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Review

Green Balanced Scorecard: A Tool of Sustainable Information Systems for an Energy Efficient Business

Eirini Stavropoulou [1], Konstantinos Spinthiropoulos [1], Konstantina Ragazou [2,3,*], Christos Papademetriou [3] and Ioannis Passas [4,5]

[1] Department of Management Science and Technology, University of Western Macedonia, GR50100 Kozani, Greece; stavreirini@yahoo.gr (E.S.); kspinthiropoulos@uowm.gr (K.S.)
[2] Department of Accounting and Finance, University of Western Macedonia, GR50100 Kozani, Greece
[3] Department of Economics and Business, Neapolis University Pafos, Pafos 8042, Cyprus; c.papademetriou@nup.ac.cy
[4] Department of Business Administration and Tourism, Hellenic Mediterranean University, GR71410 Heraklion, Greece; ipassas@hmu.gr
[5] Department of Accounting and Finance, Neapolis University Pafos, Pafos 8042, Cyprus
* Correspondence: koragazo@uth.gr

Abstract: A green balanced scorecard allows businesses to monitor their environmental progress and energy use, as well as quantify their achievements toward decreasing their ecological footprint. The scope of the current research is twofold: (i) to highlight the new sustainable profile of the Balanced Scorecard; and (ii) to investigate the contribution of the Sustainable Balanced Scorecard to the achievement of the energy efficiency and environmental goals of businesses. The present research study applies the rigorous bibliometric analysis technique and the PRISMA method for the years 2011–2023 to investigate the most popular research sources and documents, where the most frequently used keywords and research trends are utilized to answer the research question. In addition, findings from the network, content, and cluster analyses were visualized with the use of the bibliometric tools of Biblioshiny and VOSviewer. The results of the study indicate that businesses have made it a priority to build an energy-efficient management system based on the Sustainable Balanced Scorecard, which will help them achieve their organization's environmental strategic goals. Moreover, a new era in the Sustainable Balanced Scorecard, that of the Contact Balanced Scorecard, has started emerging in the field. This article explains how the Sustainable Balanced Scorecard benefits organizations by enabling them to enhance their performance on both the economic and social fronts as well as the environmental front. Finally, by employing strategic evaluation methods like the Sustainable Balanced Scorecard to analyze organizations' sustainability performance, the present study effort supports the sustainable growth of enterprises.

Keywords: business; energy management system; energy efficiency; environmental footprint; sustainable balance scorecard; sustainable continuity

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1. Introduction

The Balanced Scorecard is a tool for strategy implementation and management. Its development addresses both the challenge of efficiently assessing corporate performance and the important issue of successfully implementing strategy [1,2]. Organizations that already have a defined plan might speed up their speedier and more successful execution by adhering to the principles chosen. When developing a plan, several management teams initially assumed that all their members agreed with it. However, the original Balanced Scorecard (BSC) discovered that each team member interpreted strategy extremely differently. They could not agree on who the target consumers were, what the distinctive value offer was, or how innovation and shared services fit into the plan. The process of developing the Balanced Scorecard resulted in clarification and agreement on what the plan

was and how it might be achieved. Organizations that did not have an explicit or common plan utilized the Balanced Scorecard approach to generate business unit strategies. The scorecard incites an extensive management dialogue to determine strategy. The Balanced Scorecard introduces a new shared language and infrastructure for strategy. Strategy maps and templates serve as the foundation for strategic conversations. As a result, having a clear approach that everyone knows and agrees on will reduce the time it takes to create the initial Balanced Scorecard [3].

On the other hand, businesses do not need to wait until they have reached an agreement on a plan before developing a scorecard. They can utilize the process of creating the scorecard as a tool for a parallel process that eventually results in the strategy. The Balanced Scorecard enables financial outcomes to be measured in connection to customers and operations while also enabling the development of organizational capacities and capabilities [4]. Unlike other systems, the performance assessment information acquired highlights the importance of financial and non-financial indicators being included in employee information at all levels of the hierarchy. Front-line workers must comprehend the ramifications of their job, while senior management must understand how to reach the long-term financial objectives set in the process of converting their vision into strategy while achieving the day-to-day short-term ones [1,5].

In recent years, the demand for environmentally conscious business initiatives has grown, and the benefits of green entrepreneurship are increasing, leading to the treatment of environmental consequences from corporate operations [6]. Environmental protection actions may be an arm of developing a specialized know-how with large export potential and competitive advantages, generating surplus value for the economy and thousands of new jobs. In terms of environmental management, the business climate is continually changing, resulting in a new situation in which environmental commodities become economic products and enter the realm of corporate activity [7]. The economy no longer views the environment as an endless resource that is perpetually renewed and self-healing [8]. In addition to the production costs, the environmental costs can be calculated either directly or indirectly. Green entrepreneurship's key industries meet the demand for both continuity and innovation. Thus, environmental adaptation of traditional production actions and methods is associated with continuity, slow progress, and transition, whereas exclusively green economic actions form the basis of the new economic world.

Although green activities are unquestionably beneficial to the environment, the effects of such policies on a company's profitability may be both positive and negative [9]. On the one hand, green practices may boost profitability by helping to distinguish products and services in the market, improving the corporate image for investors and consumers (both existing and new). Green practices, on the other hand, may impair profitability owing to the increased expenses associated with their adoption, implementation, and maintenance [10]. The Green Balanced Scorecard, which may provide a framework for integrating non-financial measurements into business operations and evaluations, can help to reconcile these competing challenges by aligning sustainability measures with corporate strategy. Through the above method, businesses can clarify the link between sustainability objectives and their performance, strategy, and profitability [11].

Therefore, the scope of the current research is twofold: (i) to investigate the transition from the traditional role of the Balanced Scorecard to that of the Green Balance Scorecard and (ii) to highlight the role of the Green Balanced Scorecard to the assurance of businesses for an energy efficient and sustainable continuity. The integration between the principles of sustainable development and the Balanced Scorecard is a research issue that has not been explored in depth by the academic community. As a result, the recognition and investigation of the characteristics of such a tool are considered very important and beneficial for its application by businesses. Moreover, the literature falls short when it comes to identifying the traits and the method of use of a particular tool for the rational management of a company's energy resources. Additionally, this study introduces, for the first time, the development of a model for the use of the tool of the Green Balanced Scorecard in businesses

to enhance their energy efficiency. The visualization of the findings has been achieved with the use of a series of bibliometric tools such as R Studio, Biblioshiny, and VOSviewer. Finally, the current research is broken into the following sections: Section 2 discusses the literature review about the importance of the Green Balanced Scorecard in the energy efficiency and sustainability of businesses. Section 3 presents the methodology that has been applied to this research work, while Section 4 illustrates the results. Section 5 further discusses the findings, limitations, and proposals for future research, and Section 6 concludes the paper.

2. The Role of the Green Balanced Scorecard to the Rational Management of Energy in Businesses

Energy management is the continuous and regular monitoring, control, and improvement of an organization's energy use to save energy and reduce energy expenditures [12,13]. Minor steps such as checking monthly energy bills and upgrading to energy-saving lightbulbs fall under the purview of energy management. It might imply more comprehensive upgrades such as adding insulation or installing a reflective roof to cover or enhance heating and cooling equipment to maximize their energy performance. Additionally, energy management can cover more complex operations, such as developing financial predictions for commissioning renewable energy services and implementing other changes for clean energy usage and lower energy expenses in the next few years [14]. Technology is used in more advanced energy management strategies. Utility tracking software, for example, forecasts future energy demand and sets energy budgets, which assists a company's strategic decision-makers in ensuring that its energy management strategy aligns with its objectives and financial planning. Enterprise management software makes use of IoT, sophisticated connectivity, and big data to enable a company to benefit from energy data analytics for improved facility management and to assist with energy consumption and management difficulties [15,16].

Despite the role of technology, the Balanced Scorecard (BSC) developed by Kaplan and Norton (1992), which has proven to be one of the most extensively used instruments in management strategy, can serve as another tool to aid in energy management operations. Furthermore, Hansen and Schaltegger (2012) identified the four objectives reviewed by the traditional BSC—finance, customers, internal procedures, and learning and growth—as ignoring the inclusion of sustainability issues and so needing to be modified to the changing business environment [17]. While the traditional BSC framework can assist managers in matching business sustainable development goals with firm strategy, experts in the field argue that the framework should include economic, social, and environmental factors. Key economic data should be addressed in the usual BSC from a financial approach [2,18]. As a result of incorporating the dimension of sustainability into the traditional BSC, a focus on the social and environmental measuring criteria may be placed. To begin, the required environment and society indicators, goals, and accompanying Global Reporting Initiatives (GRI) must be included into the conventional BSC framework to include the social and environmental metrics in the present four BSC frameworks. The GRI may assist managers by providing a wide range of performance and department-specific metrics.

Thus, based on the above insights of experts in the field, developing a BSC for a given business sector and identifying the social and environmental variables relevant to the business sector plans can be characterized as a critical task. Many studies have investigated the use of the Sustainable Balanced Scorecard (SBSC) in different sectors for the sustainable continuity of businesses [5]. Although, neither has further investigated the contribution of SBSC in the energy efficiency of a business. Specifically, an efficient energy performance is dependent on the development of a sustainable balanced scorecard, which implies that businesses must define targets that relate to the organization's strategy for energy efficiency and long-term continuity. A group of crucial success criteria will then serve as a representation or driver of these goals and translate into a set of actions or initiatives. The following are some of the most vital categories of critical success criteria to investigate and comprehend: (i) political aspects that include government, energy, and industry policies,

as well as renewable energy industry policies and worldwide environmental challenges, such as greenhouse gas reduction targets, (ii) technology criteria include advancements in renewable energy technology and technical assessment criteria, such as the cost of creating renewable energy, (iii) market considerations include worldwide energy prices, market demand (local and even external) for renewable energy-related businesses, domestic industry development, and (iv) natural resource factors including renewable energy availability [5].

Based on the above, an example of the SBSC model that businesses may use is based on four perspectives, from which the vital success criteria, key performance indicators, and objectives should be defined. Thus, learning and growth, customers, internal business processes, and welfare are four insights on which enterprises' SBSC should be founded in order to achieve energy efficiency and sustainability [13]. The first three concepts are not significantly different from Kaplan and Norton's initial viewpoints. However, the category of welfare replaces the original financial viewpoint at the top of the strategy plan since, for an organization, local community prosperity is the most important strategic objective, which will be demonstrated by optimizing the long-term stakeholder value [19]. Figure 1 depicts the SBSC that might be utilized if a company wishes to be more energy efficient and sustainable, where the objectives, initiatives, measurements (KPIs), and targets for each viewpoint must be presented [20–22]. The objectives indicated inside each viewpoint must work together to solve the relevant key-related question.

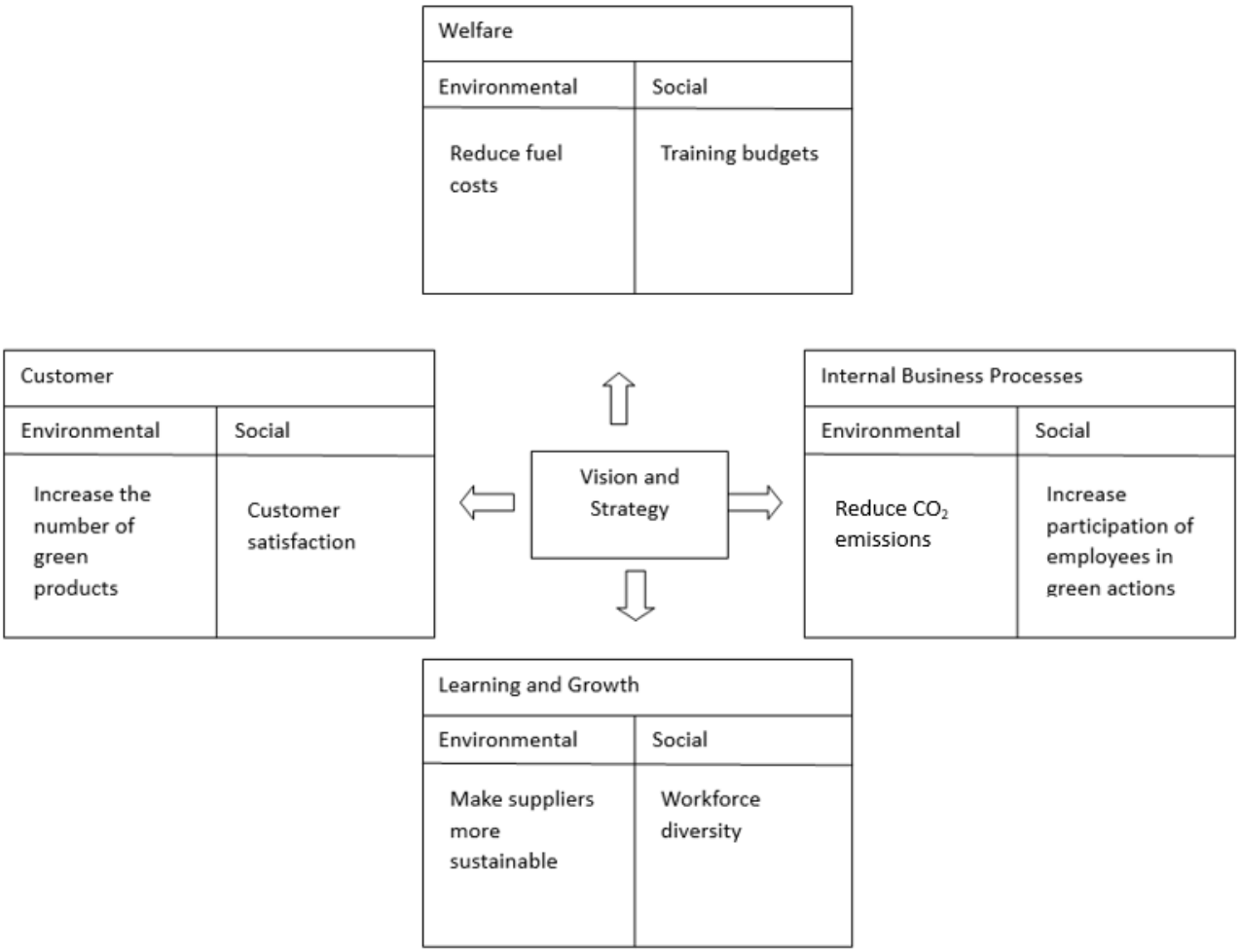


Figure 1. Sustainable Balanced Scorecard. Source: Own elaboration.

3. Materials and Methods

The current study's research issue was approached using bibliometric analysis, which is utilized to provide a review of published scientific publications in the researched subject. The goal of bibliometric analysis is fourfold: (i) to detect the state of the art for a specific field; (ii) to highlight the most cited articles and examine their impact on subsequent research by others; (iii) to show which journals, organizations, and even countries have a high impact in different fields of research; and (iv) to make comparisons. The most frequent bibliometric approaches are citation or co-citation and content analysis. Bibliometric analysis, regardless of the approach chosen by the researcher, gives a comprehensive map of the structure of knowledge, its appraisal, and measurement that focuses on the bibliographic analysis of scientific articles gathered in a database. Furthermore, the bibliometric analysis approach is a type of research that relies on the processing of the aggregated literature data provided by databases such as Scopus, Web of Science (WoS), and Google Scholar [23,24]. Quantitative and bibliometric approaches for measuring the research output have risen in favor in recent years. In addition to validity and reliability, the effectiveness of such an evaluation approach is critical. The present study's data were obtained from the Scopus database in May 2023, while the research has been placed in five steps (Figure 2).

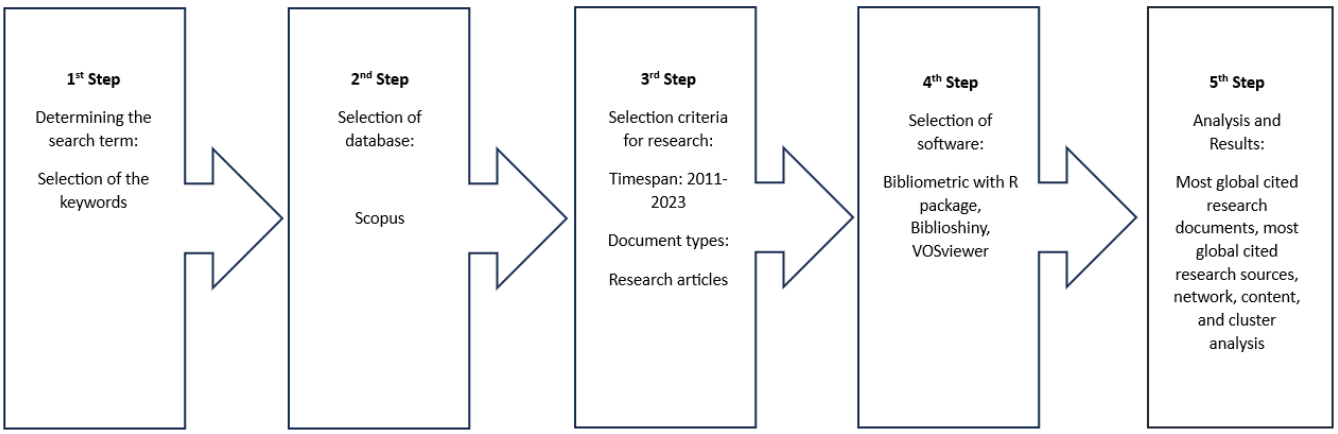


Figure 2. Methodology workflow. Source: Own elaboration.

Scopus has 36,377 titles from 11,678 publishers, including 34,346 peer-reviewed journals in Science, Technology, Medicine, Social Sciences, and Arts and Humanities. Scopus database searches entail utilizing Scopus, an Elsevier product, to search scientific websites and patent databases. Our search in the database yielded 654 results for the following key words: "Balanced Scorecard", "Information systems", "energy efficiency", "business continuity", and "sustainability". However, the number of selected research documents that were screened and included in the analysis emerged based on the PRISMA guidelines (Figure 3). The PRISMA process follows a three-step analysis: (i) identification, (ii) screening, and (iii) inclusion of the selected research documents. In the first step, the initial Scopus database search identified 654 research documents, of which 114 were eliminated because of duplication, and 112 were removed for other reasons too. Therefore, after the first clarification step, the number of remaining articles was 419, from which 92 research documents were excluded based on the application of exclusion. Thus, the reports assessed for eligibility were 327, and from this number, 146 documents were excluded due to relevance. Finally, the number of documents that were included in the bibliometric analysis was 181.

Further, to minimize the clarity and quality of the findings, we only considered original publications for analysis, omitting book chapters, conference proceedings, and white papers. In addition, because English is one of the fastest-growing languages in the modern world, it was employed in the search. The articles gathered and analyzed were confined to the

years 2011 to 2023. The authors used Biblioshiny and VOSviewer bibliometric tools to show their findings [25].

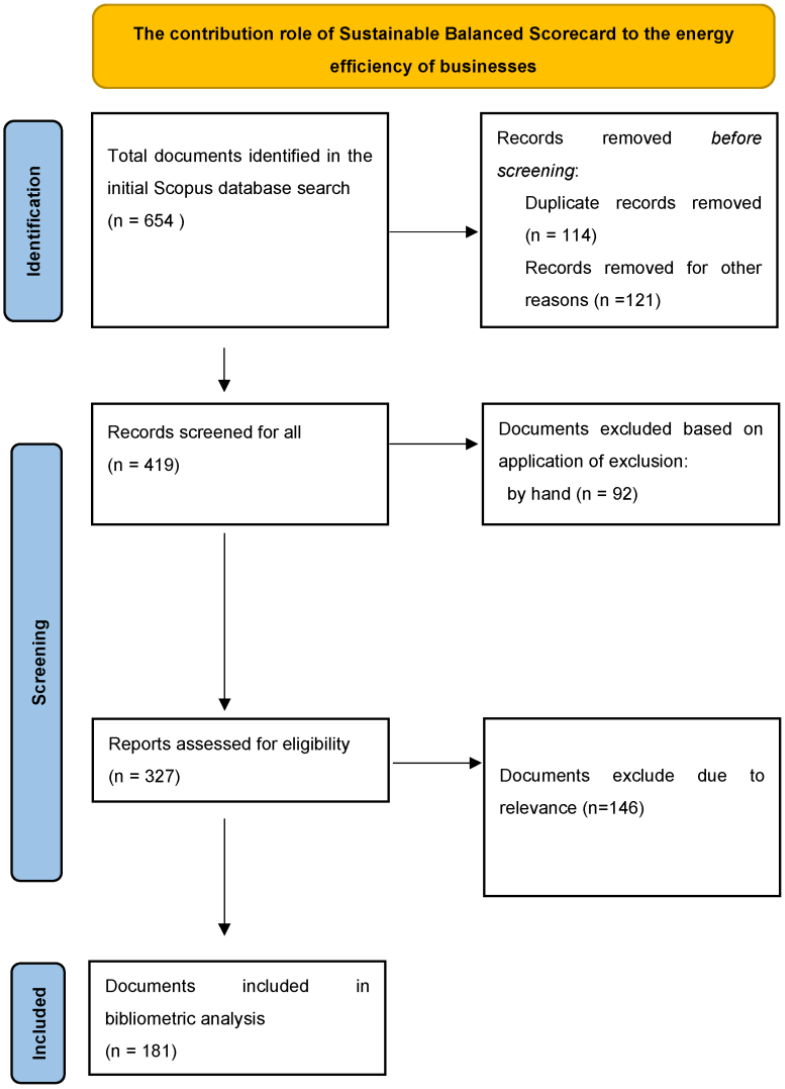


Figure 3. Selection of the scientific documents based on the PRISMA flow diagram method. Source: Own elaboration.

4. Results

4.1. Most Influential Journals and Documents in the Field

A total of 181 published scientific documents from 2011 to 2023 were examined in the current study. Table 1 presents the most cited scientific documents related to the studied field for the examined period and indicates the Normalized Total citation, which is a metric that is referred to the documents and is calculated by dividing the actual count of citing items by the expected citation rate for documents with the same year of publication. Among the documents that are illustrated in the table, only one is entitled "Balanced scorecard-based analysis about European energy investment policies: A hybrid hesitant fuzzy decision-making approach with Quality Function Deployment", which has discussed the role of the Balanced Scorecard in highlighting the most crucial factors and policies of businesses about their energy efficiency [12,26]. This can confirm that the current study is the first to discuss the importance of the application of SBSC as a tool for businesses to help them organize, monitor, and provide the appropriate information for energy efficiency. However, most of the scientific documents have indicated that technology is one of the most crucial factors for businesses to meet their energy and environmental goals. Specifically,

the document with the most citations, which is entitled "Transdisciplinary Perspectives on Environmental Sustainability: A Resource Base and Framework for IT-Enabled Business Transformation," has focused on the potential capacity of businesses for innovation and change, nationally or globally, which is considered a crucial contributor to fulfilling the problems of environmental sustainability. Moreover, this article has been provided as a starting point for scholars to begin substantial information systems and transdisciplinary work towards environmental sustainability.

Table 1. The most global cited research documents in the field. Source: Scopus/Biblioshiny.

Paper	Total Citations	TC per Year	Normalized TC
Transdisciplinary Perspectives on Environmental Sustainability: A Resource Base and Framework for IT-Enabled Business Transformation [27]	363	27.9231	1
Blockchain-empowered sustainable manufacturing and product lifecycle management in industry 4.0: A survey [28]	208	52	7.5912
Blockchain for smart cities: A review of architectures. integration trends and future research directions [29]	168	42	6.1314
A methodological framework for the inclusion of modern additive manufacturing into the production portfolio of a focused factory [30]	167	18.5556	2.0366
The adoption of PV in the Netherlands: A statistical analysis of adoption factors [31]	129	14.3333	1.5732
Balanced scorecard-based analysis about European energy investment policies: A hybrid hesitant fuzzy decision-making approach with Quality Function Deployment [32]	104	20.8	4.8417
Making sense in the cloud: Farm advisory services in a smart farming future [33]	90	18	4.1899
Developing sustainable building assessment scheme for Saudi Arabia: Delphi consultation approach [34]	84	7.6364	1
Sustainable enterprise resource planning: imperatives and research directions [35]	81	8.1	2
Identifying causal relationships in strategy maps using ANP and DEMATEL [36]	73	12.1667	5.1408
To Facilitate or Curb? The Role of Financial Development in China's Carbon Emissions Reduction Process: A Novel Approach [37]	69	9.8571	1.9492
Zero-energy hydrogen economy (ZEH2E) for buildings and communities including personal mobility [38]	66	9.4286	1.8644
Fuzzy-set qualitative comparative analysis (fsQCA) in business and management research: A contemporary overview [39]	61	30.5	8.9706
Investigating the resources for Integrated Management Systems within resource-based and contingency perspective in manufacturing firms [40]	59	6.5556	0.7195
Challenges of urban digital twins: A systematic review and a Delphi expert survey [41]	58	11.6	2.7002
Industry 4.0: driving factors and impacts on firm's performance: an empirical study on China's manufacturing industry [42]	56	11.2	2.6071
A systematic literature review of supply chain decision making supported by the Internet of Things and Big Data Analytics [43]	52	17.3333	3.0476
Adoption factors of cleaner production technology in a developing country: energy efficient lighting in Malaysia [44]	47	5.875	2.2381
Analysis of hotels' environmentally sustainable policies and practices: Sustainability and corporate social responsibility in hospitality and tourism [45]	45	9	2.095
The Impacts of Social Responsibility and Ownership Structure on Sustainable Financial Development of China's Energy Industry [46]	42	7	2.9577

Furthermore, Table 2 illustrates the most cited research sources in the field of the Balanced Scorecard, including its transition to sustainability and contribution to the energy management of businesses. Sustainability is identified as the journal with the most cited and the most relevant published documents on the study area (19 articles) throughout the examined period. Also, with eleven (11) published documents in the discipline, the Journal of Cleaner Production is ranked in the second position. The International Journal of Innovation Creativity and Change is ranked in the third position with eight (8) published scientific papers. Despite the subject area of this journal being focused on social sciences, this is linked with the social aspect of the Sustainable Balanced Scorecard. Table 2 further shows that the selected journals span a wide variety of research topics related to business and management, such as energy, environmental management, business, management and accounting, and computer sciences. Furthermore, the selected journals are indexed by the Scopus and Scimago lists, as well as the ABS list. The average h-index is close to 131, indicating that the published research publications in the investigated topic acquire more than 131 citations each piece. This is an applicable figure that demonstrates the relevance, significance, and broad impact of research on the Sustainable Balanced Scorecard's contribution to company energy management.

Table 2. The most global-cited research sources in the field. Source: Scopus/Biblioshiny (The journals are given a star rating from * to *** (the highest)).

Sources	Articles	Subject Area	h-Index	Ranking by ABS List	Ranking by Scimago List
Sustainability (Switzerland)	19	Energy	136		Q1
Journal of Cleaner Production	11	Energy	268	2 **	Q1
International Journal of Innovation Creativity and Change	8	Social Sciences	17		
Energies	7	Energy	132		Q1
Renewable and Sustainable Energy Reviews	5	Energy	378		Q1
Technological Forecasting and Social Change	5	Business, Management and Accounting	155	3 ***	Q1
Environmental Science and Pollution Research	4	Environmental Science	154		Q1
International Journal of Energy Economics and Policy	4	Energy	45		Q2
Computers And Industrial Engineering	3	Computer science	148	2 **	Q1
International Journal of Environmental Research and Public Health	3	Environmental Science	167		Q2
Kybernetes	3	Computer science	47	1 *	Q2
Accounting Auditing and Accountability Journal	2	Business, Management and Accounting	112		Q1
Acm International Conference Proceeding Series	2	Computer science	137		
Annals Of Operations Research	2	Decision Sciences	118	3 ***	Q1
Expert Systems With Applications	2	Computer Science	249	1 *	Q1
Frontiers In Psychology	2	Psychology	157	1 *	Q2
Global Knowledge Memory and Communication	2	Social Sciences	35		Q2
International Journal of Contemporary Hospitality Management	2	Business, Management and Accounting	113	3 ***	Q1
Journal Of Financial Reporting and Accounting	2	Business, Management and Accounting	16	1 *	Q2
Opcion	2	Social Sciences	21		

4.2. Network, Content, and Cluster Analysis

The visualization of the link between authors, countries, and keywords can reveal unique insights into the scientific community. Figure 4 illustrates a three-field plot, commonly known as a Sankey diagram, that depicts the interaction between the most relevant authors (left), nations (middle), and keywords (right) in the sustainable balanced scorecard and energy efficiency research topic. The results show that Jordanian academics are mostly interested in issues like businesses' sustainability and the deployment of a balanced scorecard to help them track their environmental progress. However, the above is not weird. Jordan is among the first nations, both internationally and in the Arab World, to have taken steps to achieve the Millennium Development Goals (MDGs). Overall, throughout the first 10 years, significant accomplishments were realized, particularly in the field of environmental sustainability. Also, many companies in the country have already started gathering environmental information and monitoring their progress on decreasing their ecological footprint with the use of the Balanced Scorecard tool. Moreover, academics from Malaysia and China seem to have specialized knowledge in the area of businesses' energy efficiency and the development of appropriate tools like the sustainable balanced scorecard.

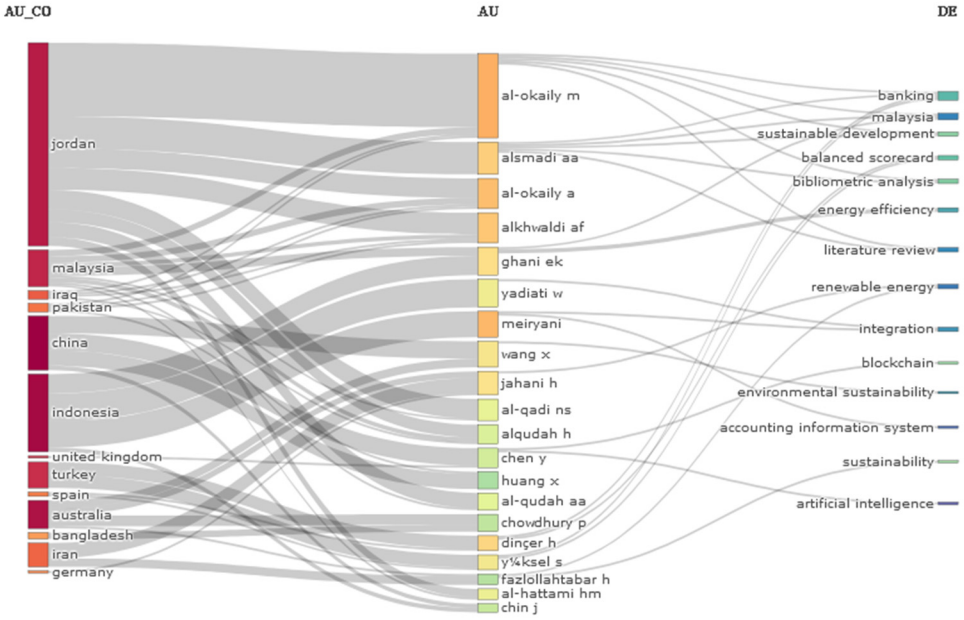


Figure 4. Sankey diagram. Source: Scopus/Biblioshiny. The darkest the color the highest the dynamic of author's country in the field (left column), author (middle column), authors' keywords (right column).

Following the previous method, network analysis can include the crucial component of keyword analysis, which is a practical technique that may provide informative data for a study field. The identification of research trends within a subject field is another use for keyword analysis. Figure 5 shows the network representation based on the co-occurrences of the authors' keywords [47]. By using VOSviewer, the co-occurrence of the authors' keywords is visualized. The bibliometric network may be mapped with the help of this program. A co-occurrence case is represented by each circle in the graph. The larger the circle, the higher set the frequency of each of the word is. The circles of the same color represent a group of keywords (cluster), and the links between the circles show the relationships between the keywords. Based on the current findings, 81 keywords surfaced, and they were grouped into nine (9) clusters. Cluster 1 (green color) is associated with the issue of sustainability and the need of the structural equation model in order for businesses to try to develop a well-fitting model for energy efficiency and sustainable continuity [48,49]. The tool of the Sustainable Balanced Scorecard can be characterized as a structural equation model, and it might be claimed by subject-matter specialists that

this alternative to the traditional Balanced Scorecard prevents learning important details about the phenomena under investigation, like that of energy management in a rational way for an efficient business. The above cluster is linked strongly to Cluster 2 (red color), which highlights the need of businesses for energy efficiency. Also, the map shows that this need is of high priority in the banking sector mainly. This is because banks play a crucial role in funding energy-efficient and renewable energy projects in buildings. Thus, financial institutions, by building a sustainable balanced scorecard, can continue to be relevant to new clients by investing in data gathering and analysis, adopting new practices, connecting with consumers, and working with industry stakeholders. Therefore, banks may finance initiatives promoting energy efficiency and renewable energy, cut greenhouse gas emissions, and lessen the effects of climate change [50].

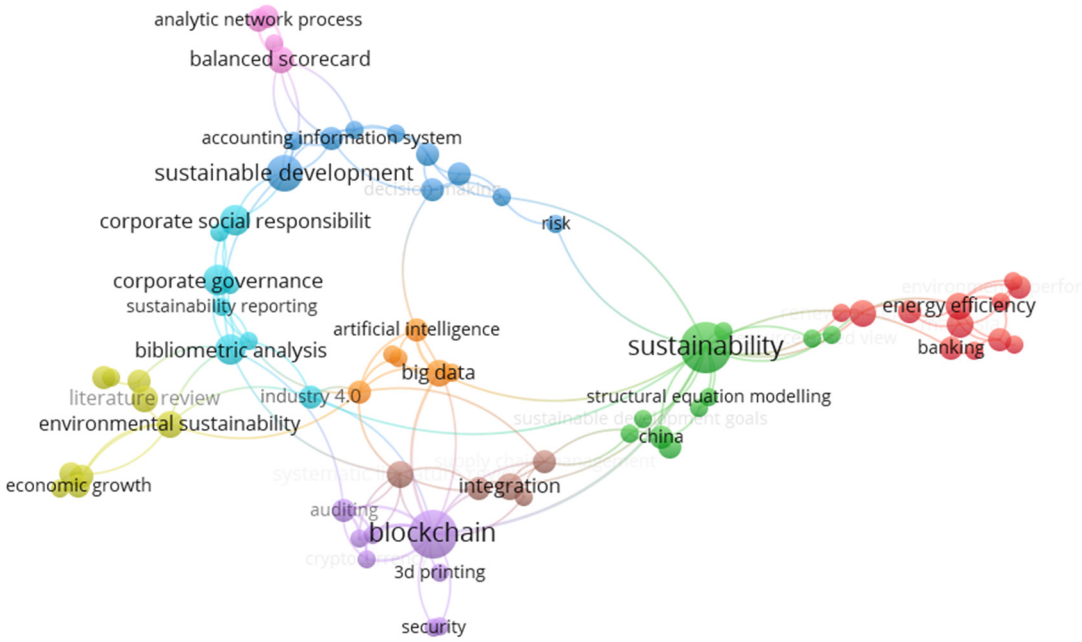


Figure 5. Co-occurrence of authors' keywords. Source: Scopus/VOSviewer. Each color represents a different cluster of authors' keywords. As it has been highlighted within the text 81 keywords have been grouped in nine (9) clusters.

Moreover, Clusters 3 (orange color) and 4 (purple color) illustrate the new era in the development of a well-structured SBSC, which is that of emerging technologies. Specifically, both clusters present artificial intelligence, 3D printing, blockchain, and big data as the new basis for building SBSC [5]. The combination of SBSC and emerging technologies can signify a revolutionary period for businesses in managing, programming, and organizing a dynamic strategy with the goal of becoming carbon neutral and lessening their ecological footprint. Additionally, Cluster 5 (brown color) highlights the importance of the integration of emerging technologies into the sustainable and carbon neutral strategies of businesses for a green continuity and economic growth (Cluster 6—yellow color). Finally, Cluster 7 (pink color) is stong linked to Clusters 8 (blue color) and 9 (light blue color) and illustrates the contribution of the Balanced Scorecard in sustainable reporting and "green" business continuity.

Sustainability, a new aspect of the balanced scorecard, was previously discussed and handled using co-occurrence analysis. The topic map (Figure 6), on the other hand, provides some extra prospective research opportunities in the area [19]. The research topics derived from the conceptual structure of the documents are portrayed via a thematic map based on the authors' keywords in the Bibliometrix analysis. The map is split into four quadrants, each indicating a different research field related to the issue under investigation. The cluster's size denotes the frequency of the words. Furthermore, the density and centrality

dimensions of the thematic map are the major critical criteria for defining the numerous challenges that happened. Based on internal linkages between the authors' keywords, the density dimension underlines the degree of growth of each study subject. The second factor, centrality, which is based on the external relationships between the writers' terms, reflects the importance of each topic. As mentioned before, the thematic map is partitioned into four quadrants. The motor themes are illustrated in the upper-right quadrant and are characterized by their combination of high density and high centrality. On the other hand, the basic themes are represented in the lower-right quadrant and are distinguished by their high centrality but low density. The niche themes, however, are depicted in the upper-left quadrant and are characterized by their high density but low centrality. Lastly, the emerging themes are situated in the upper-left quadrant and are distinguished by their high density and low centrality.

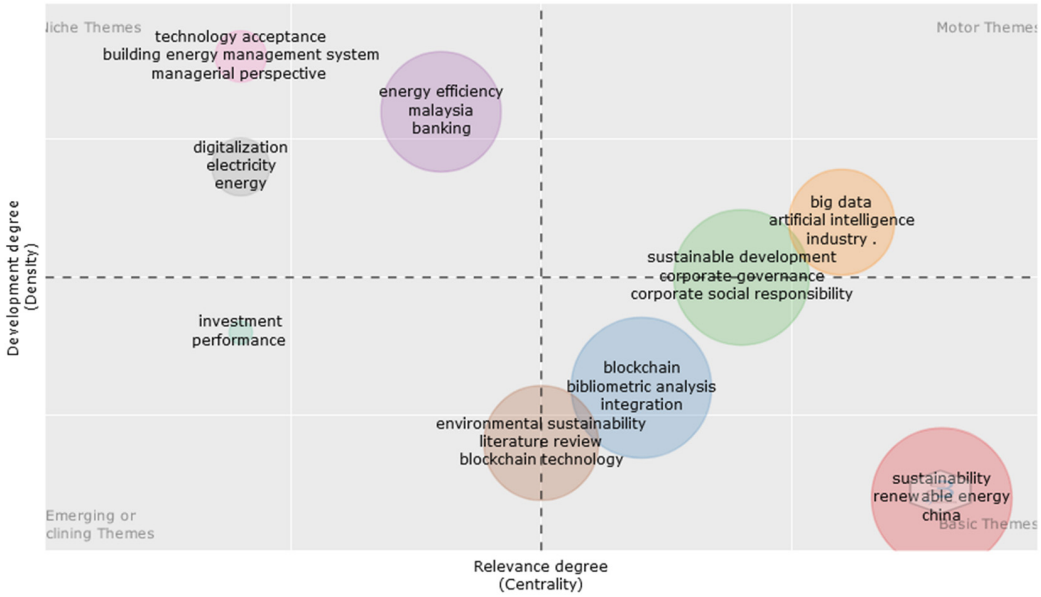


Figure 6. Thematic map. Source: Biblioshiny/Biblioshiny.

Among the niche themes, the issues of digitalization in achieving energy efficiency, mainly in the banking sector, have been merged once again, while also confirming the findings of the previous network maps [51,52]. However, businesses and organizations, like financial institutions, should develop a strategy that will facilitate their roadmap and will contribute to the processes of an effective energy management system. To this purpose, the Sustainable Balanced Scorecard is an ideal solution for businesses to any sector to meet their energy goals. By combining the three sustainability pillars into a single, all-encompassing strategic management tool, sustainability management with the use of the Balanced Scorecard aids in overcoming the drawbacks of traditional approaches to environmental, energy, and social management systems.

In addition to the analysis of the thematic map, the multiple correspondence analysis (MCA) indicates some new points that might help businesses, and especially financial institutions, in focusing on "green tools" like smart contracts, which can help them in saving energy and decreasing their ecological footprint (Figure 7). MCA consists of a matrix that combines co-word analysis with a two-dimensional map of the most frequented and mentioned phrases in the related scientific documents. Based on each keyword's frequency and the collective use of its references in each recovered document, the MCA approach clusters the keywords of the recoverable scientific documents [47,48]. The data generated via the MCA method may be examined in terms of the distribution and placement of points along each dimension. As a result, the more similar the distributions of words are, the closer the words are represented on the MCA map. Two clusters may be seen on the map.

The first cluster (red) shows the topics that have previously been covered in the literature, while the second cluster (blue) shows the knowledge gap.

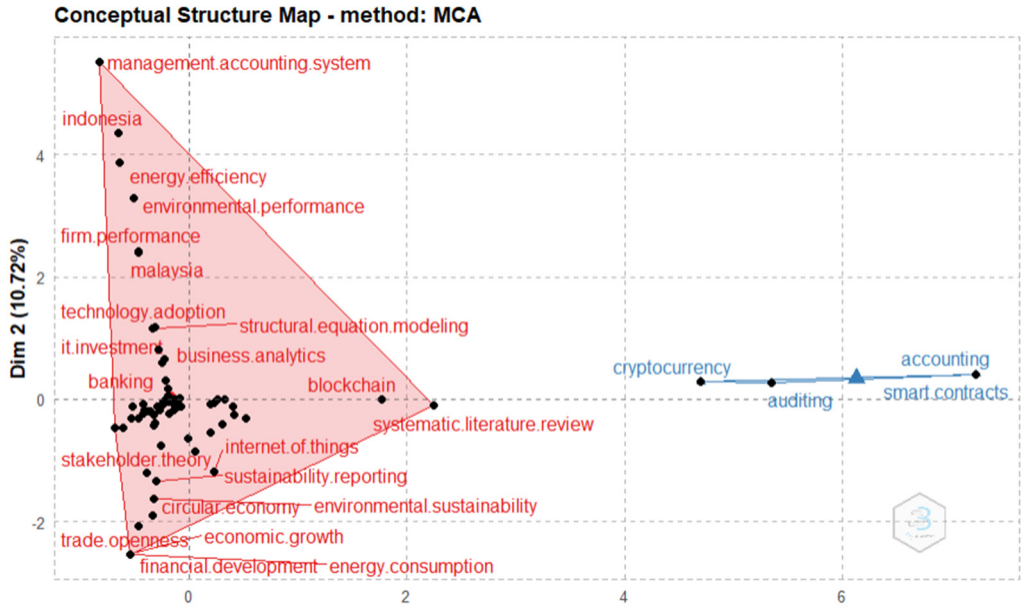


Figure 7. Multiple Correspondence Analysis (MCA). Source: Scopus/Biblioshiny.

Therefore, while the clusters in the red color presents once again the need of businesses for sustainability, economic growth, and monitoring of energy consumption, the clusters in the blue color highlights the research gap in the field, which is the adoption of smart contracts as tools for an energy efficient organization. About smart contracts, there are a few research studies that demonstrate how smart contracts may contribute to the sustainability and energy efficiency of enterprises [53–55]. For instance, researchers in the field have already suggested the development of a platform for energy transactions based on P2P (peer-to-peer) blockchains to allow energy-efficient transactions between businesses and consumers. However, smart contracts, in cooperation with the balanced scorecard or the contract's balanced scorecard, can emerge among the most dynamic and powerful practices. As it has already been mentioned above, businesses need to be adaptable, customer-focused, and meet their environmental goals to be efficient, sustainable, and more competitive. Even when they are putting contracts into effect, some firms could consider they embody these criteria without measuring their success. Thus, SBSC are required to provide a holistic approach to enhancing an organization's environmental and sustainable performance [3]. The approach of learning more about your business to increase the energy performance and effectiveness may be implemented by putting in place balanced scorecards. They can aid in the development of a long-term sustainable strategy and make it easier to adapt to the shifting conditions, trends, and situations of the market.

5. Discussion

The BSC's approach to sustainability management aims to handle the issue of corporate sustainability contributions holistically. It makes the case that businesses should concurrently enhance their performance in the economic, environmental, and social facets of sustainability if they are to contribute to sustainable development. The relationship between the firm's environmental, social, and economic performance and the three performance elements of sustainability must be expressly considered. Three key benefits may be derived from incorporating the three sustainability pillars into regular company management via a pragmatic approach [1,2,4,19]. First, because it is practiced if the business is successful, sustainability management that is financially viable is not threatened by the economic crisis. Additionally, organizations like financial institutions frequently focus on their

rivals while trying to advance or strengthen their environmental and social management. As a result, sustainability management that also advances economic goals aids in the spread of the notion of sustainable development in business by providing an acceptable role model for other enterprises [6,7]. Additionally, a corporate sustainability management strategy that incorporates social and environmental concerns into regular company management guarantees that all three sustainability dimensions are considered [18,56].

Thus, while BSC supports the identification and administration of simultaneous improvements to corporate objectives in the areas of the environment, society, and finances, the main goal of SBSC is to maintain the idea of sustainability and to continuously enhance a company's performance in terms of economy, environment, and society [3]. The SBSC's potential for integrating business strategy management with sustainability strategy management has been highlighted for two main reasons. To begin with, it enables the management to meet goals in all three elements of sustainability by combining economic, environmental, and social challenges, when other approaches only handle one. Second, rather than needing different systems (for example, separate financial, social, and environmental performance management systems), the SBSC combines all three components into a single integrated performance management system [2,4]. Thus, based on the above-mentioned, the use of the SBSC assists businesses in implementing and evaluating sustainability plans. It has established itself as one of the most essential instruments for measuring sustainability performance since it includes both financial and non-financial variables. Furthermore, cause-and-effect correlations between environmental and social measurements and other metrics can aid in interpreting and evaluating the impact of environmental and social activities on the four perspectives of the Balanced Scorecard, notably the company's financial performance.

Although, the current study presents some new insights about the SBSC model for an energy efficient business. Specifically, a new model emerged which is based on the principles of the Sustainable Balanced Scorecard and the smart contracts. This new model is called Contract's Balanced Scorecard and has been proposed to help businesses to evaluate their environmental and energy performance [10,54,55]. This model can ensure that all stakeholders are on the same path about measuring the appropriate parameters, which will contribute to meeting their environmental goals. Furthermore, this tool might allow firms to solve environmental and energy managerial flaws. A common concern noted across industries and organizations is a lack of transparency, particularly about their environmental scope and aims. This frequently leads to disagreements, which in turn lead to processes of arbitration, escalation to senior management, or compromises to reach a solution that all parties involved will be happy with [53]. Furthermore, including a balanced scorecard into a contract is an approach for reducing total firm environmental complexity and unpredictability. The Sustainable Balanced Scorecard's four perspectives, quantitative performance indicators, and qualitative criteria for determining an organization's levels of environmental and energy performance help to adequately define or reach an agreement during the pre-award phase; they can also help with the post-award phase to maintain and update the scope and goals to reflect changing requirements or capabilities.

However, the implementation of the new model of the contract's balanced scorecards in enterprises remains a subject of inquiry. In general, contracts serve as mechanisms for regulating enduring partnerships, overseeing intricate transactions that necessitate cooperation and adaptability [1,19]. Challenges may occur because of the partial nature of contracts or the lack of a clear understanding among the involved parties. The initial argument pertains to the notion of a relational contract, while the subsequent point pertains to the necessity of establishing appropriate key performance indicators (KPIs). Parties commonly engage in the practice of assessing and overseeing each other's energy performance in a reciprocal manner, employing a balanced scorecard framework to automate the reporting process. This involves establishing a connection between contracts and the balanced scorecard system. Key performance indicators (KPIs) enable firms to enhance their ability to identify bottlenecks, inefficiencies, and the value associated with contractual

agreements. It is often regarded as optimal to establish, reach a consensus on, and execute quantifiable key performance indicators (KPIs). The identification, measurement, and monitoring of KPIs are essential for businesses to mitigate avoidable risks, enhance revenue generation, accomplish objectives, and apply optimal practices for sustained success [3]. The utilization of a contract's balanced scorecard in the context of contractual agreements allows for the mutual advantage of all parties involved, since they collaboratively oversee these performance metrics in a simultaneous manner throughout the duration of the contract, rather than only responding to retrospective reports. The objective of these standards is to introduce shared responsibility for outcomes within the buyer–seller dynamic. The balanced scorecard encompasses a combination of qualitative and quantitative data. It serves to monitor the adherence to the key performance indicators (KPIs) that have been agreed upon, while also tracking, visualizing, and rating the performance of the contract.

One effective approach for implementing energy metrics is to consolidate all contracts into a centralized platform, serving as a singular source for easy and efficient access. Moreover, it is important to establish a compliance framework that clearly delineates the individuals allowed to grant approval and affix their signatures to contractual agreements. This measure serves to mitigate the potential for security breaches. When considering the selection of appropriate KPIs, it is important to consider the objectives of the organization. The objectives should be formulated in a manner that is outcome-focused, exhibiting specificity, accuracy, and realism. It is essential for the objectives to be quantifiable and attainable. The concept of measurability raises inquiries such as the following: The generation of data is attributed to individuals or entities that engage in activities that result in the production or collection of information. What specific data are required to calculate a certain key performance indicator (KPI)? This inquiry pertains to the methods of accessing and effectively managing information to derive significance from it. The technical capacities of the organization are crucial in addressing these inquiries. Prior to the conversion of raw data into valuable information, a comprehensive analysis is necessary. Only then can this information be utilized to implement suitable measures for enhancing the firm. An unequivocal framework for the purpose of reporting and monitoring is vital. The utilization of smart contract technology, API integration, and oracles enables the measurement of contractor performance and facilitates the collection of comprehensive data on the performance indicators. This data are then utilized to evaluate the degree to which contractors effectively execute the agreed-upon services.

Apart from the new model that has emerged in the market, another issue, which has been illustrated by the bibliometric analysis of the current research, is that of the integration of the emerging technologies. Artificial Intelligence, Machine Learning, 3D printing, Big Data, and Blockchain are only some of the new types of technologies that can be used for the digital transformation of businesses and their transition to an energy efficient environment [57,58]. To this purpose, the Sustainable Balanced Scorecard can be utilized to help businesses in implementing their efforts to become digitally transformed, carbon neutral, and lessen their ecological footprint. Among the sectors with the highest need of doing so is that of the banking sector. Digital transformation in banking refers to the operational and cultural transition toward integrating digital technologies into all aspects of the bank, streamlining operations, and providing value to the consumers [57,58]. If properly implemented, digital transformation can increase the bank's capacity to compete in an increasingly saturated market. While technology is the foundation of digital transformation, it is not a panacea in and of itself. Banks that effectively execute their digital strategy may reap enormous gains to become sustainable and decrease their environmental footprint. To achieve that, the use of the Sustainable Balanced Scorecard or the Contract's Balanced Scorecard can be an ideal solution [56,59].

Furthermore, the current research has some limitations. To begin, there are certain general limitations associated with bibliometric analysis. Since the data utilized in this study came solely from the Scopus database, the data from other databases or gathered at other times may provide different results and conclusions. Aside from that, we used

the topic (which included titles, abstracts, and key phrases) as a search range; individuals who only looked for article titles or keywords may obtain different results. Future research can solve these constraints by increasing the coverage of databases and document formats and using equivalent languages. Nonetheless, based on our assessment and findings of the current work, we may offer numerous potential areas for future research. Some of them are focused on the need to further investigate the new tool of the Contract's Balanced Scorecard and its contribution to the energy efficiency of businesses. Also, the role of emerging technologies in the application of the above tool should be examined.

6. Conclusions

The SBSC can be considered as an expansion of the Balanced Scorecard (BSC). The Balanced Scorecard (BSC) is a crucial performance measurement system that is specifically developed to assist in the effective execution of various activities. The assertion is made that conventional key performance indicators (KPIs) are inadequate in evaluating economic achievement. The Balanced Scorecard (BSC) does not serve as a substitute for conventional key performance indicators (KPIs), but rather complements them by incorporating non-financial factors that have a significant impact on financial outcomes, such as the qualifications of staff and the strength of customer relationships. The primary objective of the BSC is to oversee the regulation of these indicators and ascertain their role in fostering competitive advantages and ensuring sustained organizational success. The Balanced Scorecard (BSC) is a strategic management tool used for corporate management and control, which offers a comprehensive and balanced perspective of the firm to its management [3,32].

The traditional approach of BSC handles four points of view. The financial viewpoint represents the company's economic aims. These objectives are articulated in terms of profit-oriented key performance indicators (KPIs) such as cash flow or return on investment [1,19]. The financial viewpoint serves as a model for the other perspectives. The customer perspective focuses on how the firm provides value to the customers and the key performance indicators (KPIs), including customer satisfaction and market share. Internal perspectives are focused on corporate processes and typically employ process KPIs or innovation indicators. Finally, the learning and growth viewpoint regards employee motivation and happiness as a crucial component of a company's infrastructure for achieving its objectives. The performance drivers of each viewpoint are linked to each other via cause-and-effect chains that are hierarchically aligned with the financial perspective and can only secure the company's success collectively.

However, the aim of this research is to (i) investigate the transition from the traditional role of the balanced scorecard to that of the Green balanced Scorecard and (ii) highlight the role of the Green Balanced Scorecard in the assurance of businesses' energy efficiency and sustainable continuity. To approach the research question, bibliometric analysis has been applied, while the related data were retrieved from the Scopus database for the years 2011–2023. Findings of the current research show that a new paradigm has evolved based on the concepts of the Sustainable Balanced Scorecard and smart contracts. This new approach, known as the Contract's Balanced Scorecard, has been developed to assist firms in evaluating their environmental and energy performance [3]. This strategy may guarantee that all stakeholders are on the same page when it comes to monitoring the relevant metrics that will help them accomplish their environmental goals. Also, the utilization of the contract's balanced scorecards model yields a contract that is both dynamic and outcome-oriented. This contract is distinguished by its ability to automatically measure several aspects, including but not limited to energy. Furthermore, this technology may help businesses address environmental and energy management issues. A major source of worry across sectors and organizations is a lack of transparency, particularly in their environmental scope and goals [3].

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