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# Editorial: Export product quality, renewable energy, and sustainable production

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## Editorial on the Research Topic

Export product quality, renewable energy, and sustainable production

## 1 Introduction

The ongoing and escalating destruction of the environment and climate is one of the most significant problems facing the entire globe. A key step forward in international cooperation to address climate change and the destruction being caused is the United Nations Framework Convention on Climate Change. The COP26 accord is a crucial step in raising international awareness and fostering diplomatic relations for climate-related issues. Also, COP26 is essential for the international community to recognise how the ongoing growth of economic activity has aggravated climate change by raising atmospheric concentrations of carbon dioxide (CO<sub>2</sub>), which has raised global temperatures. By utilising more natural resources and increasing energy use, the rapid development of global production has also increased the ecological footprint (EF), contributing to global warming. Additionally, as the world's population increases, environmental worries develop because of the greater need for energy. The most evident issues affecting the entire planet now are the slowly changing climate and increasing environmental deterioration. The economy and health of humanity will suffer because of this significant increase in greenhouse gases (GHG). To achieve the 2030 Sustainable Development Goals, both developed and developing countries should prioritise environmental preservation and energy security (Sharma et al., 2021).

Countries that import energy are also working to ensure a sufficient supply to maintain their individual rates of economic growth. However, since burning dirty fossil fuels has a negative impact on the environment, ensuring energy security should normally be accomplished by expanding the availability of greener energy alternatives. As a result, existing international agreements for ecological development, such as the Paris

Agreement, work to reduce emissions as a result of the burning of dirty fossil fuels. To reduce CO<sub>2</sub> emissions and ensure global growth, the 7<sup>th</sup> SDG of the UN declaration aims to promote access to dependable, affordable, and environmentally friendly sources of energy. Global economies are therefore looking for ways to transition to clean energy within global energy systems (Rehman et al.).

Yan et al. has identified a few probable reasons for environmental deterioration; economic growth, the use of fossil fuels, foreign direct investment, and trade openness have all been identified as significant sources of CO<sub>2</sub> emissions. However, it was not until the latter half of the twenty-first century that academics started to notice a potential link between environmental deterioration and trade diversification. Several countries are also attempting to diversify their exports to expand their share of world trade and safeguard their exports from fluctuations in demand. However, trade diversification is likely to enhance the chance of CO<sub>2</sub> emissions in regions where countries are inter-linked for commercial purposes. Therefore, it is impossible to exclude the possibility that trade diversification contributes to pollution (Shah et al.).

Moreover, Olanrewaju et al. (2022) suggest that governments prioritise economic growth over gratifying social and non-social interest groups to promote international trade. However, economies centred on the export of unclean goods harm the environment severely. The World Bank (2021), Lu et al. (2018) and International Monitoring Fund (IMF) encourage nations to diversify their exports to reduce reliance on certain commodities and to obtain sustainable earnings. Additionally, export diversification is essential for the economy for several reasons. First, the term “diversified exports” refers to a method of reducing the risk associated with international trade. Second, it has a favourable effect on economic expansion. Third, it enables economies to have a balanced budget and lessens the likelihood of trade shocks. Export diversification is classified as a phenomenon that is regarded as an important component of structural change and development due to the availability of resources. It also appears to have a positive impact on environmental quality.

Significant research on numerous facets of sustainable production is being conducted, primarily utilising qualitative methods (Gioia et al., 2013). However, there are still some doubts about how far the rising economies are coming to terms with renewable energy and sustainable production. It seems that various problems and difficulties are emerging because of inadequate resources. In order to help collaborative efforts across geographies, cultures, and demographics in their pursuit of sustainability and proper energy usage, it is necessary to adopt more incisive and subjective methodologies that produce more priceless insights into the topic. The focus of this Editorial on the topic of “Export Product quality, Renewable Energy, and Sustainable Production” is on both quantitative and

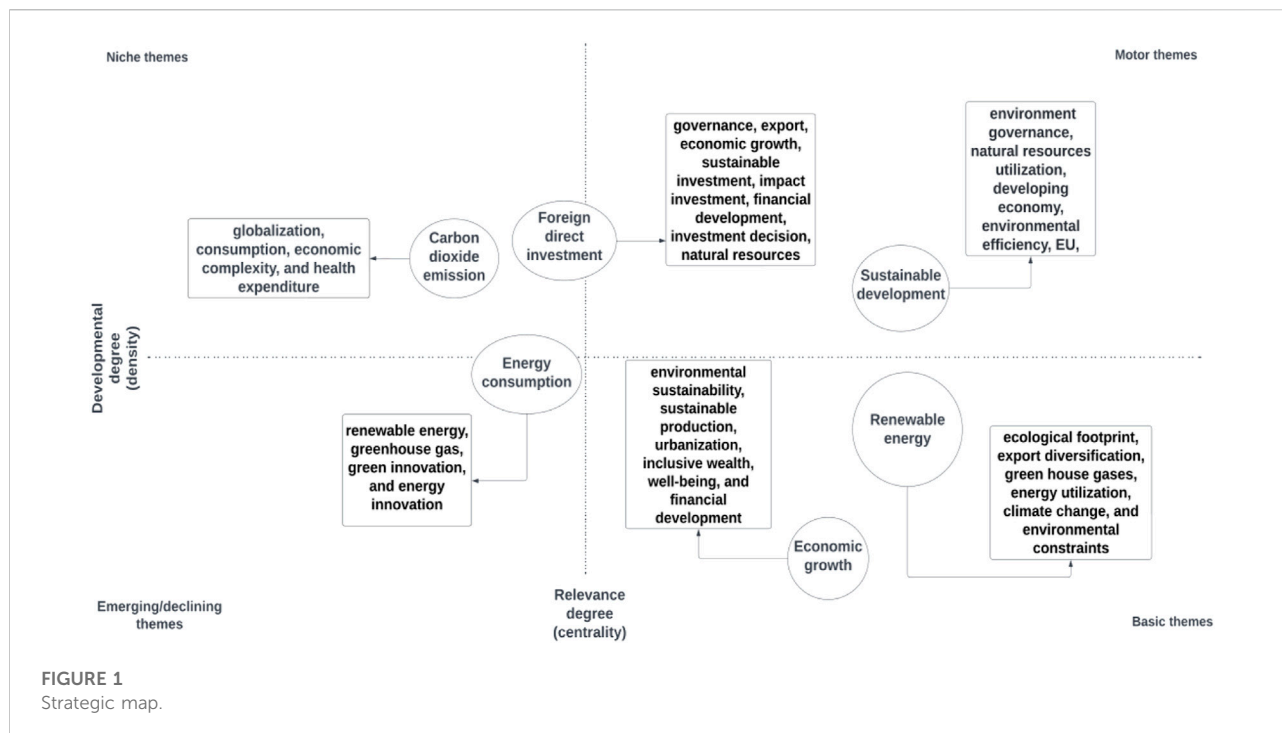
qualitative research methods pertaining to the achievement of key SDGs components in diverse emerging economies.

A large readership from academia, researchers, business, and policymakers can be anticipated given the UN’s emphasis on sustainability and clean production as well as the importance of public policy and corporate actions. As a result, the issues brought on by unsustainable production, poor export product quality and excessive reliance on non-renewable sources of energy are spreading, calling for a more targeted, intentional, exhaustive, and methodical approach to their solution. The combined perspectives of a large group of academics on some of the most important research requirements are presented in this special issue. We have assembled several perspectives on sustainable consumption in this special issue with the view to representing different aspects of consumption, methods, nations, policy initiatives, corporate participation, disciplines, and research traditions on sustainability.

## 2 Contributions to the special issue

We present the contributions to the special issue, by bibliometrically analysing the 44 studies published in this issue. As of now, the scholarship in the field has advanced quite a bit, and to showcase the most up-to-date developments we conducted a bibliometric review to present the review of literature and highlight the most prevalent topics (Shahbaz et al., 2021a). The studies have focused on some major keywords. Node size shows the total frequency of author keywords in the discussed topic or study area, while line thickness depicts the number of co-occurrences. The more lines between any two nodes, the greater the attention of researchers or academicians from various research directions, and the stronger the interlinkage of vital features (Yu et al., 2020). The spacing between any two keywords shows the strength and topical connectivity of the keywords. Nodes of the same colour showed that the publications’ topics were related (Zupic and Caronater, 2015).

The red cluster pertains to ecological footprint, renewable energy consumption and export diversification. It consists of 7 keywords such as ekc hypothesis, ghg emissions, India, ecological footprint, export diversification, renewable energy consumption and renewable energy. Many governments have been demonstrating their commitment to sustainable development goals in response to rising energy consumption and environmental damage. Specifically, these countries are increasingly concentrating on building infrastructure for renewable energy solutions rather than relying on non-renewable energy sources (such coal, oil, and natural gas). The respective governments demand a methodical transition away from fossil fuels and toward greener energy sources until these countries can generate renewable energy on their own (Atchike et al.). Mahmoodi and Dahmardeh (2022) investigated the



relationship between environmental degradation and economic growth within the EKC hypothesis framework. They recommended that governments of European and Asian emerging countries to implement policies to help reduce the adverse effects of non-renewable energy.

The green cluster is based on renewable energy consumption and it comprises of 5 keywords which are exchange rate, influencing factors, energy consumption, Pakistan and CO<sub>2</sub> emissions. With the acceleration of economic and social development, the demand for natural resources has increased. To help resolve an adverse effects, authors have contributed on the benefits of sustainable natural resources utilization and sustainable energy consumption (Naseem et al.; Yin et al., 2022). The blue cluster highlight the interlinkage of economic development and environment sustainability. Five keywords which are economic complexity, foreign direct investment, pollution haven hypothesis, environmental sustainability and globalization are shown. The studies highlight how financial development has a negative impact on energy consumption (Ke et al., 2022; Ullah et al.). Ullah et al. have urged governments to promote foreign funding for low-cost, long-term clean energy initiatives. Such a strategy will aid a nation in meeting its energy demands and lower electricity costs, which, in turn, will directly impact quality of life for the average citizen and the nation's ability to sustain its development.

The yellow cluster contains 4 keywords namely sustainable production, urbanization, China and economic growth. There are several types of activities that might pollute the environment.

Almost certainly, the education industry contributes to the degradation of environmental quality. Yan et al. inspect the influence of income, education, and foreign direct investment on carbon dioxide emissions for a panel of 46 Belt and Road initiative (BRI) countries spanning the period 1996–2016. They suggest that governments in the BRI region should improve educational services by putting in new technologies, tools, and resources because doing so will reduce emissions. Additionally, using province-level data from 1988 to 2020, Huang et al. developed a dataset of natural disasters, crop productivity, and protein levels of cereal crops in order to better understand the relationship between natural disasters and the quality of cereal crops in China (rice, wheat, and maize). According to their research, natural disaster-affected regions have seen a sharp decline in activity since the turn of the century, with province variations.

The purple cluster includes 4 keywords which are exports, Saudi Arabia, sustainable economic growth and tourism. The energy transition is accompanied by two layers of technological innovation: the development of technologies for the generation and consumption of renewable energy, and the introduction of energy-efficient equipment. The acceptance and use of new technologies are complicated processes involving psychological, social, and economic determinants. Both conditions generate a degree of opposition from consumers and local communities. In light of this, Noja et al. (2022) examined the impact of energy innovations, digital technological change, and environmental performance in

promoting the sustainable economic development of European Union (EU) nations, which have been profoundly influenced by the globalization process.

Lastly, the light blue cluster consists of only 2 keywords which are spatial spillover effect and sustainable development. According to [Cai et al.](#), green and sustainable development necessitates the successful integration of economic development and the ecological environment. Green development is considered essential in creating ecological civilization and a precondition for economic and social progress. The study by [Cai et al.](#) revealed that there exists strong, observable positive correlations between the industrial structure, digital economy development, and urbanization level and the degree of regional economic development. However, there were significant, observable negative correlations between energy structure and level of opening up.

### 3 Research opportunities

To fully visualize the current state of the literature on the topics addressed in this special issue, we provide a strategic map of the extant research in the field ([Figure 1](#)). The strategic map classifies the topics according to their centrality and density ([Cobo et al., 2015](#)). Density describes the intensity of internal links within a topic, whereas centrality indicates the degree of interaction across themes ([Aparicio et al., 2019](#)). The strategic diagram depicts four quadrants containing four themes: the motor theme, the peripheral/niche theme, the emerging or vanishing theme, and the basic theme ([Rodríguez-Soler et al., 2020](#)).

Economic growth appears in the basic theme quadrant with the highest centrality in the strategic diagram. This appearance implies that this theme has a lower density of internal ties, indicating the need for future research to diligently study the sub-themes (including environmental sustainability, sustainable production, urbanization, inclusive wealth, well-being and financial development) despite the strength of its ties with the other themes ([Gillan et al., 2021](#)). Economic growth aims to increase productivity, and full employment encourages job creation and entrepreneurship. This leads to industrialization, which increases the extraction of natural resources and deteriorates agricultural production. In other words, economic actions accelerate the rate of natural resource depletion ([Sorrell, 2010](#)). The reason for this is that sustainable production is changing toward goods or services with lower environmental effect. This might include purchasing greener items, increasing spending on services rather than produced things, or joining agreements like energy service contracting and automobile sharing schemes ([Muneer et al., 2005](#)). For instance, a move away from products and toward services may result in a rise in energy consumption, especially if it necessitates better service standards, substantial transportation usage, or the production of

ecologically hazardous substances. A significant and quickly expanding demand for adequate financing and functional financial instruments and markets may result in sustainable production. This is a crucial area that necessitates the use of sustainable finance and financial development ([Odugbesan et al., 2022](#)). However, financial development initiatives are focused on short-term requirements, which are not necessarily best for society's welfare. As a result, financial development may help reduce income disparity up to a point and create opportunities for a more sustainable society ([Odugbesan et al., 2022](#)).

Renewable energy is mentioned in the basic topic as well as in its sub-themes, which include ecological footprints, export diversification, greenhouse gases, energy usage, climate change, and environmental restraints. These aspects emphasize the importance of future research into the sub-themes. Renewable energy, sometimes known as clean energy, is derived from naturally regenerated sources or processes. Human activities have been identified as the most serious danger to clean energy and, indeed to environmental preservation or replenishment, as they contribute to climate change and ecological distortions ([Nathaniel et al., 2021](#)). Growing cities have a number of environmental limits which may be related to greenhouse gas emissions, which contribute to environmental damage ([Owusu and Asumadu-Sarkodie, 2016](#)). However, to mitigate the negative effects of urbanization, activities should be situated closer together to guarantee greater access to services. Meanwhile, ecological modernization and export diversification require environmental re-adaptation of industry expansions and economic growth ([Mälkki et al., 2015](#)). Thus, examining the environmental implications of export diversification is important for assuring both economic and environmental sustainability, which is more favourable to pollution management and carbon dioxide emissions reduction ([Khan et al., 2021](#)).

Sustainable development is a broad term that encompasses, among other things, environmental governance, natural resource usage, a developing economy, environmental efficiency, and the European Union (EU). It is the third most frequent theme because of its distinctiveness and high density. As sustainable development is linked to governance and responsible investment, it has been a popular topic of study. The authors have concentrated on the conceptual approach that demonstrates that command-based environmental regulation may effectively increase the innovative capacity of firms in green technology ([Pan et al.](#)). There is a need to increase incentive-based environmental legislation in order to promote the invention of "three wastes" treatment capabilities among businesses. In addition, the literature leaves the researcher with an unanswered question on how natural resources might be digitally simulated and utilized to decrease natural resource consumption and promote sustainable growth ([Kalymbek et al., 2021](#)). In addition, the European Union has mandated that corporations disclose their

sustainable investments under the sustainable financial disclosure regulation which is still at the infancy stage (SFDR). Significantly increased use of electric vehicles and solar panels has resulted in the enactment of new regulations controlling the new sustainable investment possibilities (Yang et al., 2022).

FDI, which comprises the sub-themes of governance, export, economic growth, sustainable investment, impact investment, financial development, investment choice, and natural resources, is the fourth essential theme. According to Simionescu et al., there is a link between renewable energy consumption, reducing pollution and the quality of governance, which may encourage environmental protection measures. Consequently, government effectiveness reduces pollution in both the short and long run, whereas corruption control and rule of law contribute to environmental protection in the long term. Due to international cooperation and environmental summits, the global awareness of the SDGs and sustainable investment projects has increased (Wen et al., 2022). Literature indicates that an increase in FDI contributes to environmental damage (Qamruzzaman, 2022). In addition, at low levels of stringency, the likelihood of pollution intensive FDIs rises as the number of stringencies decreases. This is not usually the case at lower levels of legislation, even though tight restrictions may increase pollution-intensive foreign direct investment (FDI). Consequently, there is still room for FDI regulation and oversight to make their operations viable. In the literature focusing on investment in renewable energy, the influence of a country's governance structure on liquidity and financial development has been explored (Wen et al., 2022). Investors prefer a country with better governance and a well-developed financial market, resulting in the security of their assets and a positive outlook on the creation of returns (Ahmad and Wu, 2022). Developing nations with less severe laws confront the greatest challenge right now in deciding whether or not to engage in renewable, green energy since it requires a substantial amount of capital and time (Lund, 2022). In order to encourage sustainable and responsible investment, stringent governance has become a fundamental component of the country. This FDI topic is leaning toward the motor theme since the subthemes have immense potential for future research.

Despite the fact that the term “carbon dioxide emissions” and its sub-themes globalization, economic complexity, and health expenditures are in a niche subject, it demonstrates how important it is to research how these themes affect sustainable development (Owusu and Asumadu-Sarkodie, 2016). Carbon dioxide emissions operate like a blanket in the atmosphere, trapping heat and contributing to global warming. Globalization is predicted to be a worthy examination in the context of environmental difficulties, particularly its merits and downsides. These have been linked to environmental challenges and economic complexity. Economic complexity refers to structural changes that depend exclusively on technical

innovation, which also helps to reduce environmental impact. It is also important to note that technologies like artificial intelligence, high-tech internet, and information and communication technologies (ICTs) have become a part of people's physical lives, which has an effect on all industrial operations and the economy (Doğan et al., 2021). Moreover, the largest source of environmental cost is air pollution, which causes environmental damage and has a negative impact on labour productivity (Apergis et al., 2018). As a result, nations with more pollution have higher per capita health costs, whereas countries that spend more on environmental quality defence have lower health care expenses, which impacts industrial output and the economy (Narayan and Narayan, 2008).

The last theme is energy consumption, which contains keywords such as renewable energy, greenhouse gas, green innovation, energy innovation, and ecological footprint. It is part of the emerging theme and has a tremendous potential to reach the motor theme. The research indicates that GDP increases carbon intensity. However, the usage of renewable energy is an important element in lowering carbon emissions (Wang et al., 2022). In addition, it is verified that patents and innovation may assist in reducing carbon intensity. However, but developing a renewable alternative takes a great deal of innovation in the green energy industry and impact investment (Aziz et al.). Consequently, innovation in the energy industry will increase the effectiveness of resource consumption. In his research, Yan et al. noted that economic expansion has a favorable effect on pollution. However, education and foreign direct investment have differing quantile-level negative effects on CO<sub>2</sub> emissions. The study also expressed concern over health expenditures as a result of declining health. However, the research left open the question of how urbanization, economic growth, natural resource availability and CO<sub>2</sub> emissions may forecast healthcare expenditures at different frequencies.

## 4 Concluding remarks

In summary, the international community is at a crucial juncture in its pursuit of the SDGs. The COVID-19 catastrophe has undermined decades of development achievements, but it also accelerated the shift to greener, digital, and more inclusive economies by accelerating the digital financial revolution (Sharma et al., 2020). Government and policymakers have a crucial role in establishing the conditions necessary to induce behavioral changes that promote sustainable development, renewable output, and an increase in foreign direct investment in the green sector. In putting together this special issue, we have identified a number of research possibilities and methodologies in this nascent and quickly expanding field:

- To enhance the engagement of FDI in the green and renewable sector, there is a need for more contextualized



governance, decentralization of authority and authentic and more widespread people participation.

- For responsible and sustainable growth, policy commitments to the financing and R&D of revolutionary green technologies, particularly in emerging nations are needed.
- Future studies must create and propose a digitalized method for governance, natural resource usage, and sustainable investment in the post-COVID-19 crisis period.
- The link between energy consumption and economic growth might be examined in future using a production function method, which would include labour, capital stock, human capital, and exports as variables under control.
- Future research may need to use a more complete environmental indicator since climate change and environmental restrictions may further lower the maximum amount of gross production from renewable energy sources below what is predicted from direct energy inputs.
- Future studies may investigate additional sources of CO<sub>2</sub> emissions, such as transportation infrastructure, R&D, technological innovation, and financial globalization.

This special issue tackles the theoretical and empirical concerns associated with current advancements and new approaches that integrate sustainable development, governance, renewable sources, carbon emissions, and sustainable economic growth. Recent theoretical and empirical research is utilized to examine the causes, significance and consequences of pertinent governance and accessible opportunities in renewable sources of

investment and innovation to accomplish the sustainable development objectives. We anticipate and expect that this special issue will make a substantial contribution to this rapidly expanding academic field and be of interest to academics, practitioners, and policymakers.

## Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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