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Review

Convergence between Indicators for Measuring Sustainable Development and M&A Performance in the Energy Sector

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Abstract: The energy sector is experiencing various transformations. Simultaneously, merger and acquisition (M&A) activities in the sector are surging globally. Extensive research has focused on and analyzed M&As from the perspective of acquirer- and target-level financial performance. In comparison, a significantly lower number of studies have analyzed the macroeconomic impact of M&A activities. The field of and interests in sustainability have also been expanding in recent decades. Sustainable development goal 7 (SDG7), which calls for "affordable, reliable, sustainable and modern energy for all" by 2030, is among other sustainable development goals that were established by the UN (United Nations). However, the synthesis of indicators for measuring sustainable development and M&A performance remains a relatively vaguely explored field. Here, we perform SALSA (search, appraisal, synthesis, and analysis) and analyze which M&A and sustainable development performance indicators may be used when analyzing M&A within the energy sector. The employment of an eligible set of indicators measuring sustainable development and M&A performance may be used by practitioners, governments, and scholars for the purpose of monitoring, tracking, and the communication of the progress. The results imply that most popular sustainability measurements are indicators for sustainable energy development (ISED). There is a growing number of studies focusing on and applying country-specific methodologies. The measurement of M&A and sustainability performance faces difficulties in practice implementation due to a lack of availability of data, information, and databases, etc.

Keywords: sustainability; mergers and acquisitions; SALSA; indicator

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1. Introduction

An increasing amount of research addresses the topics of sustainable development and M&A. The pursuance of M&A strategies may both affect and reflect sustainability matters. Therefore, the following two literature streams are reviewed in the study: sustainable development and M&A. While there may a significant number of studies that research these topics individually, there is a need for a better understanding of whether and how these topics converge.

The concept of sustainable energy development (SED) has been constantly evolving since the UN introduced this term in "Our Common Future" report in 1987. Recently, Gunnarsdottir et al. [1] have performed a citation analysis and have reviewed the history of the concept and emerging themes of SED. According to the authors, the content of the definition of sustainable development was limited in energy security and reduced emission until 2000. Furthermore, the SED issues were assumed to not relate to social and economic development. However, currently the SED context includes not only broad social and economic impacts, but also an awareness of climate change, energy efficiency, energy transition towards renewable energy sources, and energy accessibility. Nerini et al. [2] analyzed the energy role for sustainable development and concluded that "energy systems are a foundation of social and economic development, and affect delivery of outcomes across all social development goals". Gunnarsdottir et al. [1] acknowledge that energy system supply

and demand-side transformation is needed in order to explore the benefits of sustainable development. However, it is also acknowledged that energy system transformation is only feasible if it is economically viable through the stakeholders who are involved, or who may benefit from cost-competitive technologies.

While the need for pursuance of sustainable energy development was recognized upon the concept introduction in 1987, the need to monitor and track the progress towards SED was only recognized in 1992, by the UN's agenda 21. As observed by Gunnarsdottir et al. [3], countries, companies, and various organizations were encouraged to develop sustainable development indicators that would reason and validate decision-making at different levels three decades ago. Mak [4] acknowledges the performance indicators as being an important tool to track the evolution of strategies, policies, and decisions. Throughout the years, many studies have analyzed SED indicators. Even though there are various complications in defining sustainable development, Kemmler and Spreng [5] note that the measurement of sustainable development is irrevocable to operating the concept. Kemmler and Spreng [5] have analyzed the energy indicators for measuring sustainability and have shown that the utilization of energy indicators is not restricted to environmental and economic issues but is also relevant for social issues. Gunnarsdottir et al. [1] have summarized that sustainable energy development reflects the following four key pillars: sustainable energy supply, access to affordable modern energy services, energy security, and sustainable energy consumption.

Similarly to the sustainability issues that are attracting great attention from scholars and business leaders, M&A research has also boomed over the last years, as M&A activities play an increasingly important role within corporate growth and constitute an integral part of the current business environment. According to the database of the Institute of mergers, acquisitions, and alliances (IMAA), 1,179,611 M&A deals, with a total deal value in excess of EUR 72.8 trillion have been concluded during 1985–2021. Figure 1 introduces the dynamics of the total number and value of M&A transactions executed during 1985–2021. According to the data, both the number and the value of the deals have increased significantly. It was observed that over 80% of the deals occurred during 2000–2021. The post-pandemic years were extremely active, as the number and the value of deals have increased by 41% and 123%, respectively.

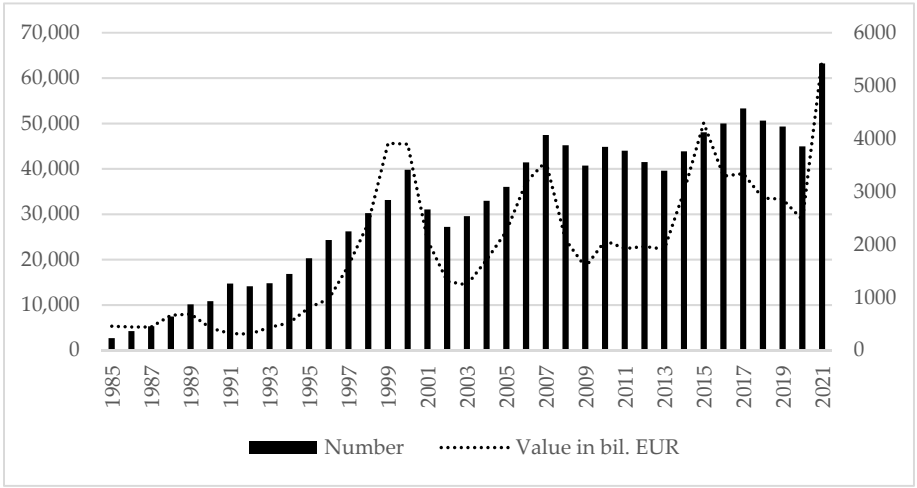

Figure 1. Dynamics of total number and value of M&A transactions executed during 1985–2021.

According to Bottis [6], a merger is the process of integrating two business entities where one or both of the companies could legally exist. On the other hand, in the acquisition, the acquiring firm takes ownership control over the target firm. The prime purpose of M&A is to increase the shareholder wealth. This may be accomplished through the following sources: a larger market share, greater efficiency, and increased capabilities by expanding the operations of the firms that are involved. The M&A activities enable

firms to benefit from using the acquired firm's resources and expertise, gaining double reputation, reducing the competition, and gaining a better market share. According to Zollo and Meier [7], M&A definition is broad and includes companies' or assets' consolidation through different financial transactions (e.g., acquisitions, mergers, tender offers, asset purchase, etc.). Choi et al. [8] acknowledge a concurrent understanding that M&A are pursued in order to deliver synergy benefits to the acquiring company, and to unify the bidders, target technology, and market-related capabilities. Having analyzed M&A effects on corporate R&D strategies, Cefis [9] concluded that the companies that are engaging in M&A events tend to rely on full resource integration in order to develop, produce, and market their innovative products. Thus, corporate innovative performance following post-merger M&A behavior favors in-house R&D and enhances the corporate innovative capabilities.

A significant increase in M&A activity levels may be attributed to the pursuit of growth markets or external growth resources. On the other hand, companies may believe in the benefits of synergy, e.g., combining managerial resources (such as having one head office instead of two), the increased bargaining and negotiation power through marketing and procurement synergies, the economy of scale reflecting reduced costs, and the avoidance of production replication and duplication.

Wang and Moini [10] acknowledge that, since 1960s, M&A events have become the focus of study across various disciplines. While the spread of M&A has increased, scholars from various disciplines (e.g., economics, management, sociology, accounting, finance, marketing, and customer behavior, etc.) have researched the field of M&A through the lens of their own discipline. According to Rahman and Lambkin [11], M&As have various effects on the business environment, which is why many studies have analyzed M&A deals and their performance. Surprisingly, several studies, such as those performed by Wang and Moini [10], Bruner [12], and Cartwright and Schoenberg [13], have observed that, despite the increase in experience of dealing with the M&A events, scientific knowledge, and the spread of the M&A events, the failure rate of the M&A deals has not changed. Given vast amount of scholars of various disciplines who are interested in the meaning of M&A performance, Meglio and Risberg [14] have analyzed various M&A performance definitions that have been imposed by different scholars. The authors conclude that the inconsistent findings relative to M&A performance research are caused by common practices of existing studies, comparing different performance measures as if they measured the same feature of the organization.

According to Wan and Yiu [15], significant financial resources are needed to lead the transition from the traditional energy production systems (fossil fuels and nuclear power) to a new energy production system that is led by renewable energy and sustainable economic growth. While M&A deals are commonly used by companies in the pursuance of an external growth strategy, Salvi et al. [16] find that M&A deals have the potential to foster the transition from the traditional energy production system towards a new era of renewable energy and sustainable economic growth. Furthermore, discussions on the relevance of the energy sector as a motivation for economic growth are still ongoing. An initial literature review has shown that there is a degree of confusion as to what motivates M&A in the energy sector and how the corresponding performance may be measured. The energy sector is interesting and exclusive for analysis because this industry has several attributes that make it different from the industrial sector. Firstly, energy companies are often regulated by governments in terms of their pricing policies. Secondly, the energy sector provides resources and services, which, at their core, are at the center of economic growth. Third, M&A deals in the energy sector are thoroughly governed and overseen by regulatory national authorities and international agencies.

The brief discussion above implies that, even though interests in M&A and sustainable development have been growing, little progress regarding the evaluation and the measurement of their outcomes has been accomplished. Therefore, key research questions regarding how the indicators for measuring sustainable development and M&A performance converge in the energy sector should be addressed. Representative and accurate

performance measurement is needed in order to effectively assess the value of sustainability and M&A to various stakeholders. Based on presenting an integrated review of the indicators measuring sustainable development and M&A performance in the energy sector, the purpose of our research is to propose a conceptual framework of appropriate indicators supporting a broader interrelationship between sustainable development and M&A in the energy industry.

2. Materials and Methods

Sustainable development and M&A are multidisciplinary subjects. They address various social, legal, cultural, political, and environmental phenomena. In order to measure the synthesis and convergence of indicators for measuring sustainable development and M&A performance, a systematic literature review (SLR) had been performed. According to Mengist et al. [17], SLR allows us to collect pertinent proof on the subject of interest and allows us to answer research questions. The essence and rationale of SLR are to aim to collect existing research, studies, and publications that meet pre-defined inclusion criteria and answer a specific research question. Grant and Booth [18] have proposed that SLR should follow the search, appraisal, synthesis, and analysis (SALSA) framework, which assures the reproducibility, systematization, methodological accuracy, and exhaustiveness of the study. Elaborating on work by Mengist et al. [17], the scope of the SALSA framework is enhanced by including a preferred reporting items for systematic review and meta-analyses (PRISMA) statement under PSALSAR (protocol, search, appraisal, synthesis, analysis, and report) to the research. Table 1 presents a summary of the PSALSAR framework used in the study.

Table 1. PSALSAR framework used in the study.

	Steps	Main Task and Method	Outcome
PSALSAR framework	Protocol	Define study scope	Indicators for measuring sustainable development and M&A performance PICOC (population, intervention, comparison, outcome, and context) method [19]
	Search	Search for studies	Search databases with preselected keywords
	Appraisal	Selecting studies Quality assessment of studies	Inclusion and exclusion criteria based on PRISMA statement (papers identification, screening, eligibility, and included papers) [20] Snowballing technique [21]
	Synthesis	Extract data Categorize data	Template construction for data extraction Arranging data for further analysis
	Analysis	Data analysis	Quantitative categories, description, and narrative analysis of the organized data
		Result and discussion	Trend identifications, gap acknowledgement, and comparison of results
		Conclusion	Conclusion and recommendation
	Report	Conducting a report	Summary of results using PRISMA methodology

Source: Modified by authors using Mengist et al. [17].

The PSALSAR framework starts with establishment of research protocol and determination of study scope. According to Booth et al. [19], the PICOC method should be added to each stage of the PSALSAR framework in order to assure transparency and transferability of the study. PICOC provides a prescribed structure that is needed to decompose research questions and improve the definition of the research scope. Considering key research question being converged between indicators for measuring sustainable development and M&A performance in the energy sector, the following sub-questions are raised:

- Which indicators measure sustainable development in the energy sector?
- Which indicators measure M&A performance in the energy sector?
- How do these indicators relate?

Table 2 introduces an SLR research scope based on the application of the PICOC framework to meet objectives of the study.

Table 2. Research scope based on the application of the PICOC framework.

Concept	Definition According to [19]	Application
Population	Research studies dealing with sustainable development measurement indicators or/and M&A performance measurement indicators	Research-based studies dealing with indicators, systems, or other measures to evaluate sustainable development and/or M&A performance
Intervention	Search for studies	Search databases with preselected keywords
Comparison	Selecting studies Quality assessment of studies	Inclusion and exclusion criteria based on PRISMA statement (papers identification, screening, eligibility, and included papers) [20] Snowballing technique [21]
Outcome	Extract data Categorize data	Template construction for data extraction Arranging data for further analysis
Context	Report writing	Summary of results using PRISMA methodology

The PSALSAR framework continues with searching studies (e.g., search stage) after establishment of the research protocol. At this step, databases on preselected keywords are explored. Selecting an appropriate database is essential to assure that the studies and research found are of high quality, are reliable, and represent the field of interests. In the research, the Web of Science (WoS) database is used. WoS is often referred to as the world's most trusted publisher-independent global citation database. A combination of "M&A performance" (topic) + "indicators" (topic), and a combination of "sustainable development" (title) + "indicator" (title) + "energy" (topic) were used to conduct a literature search through the WoS database.

The appraisal stage continues the PSALSAR framework. At this phase, selected studies and articles were evaluated following two steps. Firstly, specific inclusion criteria were used to select studies. Secondly, quality of each study was assessed.

Articles were selected and assessed based on the objectives of the research. The PRISMA methodology was integrated into the appraisal phase. According to Moher [20], the PRISMA statement consists of the following 4 steps: identification, screening, eligibility determination, and paper inclusion. In order for the papers to be included in the review, the following prerequisites were required to:

- Preselected keywords are in the title, keywords section, or abstract of the article;
- Studies are published in a scientific peer-reviewed journal;
- Studies are published in the environmental sciences, management, energy fuels, engineering environmental, green sustainable science technology, business, environmental studies, business finance, ecology, or economics WoS database categories.

During study selection, non-English articles, secondary research, meeting extracts, review articles, editorial letters, and proceeding papers were excluded. When conducting the literature search with the combination of the topics "sustainable development" + "indicators" + "energy", it was observed that there were 3239 results from the WoS core collection. Therefore, the sample was reduced by applying a combination of "sustainable development" (title) + "indicator" (title) + "energy" (topic) instead. Primary screening and initial review were performed and summaries of all publications were read. Duplicated studies and articles that lacked clear indicators or measurement methods were manually removed during screening of the articles. In the end, 36 publications remained that fulfilled all of the inclusion criteria used in the SLR analysis. The schematic structure of information flow in the research is presented in Figure 2.

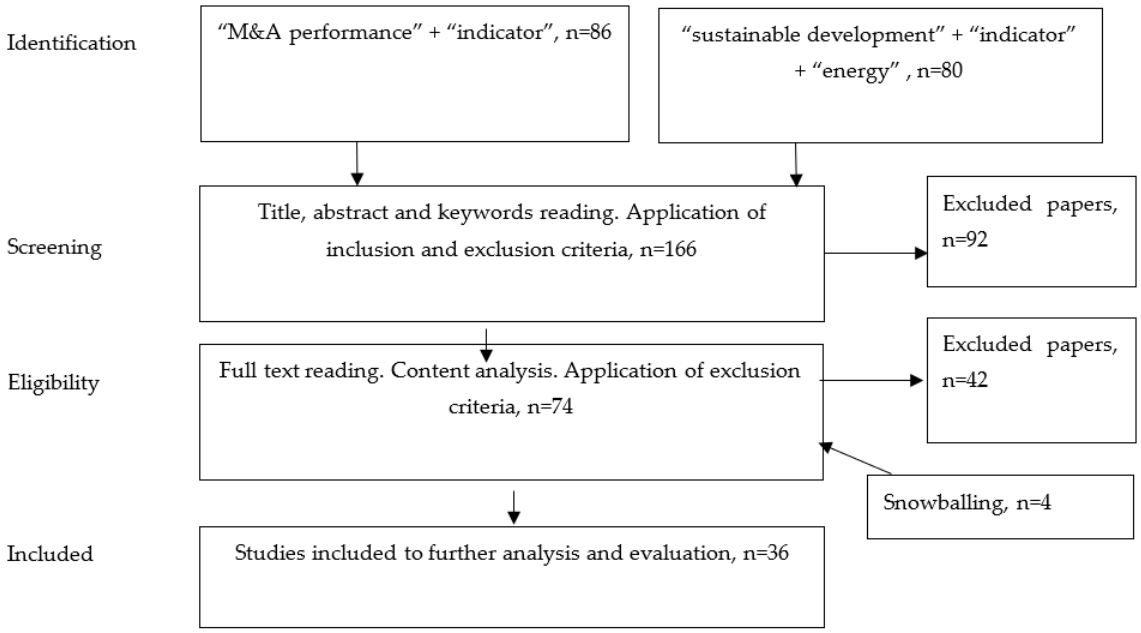

Figure 2. Schematic structure of information flow of the research.

During the synthesis stage, relevant data from selected articles were extracted and classified in order to derive knowledge and conclusion. When extracting data, they were distinguished between general- and article-specific data. Publication year, journal, case study location (region/country), and research type corresponded to the general data. Article-specific data consisted of application area, aim of the study, methodology, and indicators.

The purpose of the analysis stage was the evaluation of the synthesized data and extraction of meaningful information with the purpose of answering the research question. Thorough analysis was sought to derive qualitative explanations, answer key question of the research, and to classify and analyze data according to the identified criteria.

Finally, in the report stage, essential points of the analysis was presented.

3. Results

The examination of the relationship between the corporate social performance and the corporate financial performance has become a trend during the last several decades, as rising numbers of researchers have examined developments in this direction. Furthermore, an increasing number of studies have acknowledged the importance and the significance of ecosystems in the field of M&A and sustainable development. According to Jacobides et al. [22] and Xu et al. [23], in order to create value for sustainable development, a group of interconnected organizations (e.g., a focal firm and several related complementary asset providers) are required. Hence, M&A are an important strategy for ecosystems in order for them to gain competitive advantages in sustainable development. M&A should be seen as one of the key paths for companies to promote the complementary sectors and to gain access to the complementary assets. Zollo and Meier [7] acknowledge that research on M&A performance has interested researchers from various fields, such as strategic management, corporate finance, and behavioral economics, for decades. However, almost no agreement has been reached between these different disciplines, neither on how to measure the M&A performance or on how to relate and evaluate M&A from a sustainability perspective. Finally, Vera et al. [24] draws attention to the fact that proper M&A performance and sustainable development indicators are not merely statistics. In contrast, these indicators should extend beyond the primary statistics and should seek to provide a comprehensive understanding of the causal relationships in the complicated context and relationships between business, energy, environment, social, and economic dimensions. As proper set of indicators contains interlinkages and trade-offs among the

various sustainable development dimensions, it may give a picture of the whole energy system and, therefore, enable us to anticipate the long-term effects of the current decisions and behavior.

3.1. Indicators for Measuring Sustainable Development

Concerns over sustainability have gained importance for scholars and practitioners over the last several decades. Hence, many companies are pursuing "green", "sustainable", and "eco-efficient" concepts and strategies. On the other hand, there are governmental, national, and international concerns over sustainability. There is a need for a set of indicators that would serve as a monitoring tool and a benchmark for assessing the energy consumption, the production paths, and the trends at national and international levels. Vera et al. [24] have recognized and acknowledged that some consensus on measuring energy indicators for sustainable development (EISD) has been reached since 1997, when the UN officially acknowledged the need for sustainable energy consumption and they established intergovernmental procedures in order to pursue a common approach to the sustainable energy development. The European environment agency, the International Atomic Energy Agency (IAEA), Eurostat, the UN department of economic and social Affairs, and the International Energy Agency (IEA) have consolidated their resources in order to promote the implementation of sustainable development principles at national and regional levels and have sought to introduce a single set of energy indicators that are applicable worldwide. According to Khalid at al. [25], there are six key sustainability indexes that are used worldwide. These are provided in Table 3.

Table 3. Application of global sustainability indicators.

Indexes	Origin	Application/Description
WDI (world development indicators)	World Bank	A comprehensive set of data and statistics published annually by the World Bank that allows for the evaluation of the development of most countries in the world.
Eurostat sustainable development indicators	Eurostat	Progress towards sustainable developments by EU member states.
HDI (human development index)	UN	Measures the process of enlarging people's freedoms, opportunities, and improving their well-being.
EF (ecological footprint)	Global footprint network	Employs an ecological accounting system and measures a nation's human effects on Earth's ecosystem.
EPI (environmental performance index)	Yale University, Columbia University, and World Economic Forum	Indicated national progress towards environmental sustainability.
SSI (sustainable society index)	Van de Kerk and Manuel	Integrates human well-being and environmental well-being. Reflects a nation's sustainability progress.

The indicators for measuring sustainable development reflect the following three key themes: social, economic, and environmental perspectives (Figure 3). Firstly, the social perspective considers equity and health and emphasizes the basics, which are to have access to energy services at affordable costs. The social dimension constitutes social equity and social health. Social equity may be defined as fair and inclusive energy resource distribution and available and affordable energy access and pricing. Social health emphasizes the importance of safety and prevention of accidents that may occur at various stages of the energy production cycle (e.g., air pollution, fire accidents, etc.). The economic perspective acknowledges the importance of a reliable and available energy supply that is needed in order to secure economic growth. The consumption and production patterns, and the security of the energy supply, are reflected in the economic perspective. The indicators measuring the consumption and production patterns reflect the developments and the trends of the production volumes, the consumption volumes, the productivity, the efficiency, the energy composition, and the prices. The secure supply indicators analyze the strategic energy stocks and the reliance on energy import. The environmental dimension is very important, as energy-related effects are not only far reaching, but they also have a long-term environmental impact. Most of the environmental indicators cover the measurement of

impact on the atmosphere (e.g., greenhouse gas emission, air quality, etc.), the water quality, and the land (soil, deforestation, waste, etc.).

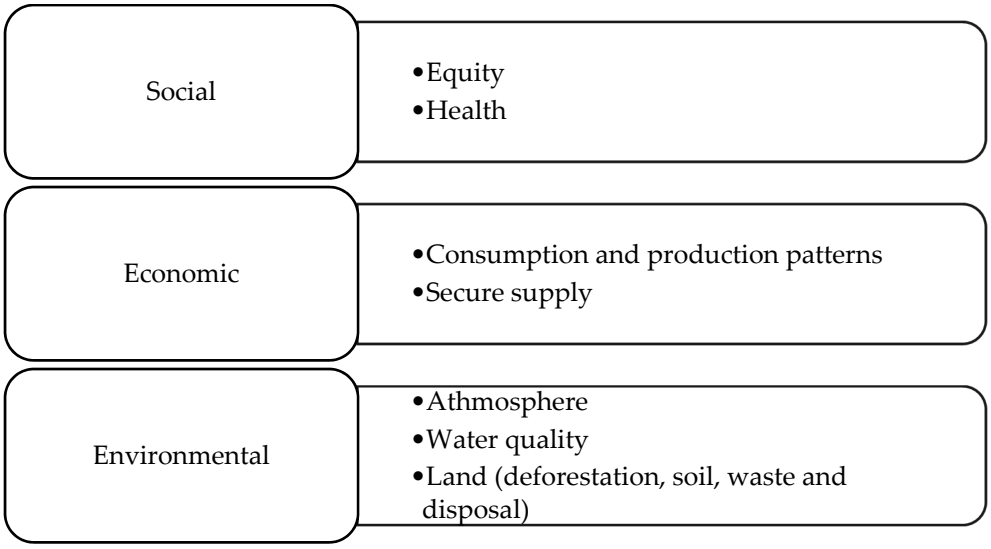

Figure 3. Key themes of indicators for measuring sustainable development.

Streimikiene [26] acknowledges that the sustainable development indicators reflect the trends and developments of energy consumption and intensity levels, the fluctuations in energy intensity among economic sectors, the energy supply security, the prices and corresponding energy affordability, and the environmental impacts. Furthermore, the author elaborates on and proposes the employment of the indicators for sustainable energy development that were introduced by the IAEA. The IAEA's set of indicators has several advantages. Firstly, it enables us to compare the trends of goals and targets in various countries. Secondly, it enables us to compare the trends in cause–effect relationships in various countries over time. Thirdly, the IAEA's indicators facilitate the comparison of policy measures, with the goals, strategy, and progress that are achieved on the way.

Todoc et al. [27] and Medina-Ross et al. [28] have employed the same methodology as Streimikiene [26] and they have applied it to the cases of Thailand and Mexico, respectively. The authors believe that the IAEA program on the indicators for sustainable energy development (ISED) enables us to gauge energy policies, identify strategies, and improve the priority energy sectors as follows: energy intensity levels, reduction in dependency on energy import, atmospheric emissions, and the increase in renewable energy volume.

Vera et al. [24] have analyzed the ISED methodology. The authors acknowledge that the original ISED framework reflects economic, social, environmental, and institutional sustainable development dimensions, which are interrelated through the intervention of an institutional state (Figure 4).

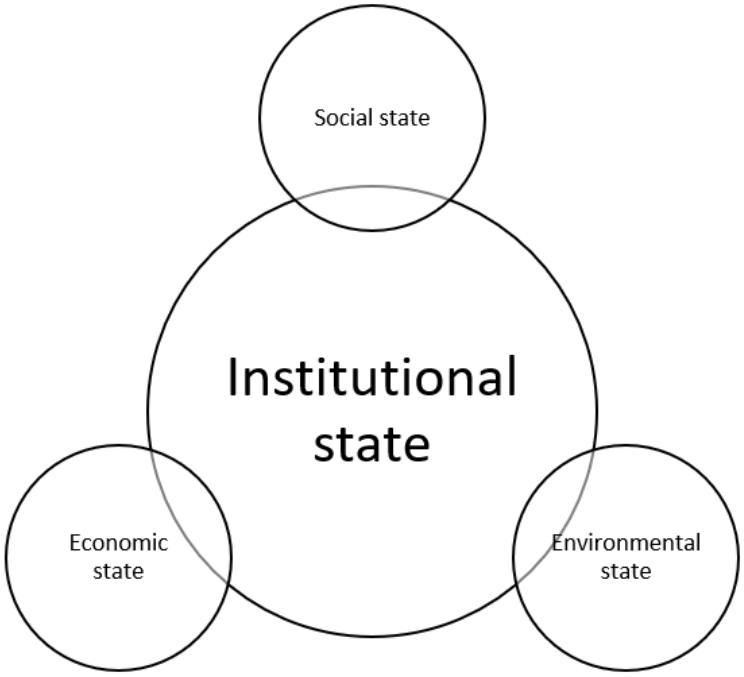

Figure 4. Governing role of an institutional state in the key themes of indicators for measuring sustainable development.

The economic indicators measure how energy consumption and production patterns and of energy service quality impacts the economic development progress. Furthermore, it also questions how trends and events in the energy sector may enhance the economic development sustainability in the long run. The social dimension considers the effects of available energy services on social well-being. These may affect poverty, education and employment levels, community development and culture, demographic developments, and health, etc. The environmental energy indicators assess the impact of the energy systems on individual households, workplaces, city, regional, national, and global levels, with focus on land, water, and air quality. According to Figure 4, the institutional indicators are intermediate between social, economic, and environmental states, because they measure the effectiveness of institutional and governance frameworks towards tackling and addressing issues of social, economic, and environmental dimensions. Vera et al. [24] acknowledge that the environmental dimension reflects the driving forces that originate from the economic and social dimensions. The social dimension is affected by the driving forces originating from the economic dimension. The institutional state, through legislation and certain policies, may affect social, economic, and environmental dimensions.

Despite broad occurrence and frequent employment, the energy indicators for sustainable development (EISD), which were developed by the UN and IAEA, there are significant issues in regard to the practical implementation and measurement of these indicators. These are as follows: specific databases are needed in regard to electricity and energy, expenditures, population, and effectiveness, and data on energy supply and consumption, generation (by fuel type), and emissions, etc. Hence, the reliability and application of these indicators directly depends on the input data that are available. This signifies the importance of content-specific and accessible databases. Salimov [29] acknowledges that the UN energy indicators for sustainable development have mostly been adopted in developed countries. However, there is a clear absence of a statistical basis in developing countries, which makes it difficult to analyze and pursue the EISD methodology in these regions.

Ledoux [30] compared the sustainable energy development indicators with inter-agency energy indicators for sustainable development and has concluded that further research is needed in order to improve the SDI set and to further explore the linkages between the various topics. The author acknowledges that the SDI framework covers

the following ten key topics: economic development, the ageing worldwide population, public health concerns, climate change and energy challenges, poverty and social exclusion production and consumption patterns, natural resource management, logistics, governance and supervision, global co-operation, and partnership.

Iddrisu and Bhattacharyya [31] are concerned that current multi-dimensional measures capture sustainability inadequately. The authors review the existing indicators, break these down into single dashboard indicators and composite indexes, and propose to use a sustainable energy development (SEDI) composite index. The SEDI is claimed to be superior to other indicators, as it has the capacity to capture sustainability levels on intra- and inter-generation needs. Specifically, the SEDI incorporates five sustainability dimensions (technical, economic, social, environmental, and institutional) and indicates beforehand how countries are performing in regards to these dimensions.

According to Gunnarsdottir [3] and Pinter et al. [32], there are four different frameworks that are used to develop indicators for sustainable development, as follows: causal chain framework, system dynamics, issue- or theme-based indicators, and mixed approach frameworks (Figure 5).

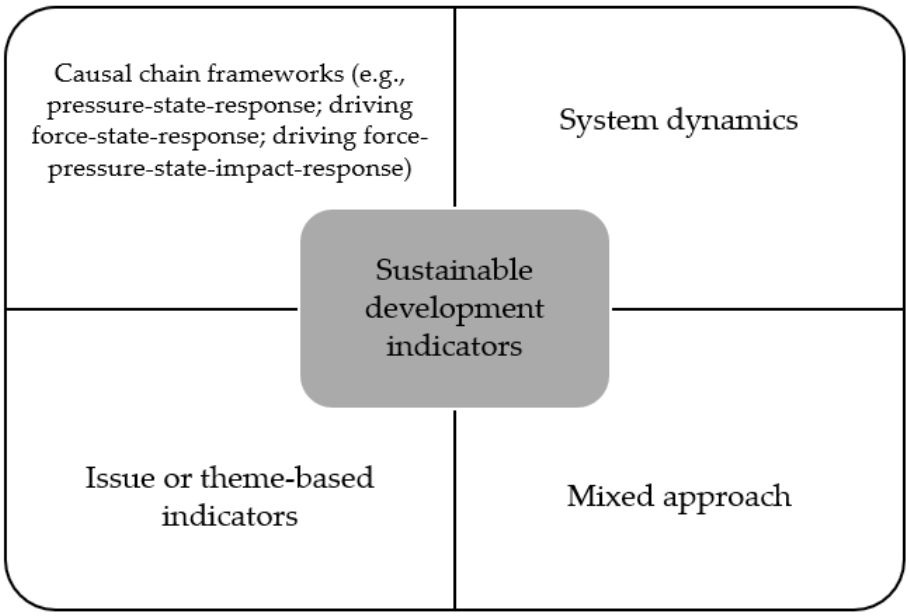

Figure 5. Key frameworks to develop sustainable development indicators.

The causal chain framework structure sustainability problems show causality relationships. This framework is usually criticized for being oversimplified and for having an unclear set for indicator selection. The benefits of issue- or theme-based indicator frameworks come from grouping indicators into different issues or themes of sustainability. Thus, particular indicators may be aligned with policy targets and the development of national indicator sets. The framework of system dynamics elaborates on the entire energy system and its dynamics within. It highlights the importance of complex energy provision and consumption, and, therefore, facilitates effective intervention strategies. The mixed approach has composites of several frameworks and seeks to overcome the weaknesses of each of them by enhancing the approach and conceptualizing particular problems.

Chen et al. [33] introduce and apply a unique methodology. The authors measure the size of ecological footprints (EF) and believe that they are the direct proportion of environmental impact. Following this perspective, the larger the ecological footprint is, the larger the environmental impact. Similarly, the size of the ecological footprints is the inverse proportion of biological productive land per person.

The international energy agency (IEA) was established in 1974 with the mission to co-ordinate and pursue a collective response to major disruptions in the global oil supply

chain. Throughout the years, it has grown into a global player that is currently at the heart of global energy issues, provides authoritative analysis, data, policy recommendations, and real-world solutions to help countries to assure their needs of secure and sustainable energy. Unander [34] recognizes the significance of the indicators that were developed by IEA, which particularly focus on the sustainability issues in the energy sector. Here, there is a special focus on energy intensities, which are usually retrieved by dividing the energy consumption data by values quantifying the activity that drives the demand for energy in a particular end-use. In addition to intensity levels, the IEA indicators also contain components measuring activity levels and structure.

Tsai [35] has analyzed sustainable development indicators in Taiwan (TSDI). The national council for sustainable development (NCSD), which was established in Taiwan in 1997, has applied and adjusted the UN's sustainable development indicators. TSDI reflects the following six key themes: society, economics, environmental quality, ecological resources, institutional response, and sustainable urban development. The TSDI differs from the traditional UN ISED framework in that it includes institutional response, measuring indicators such as the ratio of the environmental budget to the total government budget, government tax incentives to pollution, prevention and resource recycling, the ratio of the completed environmental impact assessment (EIA) reviews, and sustainable urban development, reflecting the per capita urban income, car ownership, number of transit passengers, and the increased rate of the urban area, etc.

Recent work by Li et al. [36] acknowledges that sustainable development contributes to environmental degradation through advances in the financial sector. The authors have developed the SUSDP index and empirically quantify the nexus of sustainable development. It is suggested that the financial sector may improve sustainable development through several perspectives. Firstly, the financial developments enrich the economic efficiency and may reduce energy disparity. Secondly, financial developments are a key element of economic growth in order to achieve economic efficiency. Thirdly, through reducing the spread of risk and financial costs, financial developments improve the FDI, which is the banking economy's financial sector performance.

Lucia and Grisolia [37] focus on exergy, which is a measurement of energy quality or work potential. Based on the irreversibility engineering approach, the authors advocate the consideration of three indicators that allow us to measure both the technological level and the environmental impact of the production processes and the socio-economic conditions of the countries. These are GDP (gross domestic product), the index of sustainable economic welfare, and the genuine progress indicator. GDP measures the total monetary valuation of final goods and services that are transacted in the market. Furthermore, the index of sustainable economic welfare and the genuine progress indicator evaluate the effect of the production to humans for improving the quality of life, by including non-market goods and services that are useful to humans.

Razmjoo et al. [38] acknowledge that decision making to improve energy sustainability requires scientific sustainability information. The authors suggest that the sustainable energy development index (SEDI) is not complete and has some limitations. Hence, they propose additional indicators that are grouped into seven categories (Figure 6).

Even though the consumption of fossil energy is important for development, the energy originating from fossil fuels is the main source of carbon dioxide emissions. The second stream of indicators assess renewable energy, because renewable resources have a positive impact on the environment, and they may add value to the energy supply. Proper consumption and energy saving relates to energy loss prevention. Access to affordable energy is important for urban and rural areas. The fifth category of indicators addresses the creation of a reliable infrastructure in order to prevent unexpected accidents that may harm people and the environment. Transportation is a strategic sector and should, therefore, be reflected accordingly. Finally, the governance role is acknowledged, because the government is responsible for planning the energy supply, the penetration of new technologies, and affordable and easy access, etc.

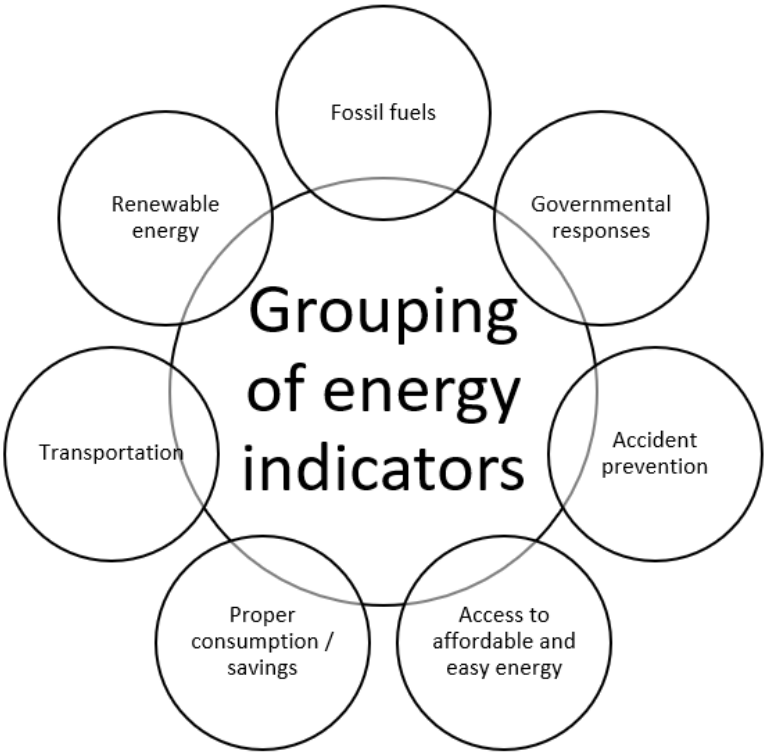

Figure 6. Key frameworks to develop energy indicators.

Khalid et al. [25] recognize that there is no formal sustainable development goal (SDG) in India, and they propose a methodology for identifying the most representative indicator set for sustainable development measurement in India. The researchers have based their work on sustainable development goal 7 (SDG7), which is affordable and clean energy. Hence, they recognize five global SDG targets and the following subsequent six global indicators: the share of the population that has access to electricity, the share of the population that relies on clean energy and technology, the share of renewable energy in the total energy consumption levels, the energy intensity levels, the international financial flows to developing countries that are seeking to advance clean energy research and development, and renewable energy production, including in hybrid systems, investments in energy efficiency measured as a proportion of GDP, and the amount of FDI in the financial transfer for infrastructure and technology to sustainable development services. In addition to that, the authors propose several national indicators, such as the percentage of households that have access to electricity and the percentage of households that use clean cooking fuel and renewable energy.

Recent work by Schöne and Heinz [39] suggests that the SMART framework (specific, measurable, achievable, relevant, and time-bound), which was originally introduced by Drucker in 1954, should be added to the analysis and evaluation of sustainable development indicators. From the energy perspective, the authors recognize that only goal 7 of the 17 UN's sustainable development goals addresses "affordable and clean energy". However, the developments and achievement in most of the remaining 16 sustainable development goals depend on access to energy too.

Cook et al. [40] recognize that the growth of GDP is often treated as a measure of well-being. The researchers question if energy consumption may be a sustainable driver of this expansion. Alternatively to GDP growth, they propose the genuine progress indicator (GPI), which has been found to be an alternative economic well-being indicator that is most aligned with sustainable development goals. The authors conclude that the pursuit of sustainable energy development is likely to simultaneously benefit the fulfillment of energy and climate policies and the promulgation of economic and societal well-being, as reflected by GPI measures.

A novel approach is provided by Stankowska [41]. The author proposes a synthetical measurement to assess the degree of sustainable energy development (SISED) in several EU member states. According to the author, the SISED index is an appropriate tool to compare energy, environment, climate, and economy data between different countries, to show how the countries are interrelated, to assess and analyze trends, and to review policies.

3.2. M&A Performance Indicators

Prior to going into a detailed analysis of M&A performance indicators, several findings are worth mentioning. Firstly, it has been observed that most of the scientific research has focused on M&A processes that were undertaken by large publicly listed companies, principally considering the information provided by the quotation values. Secondly, when screening the studies, it was observed that many of them analyzed how specific deal characteristics (e.g., payment term, geography, deal type, size, etc.) affect the outcome of the event, rather than the actual performance indicators. Finally, a common understanding between all of the studies is that the main motives in M&A are the efficiency gains. According to Morck and Yeung [42], the efficiency potential arises from the cost savings or the capacity to make a combined company more profitable than two individual companies.

Table 4 presents the systematized results of the literature analysis in regard to the M&A performance indicators.

Table 4. M&A performance indicators.

Study	Methodology	Case Study Location (Region/Country)	Aim of the Study/Issue Addressed	Indicators
Cubas-Díaz and Martínez [43]	Fixed-effects ordered probit analysis	Worldwide	Credit rating of the potential investment	S&P ratings Relative sustainable performance measure (RSPM) and the measure of commitment-failure (MC)
Jing [44]	Reduced form estimation method	China	Relationship between the M&A and the exports	Ownership, firm size, original value of the fixed asset, and intermediate inputs. Product, export, export destinations, the identity of Chinese exporter, and the trade regime
Kumaraswamy and Ebrahim [45]	Ordinary least square regression method	Gulf region	Assessment of the M&A impact on the overall performance of the Gulf cooperation council (GCC) firms using profitability, liquidity, and leverage measures	Liquidity: Current ratio (CR) and quick ratio (QR) Profitability: Net profit margin and return on equity (ROE) Debt ratios: Debt to equity (D/E)
Mihau et al. [46]	Score function/methods: Statistical models and AI-based models	Pharmaceutical sector	M&A impact and ESG sustainability scores of companies	Financial performance: Profitability, liquidity and solvency, assets and debt management, and market value Non-financial performance: ESG score
Brahma et al. [47]	Berkovitch and Narayanan (1993) model	European utility sector	M&A motives and performance	Five accounting indicators of operating performance: Growth of turnover, growth of earning before interests and taxes (EBIT), return on assets (ROA), net profit margin, and growth in fixed assets
Krishnan and Jialun [48]	Bootstrap DEA (data envelopment analysis) model	Cross-border mergers involving U.S. acquirers	Acquirers' operating efficiencies around and after cross-border acquisitions	Cumulative abnormal returns (CARs)
Ibrahimi and Meghouar [49]	Stepwise regression method/variation of indicator	France	Value creation and destruction in horizontalM&A	Turnover (Tv) and operating cost (OpC); Investment cost of fixed assets (FA) and financial charges (FiC); Profit tax (Tax); Debt capacity (Debt); Financial risk

Table 4. *Cont.*

Study	Methodology	Case Study Location (Region/Country)	Aim of the Study/Issue Addressed	Indicators
José et al. [50]	Counterfactual methodology. Analysis of accounting data	Spain	Contrast between merging and non-merging companies	Business profitability and technical efficiency: Economic profitability, financial profitability, and productivity Cash-flow generation capacity/liquidity: earnings before interest, taxes, depreciation, and amortization (EBITDA)/total assets and earnings before interest, taxes, depreciation, and amortization (EBITDA)/turnover Financial structure of the company: Operating costs, personnel costs, and financial
Hong et al. [51]	Machine learning method. AdaBoost and SVM methods	A total of 25 developed countries plus 26 emerging market countries and regions	Prediction model of cross-border M&A activities from a sustainable development and ecosystem perspective	Macroeconomics, geography, climate, cultural and law, deal and payment, ESG, and financial indicators, with a focus on the exploration of their predictability of success for M&A International advantage factor; geography factor; climate factors; deal factor; payment factor; ESG factor; size factor; growth factor; profitability factor; cash flow factor; leverage factor; investment factor; valuation factor; culture and law factor; information factor
Jones et al. [52]	Cox proportional hazards model (takeover likelihood study); Accelerated failure time model	UK	1. Does underperformance result in increased takeover hazard in the disciplinary set? 2. Within the disciplinary set, which agency cost indicators are associated with market discipline?	Stock return and market return. Asset utilization, operating expense divided by net sales, cash dividends paid, capital expenditure, leverage, ROA, sales growth, and assets growth

Firstly, pursuing the event-study approach, and employing measures of stock return and market return, are popular among researchers because it allows them to gauge the market reaction to the M&A events and to directly measure the shareholder wealth effects. This approach relies on efficient market hypothesis and signifies the disciplinary nature of efficient markets. For example, the results by Krishnan and Jialun [48] imply that, instead of improving the acquirer's operating efficiency, cross-border M&A on average decrease the acquirer's operating efficiency during the post-acquisition performance.

Secondly, most of the studies employ economic–financial indicators. Researchers believe that the benefits of economic–financial indicators are twofold. Firstly, they have been found to provide a better understanding of the variation that is experienced by companies in terms of performance and efficiency. Secondly, economic–financial indicators may explain the reasons for value creation and reduction for their owners.

It is a common practice in various studies to group economic–financial indicators into categories. Liquidity measures (e.g., current ratio and quick ratio) define a company's ability to timely settle its short-term obligations and signals corporate performance. Profitability measures (net profit margin, ROE, and ROA) are important as they indicate a company's ability to earn a profit, in comparison with its sales, operating costs, balance sheet assets, or shareholders' equity. Debt accounts to the amount of leverage that is used by firms in proxied by debt to assets/equity proportion. A particular feature of this proportion is that it varies widely across industries, such that capital-intensive businesses tend to have much higher debt ratios than others. However, even though liquidity, profitability, and debt rations dominate, there are other indicators that may be used to measure M&A

performance, such as firm size, export volume, sales and turnover volume, costs and cost structure, risks, and cash flow management, etc.

Thirdly, a stream of research analyzes non-financial M&A performance. For example, the findings by of Cubas-Díaz and Martínez [43] signify sustainability effects and supports the theory that that firms with higher sustainability performance tend to have higher credit ratings. According to the authors, traditional sustainability indicators are considered by credit rating agencies more than novel quantitative sustainability performance indicators. Furthermore, Cubas-Díaz and Martínez [43] support the idea that commitment measures are not considered at all in the credit rating process. Another study [46] has also considered the sustainability pillar and found that the ESG score may be used as an indicator for measuring sustainability. Particularly, ESG has a positive and direct impact on the company performance. A high ESG score determines an increase in company performance. From the perspective of sustainability and M&A, a study by Hong et al. [51] is important, because the authors acknowledge the credibility of the following theories and hypotheses that may increase the success rate of M&A to achieve sustainable development: corporate governance, the ecosystem stakeholder theory, the ecosystem risk theory, and the institution theory.

Considering the results that are discussed above, Figure 7 provides a list of key performance indicators and categorizes these into financial (accounting performance and market performance), sustainability performance, deal characteristics, and operational performance indicators.

Figure 7 suggests that M&A performance measures contain an ambiguous construct and lack consensus between scholars on how to measure them. Furthermore, it is observed that, even though multiple ways to measure M&A performance may mean a lack of universality, each of the indicators have their own advantages, purpose, and perspective. Similarly to Meglio and Risberg [14], analysis supports that M&A researchers employ both broad and narrow M&A definitions, reflect unique time scales and units of analysis, often estimate different things in different settings, and rely on a wide array of performance indicators. While analyzing existing M&A performance indicators, the following differences appear:

- The industry and geographical area where M&As took place and where M&A performance was measured differs;
- Most popular are quantitative analyses that employ either secondary data (e.g., from databases) or primary data (e.g., surveys). Less popular are cases studies or laboratory and field experiments;
- The time scale of M&A performance measurement. From this perspective, it is a common practice to group the indicators into the following three categories: short-, medium-, and long-term time scales. Short term usually employs event-study methodology and reflect M&A performance during a duration to up to one year. Medium-term studies usually analyze M&A performance in one to three years. This time window is usually motivated by the consideration that it should be a sufficient period for the M&A integration processes. The studies analyzing M&A performance in excess of three years are referred to, and are accounted to estimate M&A performance, in the long term.

To sum up the above discussion, various prevailing performance measures suggest that scholars seek to gauge M&A results and seek to find the ultimate independent, moderating, and mediating variable that can explain or predict M&A performance. Hence, there is a clear need to create and employ a set of M&A key performance indicators (KPIs) that would correctly measure M&A performance and increase the success rates of M&A events.

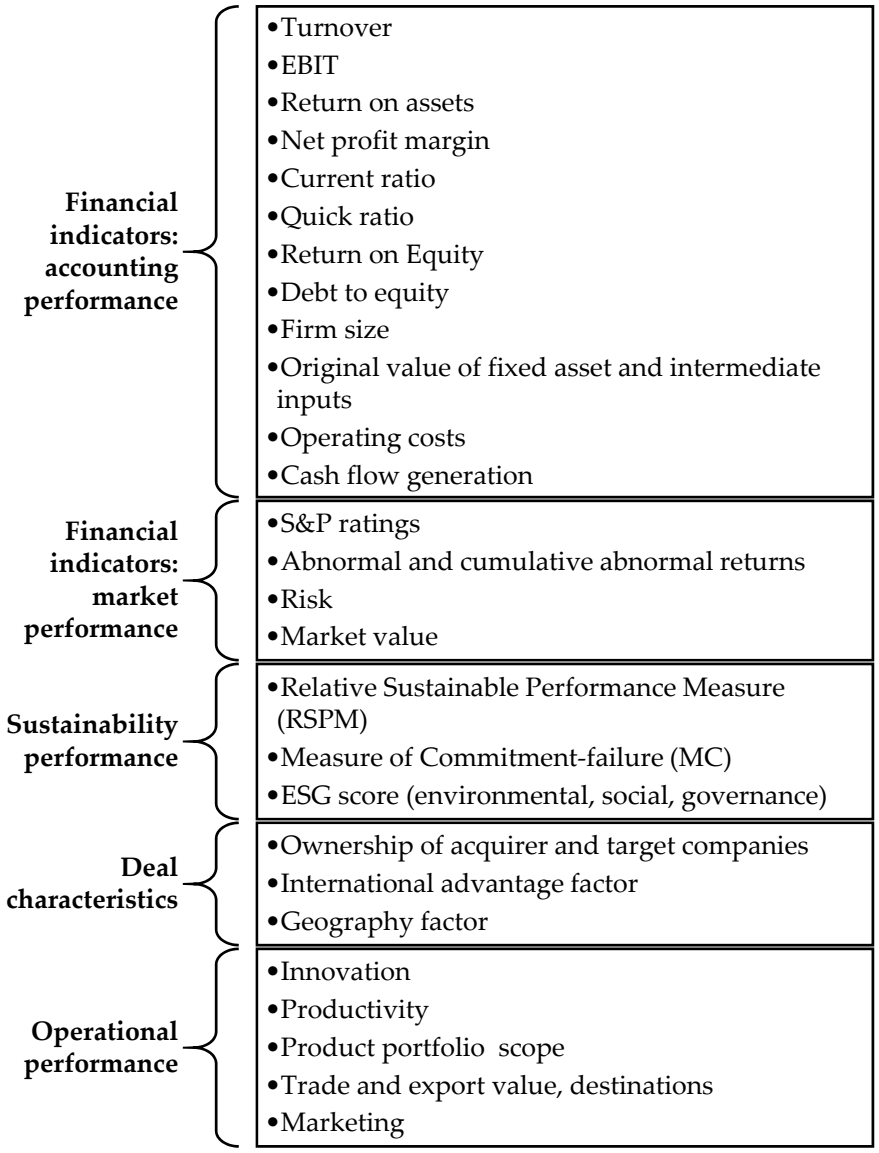

Figure 7. Classificatory scheme of M&A performance indicators.

4. Discussion

Similarly to the results of Caiado et al. [53], research suggests that the pursuance of sustainability and M&A strategies share a common goal, i.e., they take advantage of the potential synergy benefits that may come from economic, environmental, and social perspectives. However, incorporating sustainability aspects into M&A would mean exploring the synergy benefits without compromising the ability of future generations to meet their own needs.

Economic synergies arise from several sources, such as product and service quality, which are increased by more efficient methods, improved technology processes, increased innovation and encouraged competitiveness, and cost saving, etc. Environmental synergies have their roots in waste and emission reductions and toxin- and risk-potential reduction. Social synergies explore the potential advantages of life quality and welfare improvement, increased personal responsibility, and employee's motivation.

On the other hand, we agree with Caiado et al. [53] and support the idea that there is a set of various barriers—market, economic, policy, organizational, technical, and informational—which threaten the exploration of potential synergies. Low pressure, lack of public awareness, and the demand for eco-efficiency constitute the market barriers. The pol-

icy barriers relate to insufficient environmental regulations, a lack of economic incentives, and inadequate industrial self-regulation policies. The economic barriers mainly reflect significant initial capital cost that are required, complications to access finance, and a vague short-term economic outlook. Limited information, insufficient and fragile infrastructure, and poor training and expertise are among the key technical and informational obstacles that limit synergy exploration and subsequently reduce the value of various performance measures. The organizational barriers come from within companies, industries, projects, or processes. Among others, these include awareness and demand for competitive advantages, growing demand for production growth, and inadequate and resistant management.

Many countries have M&A regulations and legislation in place that seek to promote competition and, hence, they introduce controls in the M&A process. The number of M&A law enforcement activities that are related to cross-border M&A has risen substantially due to international trade and the FDI increasing significantly in the past decades. Similar trends are observed in regard to increasing regulations and the enforcement of sustainability measures.

Table 1 in Appendix A provides the results of a SALSA analysis in regard to indicators for measuring sustainable development. According to the results, several trends may be observed. Firstly, the most popular sustainability measurements are the indicators for sustainable energy development (ISED) that are developed by the international atomic energy agency (IAEA). These have been used by numerous studies (Vera et al. [24], Streimikiene [26], Todoc et al. [27], Medina-Ross et al. [28], Ledoux et al. [30], Gunnarsdottir et al. [1], Ansari et al. [54], Streimikiene et al. [55], Schaeffer et al. [56], and Unander [34]). Secondly, there is a growing number of studies and researchers that focus on the issues of specific countries, and they apply country-specific methodology and sustainability measures (Tsai [35], Salimov [29], Razmjoo [38], Khalid [25], and Medina-Ross et al. [28]). Thirdly, the measurement of M&A and sustainability performance are difficult in practice, because the measurement of specific indicators is subject to the availability of data, information, and databases, etc.

Our results suggest that M&A measurement and sustainability measurement are often treated as unrelated topics. However, we draw attention to the need to have a broader picture, especially as M&A events increase in value and volume. As M&A leads to corporate concentration, it has consequences for sustainability. From this perspective, due to M&A events, there may be a small cluster of powerful firms that would play a significant and shaping role in the economy. The purpose of the existing governance and legal frameworks should be to address the problem of corporate concentration matters from a sustainability perspective. Hence, there is a larger need for convergence between these indicators. We believe that having a proper set of converging indicators would favor the economic performance of a firm at a national level in the long run.

5. Conclusions

The objective of our research was to analyze if and how indicators for measuring sustainable development and M&A performance in the energy sector converge. Having a set of reliable indicators may improve corporate- and country-wide strategies and programs in regard to assurance of sustainable development goals and objectives.

The core of our research was the performance of SALSA analysis. Using the Web of Science database, two streams of literature were reviewed, sustainable development and M&A. The indicators for measuring sustainable development reflect the following three key themes: social, economic, and environmental perspectives. Research has shown that ISED indicators by IAEA are the most commonly used tool to measure sustainability. Research supports that energy indicators for sustainable development could be considered as primary measurements. However, in order to ensure the policy relevance and usefulness, the ISED indicators should be further refined, considering the context where they will be applied. The refinement process would benefit from involving more stakeholders, taking into account the specific context, and making sure that there is a balance in the representation

of the three dimensions of sustainable development (social, economic, and environment). When looking into M&A, this article supports that most of the existing studies employ economic–financial indicators to measure M&A performance. The convergence between the indicators measuring M&A performance and the sustainable developments is mainly limited by the sustainability indicators of credit rating agencies, ESG score, and CSR. Our paper supports that there is a further need to explore M&A and sustainable development from the perspective of corporate governance, the ecosystem stakeholder, and institution theories, which have better knowledge in the field that not only increases the sustainability levels, but also enhances the M&A performance.

We believe that our research adds multiple contributions to the existing body of sustainable development. Firstly, our research adds value to the knowledge by creating a framework for the integration of sustainability and M&A performance measurements in a systematic, simple, and consistent manner, thus enhancing the decision-making processes that can be used in order to improve life quality and preserve natural resources. Secondly, our analysis elaborates on the various measures that may be used for the benchmarking of corporate sustainability operations and strategies. Thirdly, managerial implication is relevant to business professionals who seek to evaluate M&A and sustainability in the pursuit of long-term sustainable performance improvements. We also hope that our study will promote further research and investigation into the convergence between sustainability and M&A performance, as work in this perspective would link environmental impacts with economic performance on the one hand, and would help to monitor environmental, social, and economic effects on the other hand.

With no exception to any other study, the current research faces some limitations, which may serve as directions for future research. Firstly, the data collection methodology raises some limitations. Data for SALSA analysis were collected on a certain date. Therefore, there is a limitation in terms of time. As there may have been new authors and new articles since then, they will naturally not be a part of the portfolio. From the data collection point of view, using several keywords in the title search might have left out some relevant articles that do not use the exact keywords in their title. The criteria for searching studies on M&A performance also might have left out some studies that do not use "indicators" as their topic. Secondly, we have not discussed the advantages or disadvantages of any particular measurement. However, we have drawn attention to their limitations and their practical implementation. Thirdly, this paper argues that the sustainability and M&A strategies both allow firms to take advantage of synergies. However, it may be a stretch to analyze this as a convergence between both of the subjects. The synergies that are achieved through the M&A strategies arise from the combination of the combined firms' resources, whereas the synergies of sustainability depend on which level (firm, local government, central government, or cross-national institutions) is examined. Fourthly, this paper argues that the exploration of M&A synergies should take into consideration the long-term outcomes. This idea may be further explored by identifying the relevant indicators for these long-term outcomes.

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Abbreviations

The abbreviations used in the study:

Abbreviation	Full term
M&A	Merger and acquisition
SDG7	Sustainable development goal 7
UN	United Nations
SED	Sustainable energy development
IMAA	Institute of mergers, acquisitions, and alliances
SLR	Systematic literature review
SALSA	Search, appraisal, synthesis, and analysis
PRISMA	Preferred reporting items for systematic reviews and meta-Analyses
PSALSAR	Protocol, search, appraisal, synthesis, analysis, and report
WDI	World development indicators
HDI	Human development index
EF	Ecological footprint
EPI	Environmental performance index
SSI	Sustainable society index
IAEA	International atomic energy agency
ISED	Indicators for sustainable energy development
EISD	Energy indicators for sustainable development
SEDI	Sustainable energy development composite index
IEA	International energy agency
SMART	Specific, measurable, achievable, relevant and time-bound

Appendix A

Table 1. Results of SALSA analysis in regard to indicators for measuring sustainable development.

Author/Study	HDI	GDP	Access to Clean Energy and Technologies	Access to Technological Innovation	ISED by IAEA	Composite SEDI	Ecological Footprints and Carrying Capability	TSDI. Weighted-Sum Method	WDI and FDP	Index of Sustainable Economic Welfare	Genuine Progress Indicator	Price, Renewables, Innovation, R&D	GPI	Other 1	Other 2	Other 3	Other 4	Other 5
[1]					+	+								+				
[24]					+													
[25]	+						+										+	
[26]					+													
[27]					+													
[28]					+													
[29]															+			
[30]					+													
[31]						+												
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[36]									+									
[37]		+								+	+							
[38]																+		
[40]		+											+					
[41]												+						
[57]	+	+	+	+														
[54]					+													

Table 1. *Cont.*

Author/Study	HDI	GDP	Access to Clean Energy and Technologies	Access to Technological Innovation	ISED by IAEA	Composite SEDI	Ecological Footprints and Carrying Capability	TSDI. Weighted-Sum Method	WDI and FDP	Index of Sustainable Economic Welfare	Genuine Progress Indicator	Price, Renewables, Innovation, R&D	GPI	Other 1	Other 2	Other 3	Other 4	Other 5
[55]					+													
[56]					+													
[58]																		+

Notes and explanations: Other 1: Set of 57 indicators: SED, SISED, SEW, energy architecture performance index, regulatory indicators for sustainable energy (RISE), energy indicators for sustainable development through policy assessment index (AI), energy sustainability country index (ESCI), energy development index (EDI), regional sustainable energy development evaluation indicator system, local energy sustainability indicators, indicators for sustainable energy development in Chinese villages, energy sustainability index (ESI), urban energy sustainability index (UESI), sustainable energy indicators for cities, sustainability indicators for urban energy systems, indicators for sustainable energy development (ISED), etc. Other 2: Energy use per capita, energy use per unit of GDP, efficiency of energy conversion and distribution, industrial energy intensities, household energy intensities, fuel shares in energy and electricity, renewable energy share in energy and electricity. Other 3: Environmental impact: total CO_2 (Mt of CO_2), CO_2/TPES (Mt of CO_2), CO_2/population (Mt of CO_2), CO_2/GDP (USD 2010 billion/Mt of CO). Renewable energy: total energy production from renewable energy/renewable heat consumption, amount of renewable energy in electricity production/total energy production from renewable energy (Ktoe), TFC renewable energy consumption in residential/total energy production from renewable energy (Ktoe), TFC renewable energy consumption in commercial/total energy production from renewable energy (Ktoe). Transport: total TFC in transport (Ktoe), TFC of fossil fuel use in transport/total TFC in transport (Ktoe), TFC of electricity in transport/total TFC in transport (Ktoe), TFC of biofuels and waste consumption/total TFC in transport (Ktoe). Use of energy: loss/TPES, TFC residential/population (Ktoe), TFC industry/population (Ktoe), TFC commercial/population (Ktoe), TPES/GDP (Ktoe), electricity consumption/population (Ktoe). Resource access to energy: total energy production (Ktoe), total fossil fuel production/total energy production, renewable energy production/total energy production (Ktoe). Resilience and safety: access to electricity (million population), renewable internal freshwater resources per capita (cubic meters), electricity consumption/population (MWh/capita), CO_2/population (Mt CO_2/capita, population/land area (sq. km). Other 4: World development indicators (WDI), Eurostat SD indicators, ecological footprint (EF), environmental performance index (EPI), sustainable society index (SSI), proportion of population with access to electricity, international financial flow to developing countries in support of clean energy research and development and renewable energy production, including in hybrid systems, investments in energy efficiency as a proportion of GDP and the amount of foreign direct investment in financial transfer for infrastructure and technology to sustainable development services. Other 5: Social: rural electrification coverage by region (%), share of electricity spending in total household expenditure for different income groups (%), share of electricity subsidy received among different income groups (%). Economic: energy use per capita, energy use per GDP, rate of self-sufficiency, share of sectorial energy demand in the total energy consumption, sectorial energy intensities, fuel shares in energy and electricity, renewable energy (RE) capacity in the power supply grid, end-use energy prices by fuel, reserves-to-production ratio. Environment: GHG emissions from energy consumption per unit of GHG, share of emission loads from the energy sector in the total air pollutant emissions (%).

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