSAs, education policymakers in Europe can gain exposure to innovative approaches, such as new accountability systems or stakeholder engagement strategies, that have been successfully implemented elsewhere in response to forced events, such as the COVID-19 pandemic (Neagu et al., 2023). Essentially, the EPSAs contribute to international policy learning and help scale up successful innovations, addressing two key challenges in public sector innovation: motivating civil servants to take the risks of reform and spreading effective practices to other contexts. This international perspective is valuable for evaluating performance management approaches in education; a ministry of education that has implemented BSCs or KPIs can compare its practices and results with those of similar organizations recognized by the EPSAs.

3. Methodology and Materials

To substantiate this article, we used quantitative techniques specific to the bibliometric approach to analyze the body of literature related to performance measurement models in public education. The analysis covers the volume of publications in the period of 2020–2025, the fields involved, and the network of keywords and themes within the research. The objective of the research was to obtain an overview of how performance measurements in

public education are used, the strategies employed, and the ways in which the results are implemented to identify the main directions of research and gaps in knowledge.

3.1. Data Collection

The database on which the bibliometric processing will be based was compiled through a comprehensive search of the Web of Science (WoS) database. The queries were based on the five key terms of interest: Balanced Scorecard (BSC), Key Performance Indicators (KPI), Strategic Performance Management (SPM), Monitoring and Evaluation (M&E), and European Public Sector Award (EPSA). To ensure that our selection included publications specifically related to the public sector and education, the initial search tag was “Models of Performance Measurement in Public Education”, used for the purpose of “measuring performance in public education.” To ensure that our analysis captured relevant and current issues, we used two filters specific to the Web of Science database: articles must have been published between 2020 and 2025 and must belong to the following Web of Science categories: materials science multidisciplinary, environmental sciences, management, business, multidisciplinary sciences, business finance, economics, education educational research, social sciences interdisciplinary, education scientific disciplines, and public administration. After applying the two specific filters, 2626 publications remained, on which we will perform the bibliometric analysis. The evolution of the number of articles according to the search tags or the application of WOS filters is presented in Table 1. We focused on the recent five-year period (2020–2025) to capture the latest research and trends in the field. The analysis period spanned the year preceding the COVID-19 pandemic and continued into the current year, enabling the capture of the latest trends as expressed in scientific articles. The Web of Science platform was chosen over other databases (such as Scopus) due to its rigorous coverage of the high-impact literature and its robust categorization tools, which were essential for refining our dataset according to the purpose of the study.

Table 1. Results of the bibliometric search for key performance measurement terms (Web of Science).

Search Term	Description/Context	Publications (WoS)
Models of Performance Measurement in Public Education	Specific expression models in education	1080
Balanced Scorecard (BSC)	Strategic management framework	6396
European Public Sector Award (EPSA)	Specific indicators at European level	6694
Key Performance Indicators (KPI)	Performance indicators/metrics	10,851
Monitorizare și Evaluaere (M&E)	M&E program/project in the public sector	23,286
Strategic Performance Management (SPM)	Strategic performance management systems	32,769
Years of publication 2020–2025	Publications from the last 5 years only	8693
Web of Science categories—materials science multidisciplinary, environmental sciences, management, business, multidisciplinary sciences, business finance, economics, education educational research, social sciences interdisciplinary, education scientific disciplines, public administration	Categories specific to the field of education	2626

Source: Search results in the WoS Core Collection, April 2025 (compiled by authors).

It should be noted that the terms “counts” in Table 1 are indicative and are not mutually exclusive. There is some overlap, because a single publication could mention, for example, both KPI and BSC. Furthermore, some terms, particularly “SPM” and “EPSA,”

have multiple meanings or uses in different disciplines, which have inflated their raw numbers. We mitigated this by focusing our analysis on the processed set of 2626 relevant records, as described above, rather than on the sum of all results. Nevertheless, the number reflects the relative popularity of these concepts in academic discourse. KPI and M&E, for example, appear in many publications, reflecting their generic and widespread use in many fields (from business management to international development (Afif et al., 2024)) beyond education. Balanced Scorecard also has a substantial presence, signifying its importance as a performance framework in research. The expression “performance measurement in public education” produces a smaller and more concentrated subset, suggesting that, when restricted to the explicitly educational context, the literature is more modest in size but still significant (over a thousand publications).

3.2. Analysis Techniques

After collecting the data, we applied bibliometric analysis techniques in two main areas: performance analysis and scientific mapping. The performance analysis covers descriptive statistics of the literature, such as the number of publications over time, distribution across journals or subject categories, and the identification of prolific authors or institutions (this is not the main focus of this paper, so we will highlight only a few aspects). Scientific mapping involves analyzing relationships and networks within bibliographic data, particularly through the analysis of keyword co-occurrence, to map the thematic structure of the research field.

We used the VOSviewer program (version 1.6.20 available as of 31 October 2023) to build a keyword co-occurrence network. The VOSviewer (Van Eck & Waltman, 2010) is a widely used tool in bibliometric research, chosen for its capabilities to reliably map and cluster research topics. Its use in this study provides a robust visualization of the relationships between key terms in the literature. In this network, the nodes represent keywords (author keywords and derived keywords), and the links between nodes represent the co-occurrences of those keywords in the same publications. The strength of the links and the frequency of the keywords were used to group the keywords into clusters of related themes. We applied a minimum occurrence threshold to focus on sufficiently frequent keywords, which ensures that the identified clusters are built around meaningful themes in the literature. The clustering algorithm in the VOSviewer divided the network into several clusters so that the keywords in each cluster are more closely related (co-occurring more frequently) to each other than to keywords in other clusters. Each cluster probably corresponds to a subdomain or research stream within the broader theme of performance measurements in the public sector/education contexts. These bibliometric methods are quantitative in nature, as they involve the statistical analysis of publication data (e.g., co-occurrence frequencies and network link strengths) to uncover patterns in the research landscape.

The resulting visualization (a map of keyword co-occurrence) was examined to interpret the thematic groups. We also extracted a list of top keywords by frequency and by “total link strength” (a measure of how strongly a keyword is connected to others in the network). An additional qualitative reading of representative publications from each group was conducted to accurately characterize the themes. We present the results in both quantitative tables and qualitative descriptions.

4. Results and Discussion

This section is structured around the presentation of the results of the bibliometric analysis, organized into a quantitative overview of trends and distributions of publications. We also present a qualitative interpretation contained in the three clusters related to performance measurement models in public education and public policy management.

4.1. Publication Trends and Disciplinary Distribution

The volume of research on performance measurements in the public sector (including education) has grown substantially over time, with a notable acceleration in the last decade. As mentioned, over 8600 publications from 2020 to 2025 have been indexed in the Web of Science on our topic. This suggests that there has been increased academic attention over the past five years, likely reflecting real-world trends such as intensified government reforms on accountability in education, increased data availability, and global knowledge sharing on public sector innovations. The increase in the number of publications in recent years, the volume of existing information, and the variety of applications of performance measurement tools answer research *question 2* regarding implementation models and trends in public education.

In terms of disciplinary coverage, the literature is remarkably interdisciplinary. The Web of Science categories associated with the retrieved publications cover not only public administration and education research, but also fields such as management, business, economics, environmental science, and even materials science. Table 2 lists the main subject categories in which these publications fall, illustrating the breadth of fields involving performance measurement concepts.

Table 2. Main Web of Science categories for publications on performance measurement models.

Web of Science	Examples of Research Contexts in Category	Number Articles	Percentage of Total Items
Materials Science, Multidisciplinary	Performance of technological processes/materials	706	26.88%
Environmental Sciences	Assessment in environmental policy and projects	525	19.99%
Management	Management frameworks in organizations (including public)	359	13.67%
Business	Business performance management, Key Performance Indicators (KPIs) in the private sector	272	10.36%
Multidisciplinary Sciences	General scientific studies, often methodological	195	7.43%
Business Finance	Financial performance, value-for-money analysis	168	6.40%
Economics	Economic evaluation, efficiency studies	148	5.64%
Education and Educational Research	School/university performance, educational outcomes	108	4.11%
Social Sciences, Interdisciplinary	General social studies, including policy analysis	62	2.36%
Education, Scientific Disciplines	Education science, pedagogy (with a focus on metrics)	44	1.68%
Public Administration	Governance, public sector management studies	39	1.48%

Source: WoS categories of the analyzed dataset (top 11 by frequency).

As shown in Table 2, a significant portion of the literature is classified under environmental sciences and management and business (57.55%), which is not surprising given

that frameworks such as BSC and KPI originated in the business world and much of the theoretical development took place in management science.

Many of these publications apply concepts derived from business to public or non-profit contexts or compare performance management across sectors. The categories of Public Administration and Education explicitly cover studies in the government and educational environments, which are directly relevant to our objective and include research on the implementation of performance management in schools, universities, ministries, etc. We see education represented by two categories (educational research and scientific disciplines of education), confirming that a considerable subset of the literature deals specifically with educational institutions.

However, the presence of categories such as materials science and environmental science indicates that our bibliometric network has covered a wider range of studies. This is largely due to the generic nature of terms such as “performance measurement” and “SPM,” which are used in technical fields to evaluate the performance of systems or materials. For example, some works in environmental science discuss “performance indicators” for wastewater treatment plants (hence environmental sciences), and research in materials science might mention performance indicators for new materials or manufacturing processes. These works, while not focused on public policy, are nonetheless part of the knowledge network surrounding performance measurements. Their inclusion highlights an interesting point: the concept of using indicators and systematic frameworks for performance evaluation is universal and not limited to public administration. It has emerged independently in various disciplines, which is reflected in our data.

For the purposes of our research, we are primarily interested in the part of the literature that relates to the public sector and education. Even within a multidisciplinary approach, we can identify numerous works that specifically address performance management in schools, universities, or government agencies. For example, the education categories offer studies on topics such as the development of Key Performance Indicator (KPI) systems for school districts (Shah et al., 2022), the evaluation of university departments using the Balanced Scorecard (Mendes Junior & Alves, 2023), and the evaluation of national education policies using Monitoring and Evaluation frameworks (Cervantez, 2023). The public administration category includes analyses of the implementation of performance management in various government contexts, such as the adoption of scorecards by local governments (Greatbanks & Tapp, 2007) or cross-country comparisons of KPIs in the public sector.

An interesting observation is that many publications in management and business journals discuss cases from the public or non-profit sector. This may be because public management specialists sometimes publish, in general, management publications, and because the techniques have common theoretical bases with performance management in the private sector. Thus, cross-pollination of ideas takes place: for example, Kaplan and Norton’s Balanced Scorecard concept (originally published in the Harvard Business Review) is cited in public administration research; conversely, lessons from public sector implementations may appear in management studies as extensions or adaptations of theory.

Our bibliometric approach complements existing narrative analyses by providing a high-level view of the structure of the field, allowing for a quantitative and objective mapping of the research landscape, revealing publication trends, keyword networks, and research clusters that would be difficult to observe through a traditional narrative analysis. This method was particularly appropriate given the interdisciplinary and expansive nature of the subject and allowed us to systematically treat the 2626 publications and identify thematic linkages and gaps in the field as opposed to a narrative or even systematic review, which, although valuable for in-depth analysis of the selected papers, might not capture

the broader research patterns or network of concepts that link BSC, KPI, SPM, M&E, and EPSA across different studies.

Overall, the analysis of publication trends indicates an increase in the volume of knowledge around innovative performance measurement models and suggests that this conversation extends across a broad academic community. The diversification across multiple fields highlights the fact that the challenges related to performance measurements and management are not specific to the educational or governmental fields, although the focus of our research is on how these challenges are addressed and measured in the sphere of public education.

4.2. Keyword Analysis and Thematic Groups

Using the VOSviewer program for the group of 2626 articles, after several attempts and visualizations of the resulting clusters, the research team chose a minimum threshold of 25 occurrences for keywords/key phrases. The benefits of co-occurrences depend on the number of occurrences of keywords/phrases, the link between them, the number of occurrences, and the number of links between occurrences (Osmanovic, 2025). Thus, Table 3 shows the words with the highest occurrences and the strongest link strength, and Table 4 shows the composition of the three clusters after a thesaurus file was applied to eliminate similar words/phrases.

Table 3. Keyword with the highest occurrences link strength.

Keyword	Occurrences	Total Link Strength
balanced scorecard (bsc)	639	1972
management	262	893
performance	364	872
model	188	607
impact	178	540
framework	128	536
strategy	138	511
systems	150	500
sustainability	115	450
innovation	110	396
performance measurement	92	367

The 11 most frequent keywords/phrases in the literature are presented in the figure on performance measurements. “Balanced Scorecard (BSC)” is by far the most frequent keyword (639 occurrences), reflecting its importance as a research topic, followed by generic terms such as “performance” and “management.” Other notable keywords in the top ten include “model,” “strategy,” “systems,” and “sustainability,” indicating a combination of concept- and context-oriented interests.

The importance of the term “Balanced Scorecard” (BSC) as a keyword (Table 3) confirms that BSC has been a central focus of interest in performance measurement research in recent years. In fact, the frequent occurrence of the term BSC (appearing in over 600 publications in our dataset) suggests that it often serves as a unifying concept linking studies in the public and private sectors. Many academic papers use BSC as a framework for structuring their performance analysis, even if they do not specifically refer to the scorecard itself. For example, a study on performance indicators in universities may mention BSC as part of its literature review or theoretical foundation. Meanwhile, general terms such as

“performance,” “management,” “model,” and “strategy” in the top keywords indicate that much of the discussion is conceptual and relates to the development of models or strategies for performance management. It is noteworthy that “sustainability” appears among the top ten keywords (with over 100 occurrences): this resonates with the contemporary trend of integrating sustainability goals into performance management (both in corporate CSR contexts and in public sector goals related to sustainable development). For public education, this could translate into performance measures that consider the long-term social impact, inclusion, or environmental education outcomes beyond immediate academic results.

Table 4. Composition of the 4 clusters.

Cluster 1 (32 Items)	Cluster 2 (26 Items)	Cluster 3 (24 Items)
benchmarking	4d printing	accountability
circular economy	activated-sludge	adoption
data envelopment analysis	behavior	balanced scorecard (bsc)
decision-making	composites	challenges
design	degradation	corporate social-responsibility
education	dynamics	customer satisfaction
efficiency	extracellular polymeric substances	determinants
framework	identification	evolution
indicators	mechanical-properties	financial performance
industry	membrane bioreactor	firm performance
integration	membrane fouling	growth
key performance indicators	microbial community	impact
kpi	nanocomposites	implementation
machine learning	performance	information
management	polyurethane	innovation
methodology	recovery	knowledge
metrics	removal	management control-systems
model	shape memory polymer	organizational performance
models	smp	organizations
optimization	soluble microbial products	performance management
performance evaluation	technology	performance measurement
performance measurement	temperature	smes
perspective	transport	strategic management
quality	waste-water	strategy
selection	waste-water treatment	
simulation	water	
success		
supply chain		
supply chain management		
sustainability		
sustainable development		
systems		

Figure 1 shows the relationship between the 82 words/phrases that have at least 25 occurrences.

The analysis of keyword co-occurrences provides information about the main themes and lines of research in the literature. By examining the concepts that frequently appear together, we can deduce how researchers group ideas and what topics have been of interest. Figure 1 visualizes the most frequent keywords with an indication of their cluster membership.

From the co-occurrence network, three main thematic groups emerged with the following interpretation, each represented by the cluster’s most prominent keyword.

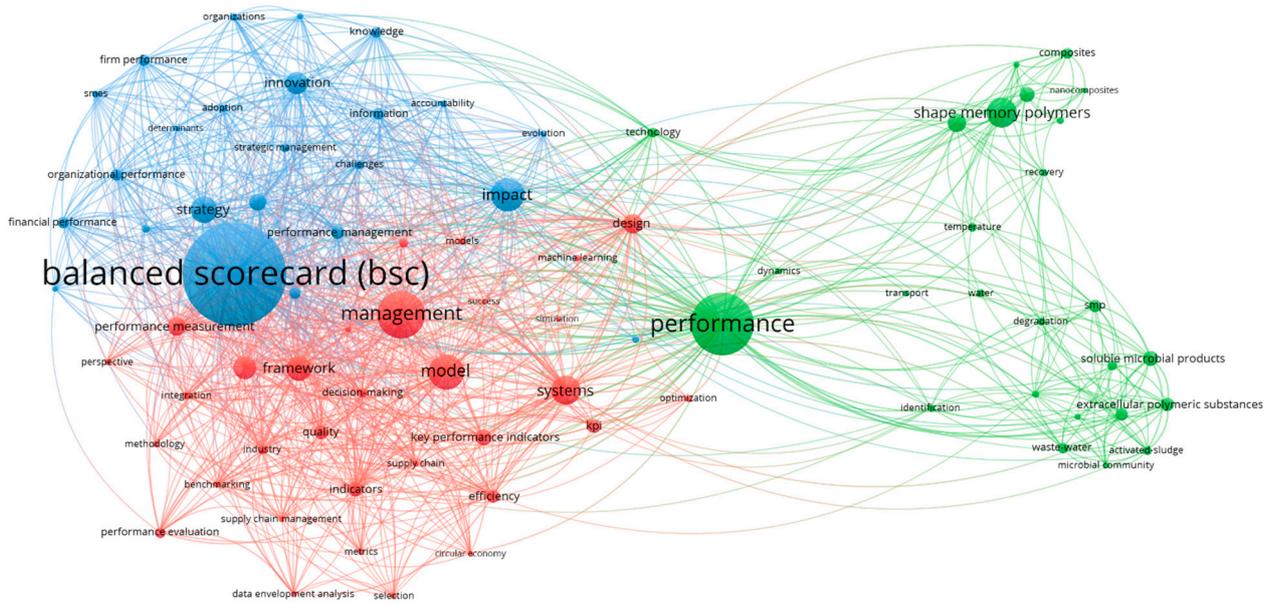


Figure 1. Visualizes the most frequent keywords with an indication of their cluster membership.

- Cluster 1: Performance measurement frameworks and methods (Figure 2).

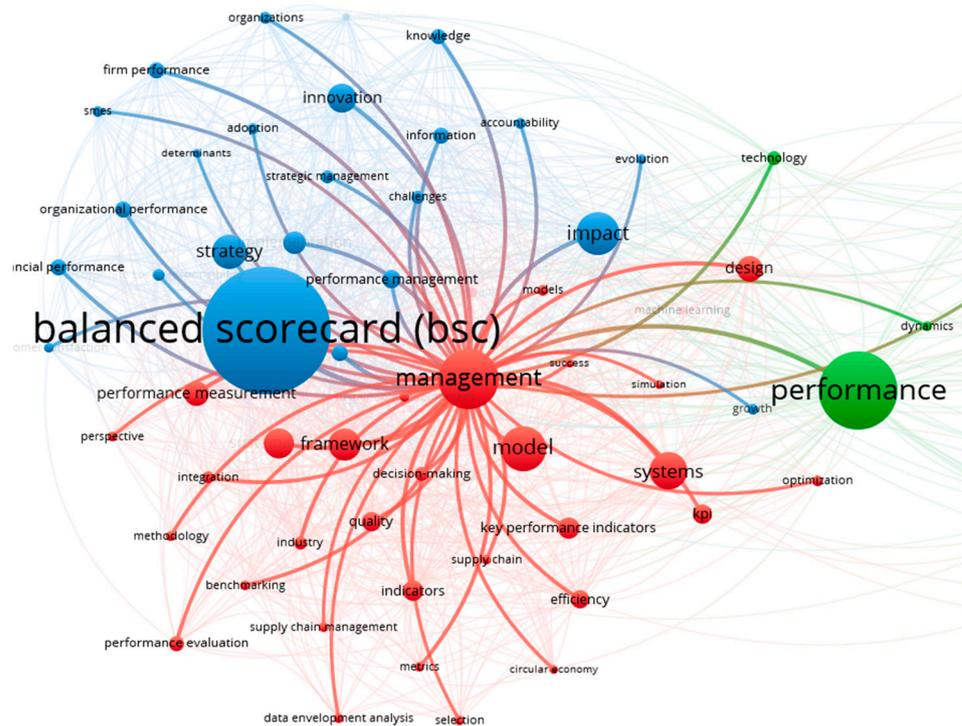


Figure 2. Cluster 1, management link strength 893.

This cluster includes keywords related to methodologies and general concepts of performance evaluation. It includes terms such as benchmarking, data envelopment analysis, decision-making, indicators, efficiency, quality, sustainability, framework, model, and methods, as well as explicit Key Performance Indicators (and the acronym KPI) and performance measurement itself. There are also occurrences of terms such as machine learning, optimization, and simulation, indicating a methodological angle (the use of advanced analytical methods for performance analysis). Education is present in this group, suggesting that educational applications are interconnected with these general discussions about performance measurement rather than isolated.

Cluster 1 focuses on performance measurement tools and techniques and evaluates how indicators are analyzed for the evaluation of public or private organizations. Studies specific to this cluster address questions such as the following: What are the appropriate KPIs for a given context (whether it is a school, a company, or a supply chain)? How can techniques such as benchmarking or DEA (a method of efficiency analysis) be applied to evaluate performance? For example, [Dima et al. \(2019\)](#) explore the implementation of a business excellence model to improve university management performance, in line with Cluster 1's focus on performance assessment frameworks. In general, a hypothetical study in this cluster could be titled "School performance evaluation using DEA and KPIs", combining several concepts from the cluster. The presence of sustainability and the circular economy in Cluster 1 also emphasizes that the performance measurement is linked to sustainable development goals and resource efficiency, reflecting a modern trend in both the corporate and public sectors to incorporate sustainability indicators into performance assessments.

- Cluster 2: Technical and engineering performance indicators (Figure 3).

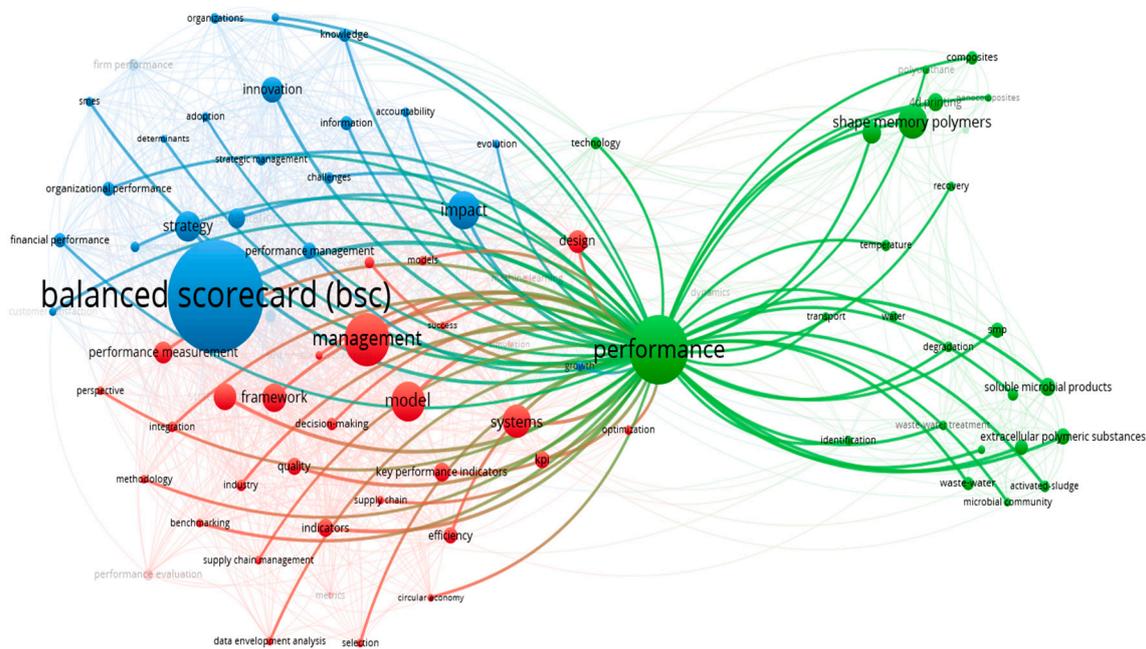


Figure 3. Cluster 2, performance link strength 872.

The elements contained in this cluster help us to substantiate the purpose of our research, highlighting the terminology used to measure performance and its use in scientific/technical research. Key terms in this group include 4D printing, active sludge, extracellular polymeric substances, membrane bioreactors, composites, mechanical properties, degradation, dynamics, and identification. These terms are clearly related to topics in engineering, materials science, and environmental engineering. For example, "4D printing" refers to the advanced manufacturing of materials that change over time, "activated sludge" and "membrane bioreactor" are terms used in wastewater treatment processes, and "extracellular polymeric substances" are studied in environmental biofilms. The appearance of such terms indicates that part of our dataset includes articles that evaluate the performance of technical systems or materials using indicators and metrics relevant to these fields (e.g., the efficiency of a bioreactor or the durability of a composite material). They use indicators and metrics to evaluate things such as the efficiency of a bioreactor or the durability of a composite material. Although this is outside the realm of public policy management, co-occurrence analysis is linked to these papers because such papers use words such as

“performance indicators” or “evaluation model,” bringing them into the broader network. In the context of public education, we might think of Cluster 2 as a reminder that school systems also have infrastructure and technology whose performances can be measured (such as IT systems, laboratories, etc.) and that educators sometimes collaborate with engineers to, for example, improve the environmental performance of school facilities.

- Cluster 3: Strategic management and organizational performance (Figure 4).

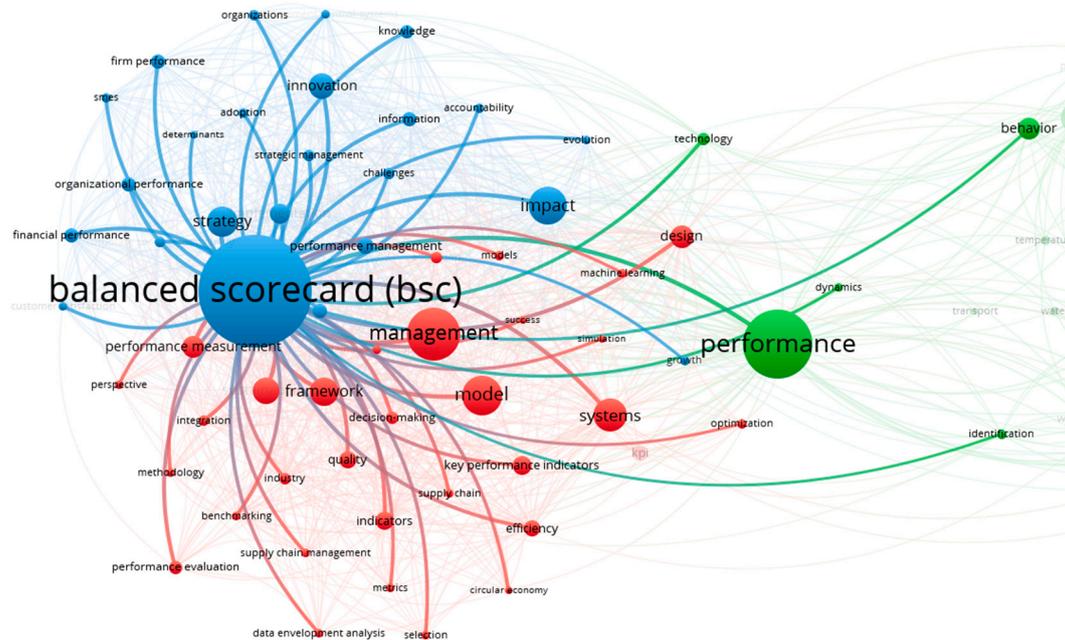


Figure 4. Cluster 3, Balanced Scorecard (BSC) link strength 1972.

Cluster 3 contains the concepts of organizational performance and strategy execution, largely presenting the terms pursued in our research. Key words in Cluster 3 are accountability, adoption, Balanced Scorecard (BSC), challenges, corporate social responsibility, customer satisfaction, determinants, evolution, financial performance, firm performance, implementation, organizational performance, perspective, strategy, systems, and success. We see here many terms that correspond to the strategic and cultural aspects of performance management implementation. For example, accountability is a key objective in public administration; how performance systems enhance accountability is a frequent research question. Adoption and implementation refer to studies on how organizations adopt these frameworks and the challenges they face (e.g., resistance to change, technical difficulties, etc.). The inclusion of the Balanced Scorecard (BSC) explicitly confirms that this group is directly involved in that framework and others that are likely similar. Customer satisfaction in a public sector context often translates into citizen or student satisfaction, indicating the emphasis on the customer/stakeholder perspective within the BSC in non-profit organizations. The corporate social responsibility (CSR) that appears here is interesting, suggesting that some studies link performance measurements to broader social outcomes and responsibilities, aligning with how the public and private sectors are concerned with social impacts (e.g., a university might include community engagement as part of its Balanced Scorecard, analogous to CSR in companies). The keywords financial performance and firm performance reflect the fact that private sector performance (firm performance) is discussed alongside these frameworks, often as a comparison or to draw lessons for the public sector (or vice versa). Overall, Cluster 3 can be seen as dealing with Strategic Performance Management and its organizational implications, which is central to our investigation. Research in this cluster often addresses questions such as the following:

How does the implementation of a Balanced Scorecard affect organizational culture and performance? What factors determine the successful adoption of performance management systems in a public organization? What is the impact of these systems on accountability and decision-making? For example, the study by [Greatbanks and Tapp \(2007\)](#) on a local council's Balanced Scorecard is a prototype study in Cluster 3, examining the empirical evidence of performance improvement and the conditions that enabled it. [Taylor and Baines \(2012\)](#) also fall into this group, exploring the determinants of adoption (such as the need for improved governance and accountability in universities). Case studies documenting best practices, as well as reviews of the literature (e.g., [Mendes Junior & Alves, 2023](#)), are part of Cluster 3, which summarize how strategic performance frameworks contribute or fail to deliver better public service performances.

Interpreting clusters in context: Clusters 1 and 3 are most relevant to our focus on public education and public policy management. They represent two complementary angles: Cluster 1 refers more to the technical design of performance measurement systems (how to measure, what to measure, tools such as KPIs, benchmarking, etc.), while Cluster 3 refers to the strategic and organizational dimension (why to measure, what to do with the measurements, and how it affects accountability and performance). Both aspects are crucial in implementing performance management in education. For example, a ministry of education embarking on a new performance measurement initiative must decide on the appropriate indicators and methods (questions from Cluster 1) and ensure that the system is accepted by educators and used for strategic improvement rather than punitive control (questions from Cluster 3). This analysis addresses research *question 1* by showing how performance measurement models have been discussed and classified in the literature.

The interaction between these clusters is evident in the literature. An example of this is from [Pietrzak et al. \(2015\)](#), who examined the use of the Balanced Scorecard in a Polish university. They had to address the issues of Cluster 1 (developing appropriate indicators for academic departments, such as research output quality, teaching effectiveness, and stakeholder satisfaction) and Cluster 3 (ensuring that the BSC was used to enhance strategic clarity and not just to produce additional documents and investigating whether it improved performance results). They found that the BSC helped clarify the institution's vision and strategy and allowed for a more objective assessment of performance, supporting the claim that the BSC "enables educational institutions to assess and improve their performance." However, they also highlighted challenges such as aligning the scorecard's performance indicators with educational values and ensuring acceptance by teachers, concerns typical of Cluster 3 regarding implementation.

Another thematic perspective is the importance of accountability and stakeholder perspectives, highlighted by the keywords in Cluster 3. In public education, accountability is multifaceted: schools are accountable to government bodies for the use of funds and the achievement of standards, but also to the public (parents, students, and community) for providing quality education. Performance measurement models have been introduced largely to strengthen accountability; for example, the publication of school performance reports with Key Performance Indicators (KPIs) or the implementation of education budget monitoring systems to prevent leakage. The literature shows both enthusiasm and caution in this regard. On the one hand, evidence suggests that performance systems can indeed make institutions more transparent and accountable (e.g., publishing KPIs puts pressure on underperforming schools to improve). On the other hand, some researchers argue that if accountability is defined too narrowly (e.g., only test results), it could lead to neglect of unmeasured aspects of education (a classic "teaching to the test" problem). The presence of customer satisfaction in Cluster 3 signals the attention paid to the user experience of public services. In education, this corresponds to student or parent satisfaction, an increasingly

measured outcome, particularly in higher education, where student satisfaction surveys are now included in university rankings and funding models (Manea et al., 2021).

The inclusion of terms such as machine learning and optimization in Cluster 1 suggests an emerging line of work: the use of advanced data analytics to improve performance measurement. In recent years, some studies have applied machine learning to analyze educational data (e.g., predictive analytics for student performance), which can then inform the setting of Key Performance Indicators (KPIs) or interventions. Optimization methods could be used to allocate resources in a way that optimizes certain performance criteria. These technical developments indicate that the field is not static; it is evolving with new technologies, offering more sophisticated ways to monitor and improve performance (such as dashboards for learning analytics in schools or AI-based decision support for administrators).

4.3. International Practices and Comparative Perspectives

The bibliometric groups and trends discussed above reflect the global literature. It is now valuable to connect these findings to international practices in implementing performance measurements in public education and public policy. Different countries and regions have approached these models in various ways, providing case studies and results that fuel academic discourse.

The balanced scorecard globally: After Kaplan and Norton introduced the BSC in the 1990s, the framework spread rapidly around the world, including in the public sector. In the early 2000s, governments in countries such as the United Kingdom, Canada, Australia, and New Zealand were among the first to experiment with adapting the Balanced Scorecard to public agencies (Niven, 2003). Its adoption in UK universities, documented by Taylor and Baines (2012), showed that the BSC could be used to align academic departments with broader strategic objectives, such as improving the quality of teaching or the impact of research. In the United States, some school districts (e.g., Charlotte-Mecklenburg Schools in North Carolina) became among the first to adopt the Balanced Scorecard to drive district-wide improvements, reporting indicators in categories similar to the four BSC perspectives (academic achievement, similar to the customer/stakeholder perspective, internal processes such as curriculum delivery, staff learning and development, and financial management). These cases, often shared in conferences and publications on education, have provided models for others. For example, the Atlanta public school system implemented a Balanced Scorecard to connect its strategic plan to measurable results, selecting a series of key indicators for each strategic objective and periodically reviewing progress. Internationally, developing countries have also shown interest. Similarly, some universities in Latin America have published studies on BSC implementation (e.g., in Mexico and Colombia), adapting perspectives to include community engagement and student development outcomes.

The KPI approach is virtually universal at this point; it is difficult to find an education system that does not have some key indicators that it tracks. However, the indicators and how they are used can vary. In many European countries, government agencies in the field of education set national KPIs (such as PISA scores, graduation rates, and student–teacher ratios) and use them to evaluate regions or schools. In the United States, under federal initiatives such as No Child Left Behind and, later, Every Student Succeeds Act, states were required to report annually on specific KPIs in education (proficiency tests, graduation, etc.) and were held accountable for progress. This generated a wealth of data and controversy over accountability for high-stakes situations. Some countries, such as Finland, known for their high-performing education systems, have historically avoided high-stakes KPIs in favor of local trust and professional judgment; however, even there, recent trends show

greater use of indicators for public transparency (though not for punitive measures). The literature captures these international differences: for example, a comparative study could analyze how the United Kingdom, France, and Sweden define and use school performance indicators, drawing correlations with cultural and policy differences. In our bibliometric data, terms such as “adoption” and “determinants” in Cluster 3 suggest such comparative or case studies that investigate why some organizations or public systems adopt certain performance practices and what influences their success.

Monitoring and Evaluation (M&E) also differ globally, often influenced by international organizations. In many developing countries, education sector reforms and programs are supported by bodies such as the World Bank, UNESCO, or bilateral aid agencies, which typically require a robust M&E framework. As a result, countries in sub-Saharan Africa, South Asia, and elsewhere have created M&E units within their ministries of education to track progress toward goals such as universal primary education or gender parity in schooling. As a result, countries in sub-Saharan Africa, South Asia, and elsewhere have created M&E units within their ministries of education to track progress toward goals such as universal primary education or gender parity in schooling. The focus is on data collection and periodic evaluation studies. The academic literature often evaluates these efforts: for example, papers assessing the effectiveness of M&E in improving educational outcomes and monitoring the performance of the education system (such as tracking participation in distance learning) has become a new challenge; part of the emerging literature addresses how Key Performance Indicators in education have had to be rethought in light of the disruptions caused by the pandemic.

Strategic Performance Management (SPM) in a global context is often linked to the adoption of private sector strategic planning practices within governments. Different governments have varying levels of enthusiasm for such practices. For example, New Zealand’s public sector reforms in the 1990s (a pioneer of NPM) placed a strong emphasis on performance contracts and strategic plans for ministries, which were early forms of Strategic Performance Management. Many Western countries followed their own versions of performance-based management until the 2000s. Eastern European countries, during their accession to the EU, were influenced to implement performance management as part of the modernization of public administration. The literature includes, for example, case studies from Romania or Poland on the implementation of strategic management in education departments, where authors examine how EU frameworks and local governance intersect (some of these might appear in our dataset, given keywords such as “perspective” and “evolution”, which could refer to evolving practices in transition economies and academic entrepreneurship education (Alexe et al., 2018)). A frequently noted theme is that, while formal structures (strategic plans, sets of indicators) can be transplanted, the cultural change to truly manage performance is more difficult and takes time (Mihaiu et al., 2010). This resonates with the view expressed by some researchers that performance management can change organizational behavior and stimulate improvement, but only if the information is effectively used in decision-making and accompanied by incentives or support (Moynihan et al., 2011).

As for the European Public Sector Award (EPSA) and similar international initiatives, their role is largely facilitative. The EPSA, as described above, collects the best practices, many of which are documented in case studies. By analyzing EPSA winners and nominees, trends in what is considered cutting-edge in public management can be observed. For example, in the education sector, an EPSA-recognized project might be a municipality that has dramatically improved its school system through a comprehensive review of performance management or a cross-border project in which regions have collaborated to compare and learn from each other’s school performance indicators. These cases are often

recorded in publications that are easy for practitioners to use (some may appear in our dataset if the authors subsequently analyze them academically). They provide evidence of successful implementation: for example, an EPSA 2019 finalist from Estonia implemented a national education information system that consolidated performance data for each school and made it accessible to stakeholders, leading to improvements in data-driven decision-making at the local school level. Sharing such success stories helps other countries imagine how they could implement similar systems.

Our bibliometric findings, which show the dominance of terms such as Balanced Scorecard, performance, management, indicators, and accountability, align with these international developments. This suggests that much of the global academic and practical interest has focused on how to effectively implement these frameworks and measure what matters in education. Accountability remains a key justification in all countries, whether it is local accountability to parents or international accountability through comparisons (such as the OECD rankings of educational performance). However, one lesson highlighted by the literature is the need for balance (true to the name Balanced Scorecard): the goals of education are multidimensional. International assessments warn against relying exclusively on narrow indicators. For example, the OECD series on Education Policy Perspectives has advocated for Balanced Scorecard approaches in which, alongside concrete indicators (test scores, budgets), there are also measures of student well-being or innovation in teaching, to ensure a comprehensive assessment of education systems.

Another aspect of international comparison is how cultural and governance differences affect the adoption of performance models. Some studies (e.g., those by [Hofman et al., 2008](#)) have compared performance management in education between centralized systems (such as France) and decentralized systems (such as the US or Canada). They found that decentralized systems might use Key Performance Indicators (KPIs) more for local improvement, while centralized ones use them for national accountability and control. This reflects different underlying philosophies: there is no one-size-fits-all solution for measuring performance. The group containing “challenges” and “implementation” indicates that researchers paid attention to context-specific barriers, such as political support, technical capacity, or stakeholder acceptance, which vary internationally.

In conclusion, the discussion combining our bibliometric analysis with the international context suggests several key points:

- The widespread importance of the Balanced Scorecard model in the literature is matched by a significant number of practical implementations in the public sector globally, including notable successes in education, but also some failures where scorecards remained superficial checklists. Academic evaluations help identify success factors (strong leadership, clear objectives, training, etc. ([Méndez et al., 1993](#))) and pitfalls (too many indicators, lack of follow-up on objectives).
- KPI-based accountability systems have become the norm, but there is ongoing debate about refining KPIs to avoid perverse incentives and capture the qualitative aspects of education. Internationally, we see a trend toward “smarter” indicators and dashboards that integrate multiple data sources, often influenced by common best practices through organizations such as UNESCO and the OECD.
- Monitoring and Evaluation are recognized as essential for policy learning and program improvement. Countries with robust M&E have been able to adjust strategies more skillfully (as seen in some high-performing Asian education systems that rigorously track pilot interventions), while those without M&E risk sticking with failed policies due to a lack of feedback.
- Strategic Performance Management, as a holistic approach, is still maturing in public education. Although strategic plans with targets are ubiquitous, their actual integra-

tion into day-to-day management and budgets (a cornerstone of SPM) is less consistent. Research suggests incremental progress, with more public education departments reporting annual performance aligned with strategic objectives now than a decade ago, but it also notes that these sometimes remain reporting exercises rather than management tools (Fleaca et al., 2022).

- International award programs, such as the EPSAs, play a positive role by encouraging innovation and knowledge sharing. The academic literature on these often highlights how inspiration or models from one context (e.g., a Scandinavian education project) have been adapted in another (e.g., an Eastern European context) after gaining international recognition. This cross-pollination accelerates improvements and helps avoid each system reinventing the wheel.
- Finally, the interdisciplinary nature of the knowledge base (as evidenced by our data) suggests that future advances in measuring performances in public education may come from outside the traditional discourse of public administration—for example, from data science (predictive analytics for student success), organizational psychology (how performance targets affect teacher motivation), or comparative public policy (learning why certain governance structures produce better performance outcomes). Researchers and practitioners need to collaborate in these areas to refine and humanize performance measurement approaches so that they ultimately serve the fundamental mission of education: improving student learning and development.

4.4. Limitations

Several methodological limitations must be acknowledged. Firstly, the search strategy is based on specific keywords and may not cover all the relevant literature if different terminology is used. For example, some studies may discuss performance measurements in education without using the exact terms we searched for. We attempted to address this limitation by using broad search terms and common acronyms. However, the possibility of omitting some relevant studies cannot be eliminated. Secondly, including terms such as “SPM” and “EPSA” introduced noise due to their multiple meanings in the academic literature. Although we filtered the dataset, some irrelevant records may remain in the analysis, particularly within the technical group, which we will discuss later. Thirdly, although bibliometric analysis can identify trends and research groups, it cannot assess the quality or outcomes of educational performance measurement practices alone. Therefore, we supplement our bibliometric results with information from the literature to draw meaningful conclusions. Finally, cluster interpretation is subjective, with authors assigning thematic labels to clusters based on their understanding of keywords. Despite these limitations, the methodology provides a robust overview of the research landscape on performance management models in public education, making it well-suited to the exploratory and integrative objectives of this study.

4.5. Practical Implications

Practical implications for policymakers and educational managers:

- Integrate strategy and measurement: Articulate a sector strategy (SPM) via a Balanced Scorecard populated with a limited, balanced set of KPIs aligned to learning, equity, processes, and capacity.
- Invest in capacity and culture: Train leaders and teachers to interpret data; use indicators for learning and improvement rather than punitive control.
- Build robust M&E loops: Couple dashboards with periodic evaluations to test which policies work and adapt allocations accordingly.

- Balance indicators: Pair attainment and efficiency metrics with measures of well-being, inclusion, and instructional quality to avoid narrow goal distortion.
- Learn internationally, adapt locally: Mine EPSA cases and peer systems for designs, but tailor them to governance structures and data realities.
- Review and prune KPIs regularly: Prevent overload; maintain relevance as priorities evolve and technologies mature.

5. Conclusions

This scientific paper aimed to examine how innovative performance measurement models, in particular BSC, KPI, SPM, and M&E approaches, as well as the role of the EPSA, are analyzed and presented in the academic literature, with a focus on public education and public policy management. By conducting a bibliometric analysis of the publications included in the selection, we identified key trends, thematic groups, and perspectives that help to paint a comprehensive picture of the field. Our analysis leads to several conclusions:

1. Growth and scope of research in the field of performance measurement: The volume of the literature on performance management in the public sector (and in education in particular) has increased dramatically, especially in the last decade. This reflects the adoption of these models in the real world by educational institutions and governments globally. It is important to note that the research is highly interdisciplinary, encompassing management science, educational research, economics, and more, indicating that performance measurement is not an isolated topic but one that involves diverse academic communities. For stakeholders in education, this means that there is a rich knowledge base from which to draw information, albeit scattered across various fields, which reinforces the value of integrative analyses such as this one.
2. The dominance of the Balanced Scorecard and KPIs as frameworks: The Balanced Scorecard has clearly been a central framework in both research and practice (Madsen, 2025). It provides a versatile template that many public education systems have tried, adapting its four-perspective model to the public/non-profit context. KPIs, in turn, are the lifeblood of all these frameworks, the specific measures that are tracked. Our analysis confirms that considerable effort has been made to identify, refine, and evaluate KPIs for education and public services. The consensus in the literature is that selecting the right indicators (relevant, balanced, aligned with strategic objectives, and limited in number) is crucial for success. When performed correctly, KPI systems and dashboards can clarify expectations, motivate staff, and improve transparency. However, a recurring caution is to avoid overloading indicators and to remain flexible; as education goals evolve, so should performance indicators. Therefore, continuous review and adaptation of KPIs is recommended as a best practice.
3. The need for strategic alignment and cultural change: One of the main conclusions from Cluster 3 (strategic management and organizational performance) is that introducing performance measurements in public education is not just a technical endeavor but a profound organizational one. The literature is full of cases where a technical sound system failed to deliver results due to lack of buy-in, insufficient training, or misuse of data (e.g., using indicators for punitive purposes rather than for learning and improvement). In contrast, success stories (such as some EPSA-winning projects) show that when leadership promotes a culture that values data-driven decision-making and continuous improvement, performance measurement becomes a powerful tool for positive change. In education, this could involve training school leaders to interpret and act on data, involving teachers in setting meaningful goals, and communicating with parents and communities about what performance data

says (and does not say) about their schools. In conclusion, human and cultural factors are as important as the choice of framework.

4. International exchange accelerates innovation: By comparing international practices, we find that countries often learn from each other in implementing performance management reforms. The presence of institutions such as the OECD, which promulgates indicators and conducts assessments, as well as award programs such as the EPSAs, has created channels for the exchange of ideas. For example, the concept of school report cards (a KPI-based transparency tool) emerged in one context and was then adapted and improved in many others. Academic research plays a complementary role by evaluating such transfers, highlighting the contextual factors that need to be taken into account. One conclusion here is that there is no universal model; each education system should tailor performance frameworks to its unique needs but can still draw inspiration and avoid known pitfalls by studying the experiences of others. International standards and benchmarks (such as the Sustainable Development Goal's four indicators for quality and equity in education (Dumitrescu et al., 2019)) also increasingly frame what is measured, pushing countries toward comprehensive performance monitoring that includes not only academic outcomes but also the inclusion of lifelong learning indicators.
5. The future of performance measurements in education, integration, and balance: The field is moving toward more integrated and balanced approaches. Instead of looking at BSC, KPIs, M&E, etc., in isolation, leading organizations are integrating them: for example, a ministry might have a strategic plan (SPM) articulated through a Balanced Scorecard, populated with KPIs, and supported by an M&E system that periodically evaluates the programs contributing to those KPIs. Our analysis suggests that academia is also breaking down silos—studies are increasingly examining the entire performance management ecosystem rather than a single tool. A balanced approach also means coupling quantitative indicators with qualitative assessments. Many researchers advocate combining hard data with surveys, peer reviews, and self-assessments to obtain a 360-degree view of performance. In education in particular, numbers alone rarely tell the whole story, and successful performance management recognizes the complexity behind performance indicators. As an answer to the *third research* question, the analysis of international practices and exchanges (such as through the EPSA) suggests that the transfer of ideas accelerates innovation in performance measurement. Policymakers can learn from these cases that, while there is no universal model, taking successful elements from elsewhere with careful attention to the specifics of the local level processes where they have been implemented can result in the increased effectiveness of performance management in education.

In conclusion, performance measurement models such as BSC, KPI, SPM, and M&E have become an integral part of modern public education management. They bring a discipline of goal setting and progress measurement that, when applied effectively, can lead to improved services and educational outcomes. Bibliometric analysis confirms their importance and highlights how research critically examines their implementation. The challenges are evident, from technical measurement issues to deeper questions of purpose and impact, but so are the innovations, as demonstrated by countless case studies and experiments around the world. Going forward, the challenge for both researchers and practitioners is to refine these models to be more educator-friendly, more equity-conscious, and more learning-oriented. This could involve developing new indicators for skills and competencies that are not easily tested, ethically leveraging large amounts of data to personalize learning, and ensuring that accountability frameworks hold systems accountable for improvement rather than just compliance.

The scientific literature offers an optimistic but tempered outlook when these innovative performance measurement models are designed and implemented. They can be powerful tools needed to improve the quality, effectiveness, and responsiveness of public education to the needs of society. Performance measurement models can be the right tool for organizations to create genuine competitive advantages in the business field. Performance measurement models used in business education refer to a competitive and motivated academic staff, the quality of teaching and learning activities, leadership and management commitment, and the sustainability of the university–business relationship (Dima et al., 2019).

With the help of AI-driven learning, the personalization of educational models, and ensuring that accountability frameworks focus on improvement rather than mere compliance with theoretical models, future research should further examine the limitations of current performance measurement models being optimally adapted to the diversity of governance structures and the myriad of cultural contexts.

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