Geoscience Frontiers xxx (xxxx) xxx

Contents lists available at ScienceDirect

Geoscience Frontiers

journal homepage: www.elsevier.com/locate/gsf

Research Paper

Adoption of green finance and green innovation for achieving circularity: An exploratory review and future directions

Rohit Agrawal [a], Shruti Agrawal [b], Ashutosh Samadhiya [c], Anil Kumar [d,*], Sunil Luthra [e], Vranda Jain [f]

[a] Operations Management and Quantitative Techniques, Indian Institute of Management, Bodhgaya 824234, Bihar, India
[b] Department of Humanities and Social Sciences Malaviya National Institute of Technology Jaipur, Rajasthan, India
[c] Jindal Global Business School, OP Jindal Global University, Sonipat, India
[d] Guildhall School of Business and Law, London Metropolitan University, London, UK
[e] AICTE Training and Learning (ATAL), All India Council for Technical Education, Delhi, India
[f] Economics and International Business, Jaipuria Institute of Management, Noida, India

ARTICLE INFO

Article history:
Received 1 March 2023
Revised 15 May 2023
Accepted 4 July 2023
Available online xxxx

Keywords:
Green finance
Green innovation
Systematic literature review
Environmental protection
Climate change

ABSTRACT

There is growing attention from governments and regulators towards crucial matters such as climate change and global warming, resulting in a pressing need to investigate the factors that make it possible for businesses to engage in green finance (GF). The externality of environmental pollution prioritizes the need of green innovation (GI) in public management. GF distributes financial resources to the research and development (R&D) of clean energy and environmentally friendly goods and processes; it is complementary to the GI process for environmental protection. GF policies help to alleviate the impacts of financial constraints and GI impaired industries involving new products, processes, services and the global market. To better understand how GF and GI have functioned as a catalyst for circular economy practices, this paper seeks to present a historical and contemporary overview of these concepts. The research is thoroughly dissected by a systematic literature evaluation of articles from 2016 to 2023 that appear in peer-reviewed journals and are indexed in the SCOPUS database. To attain supply chain circularity, this article encompasses four major research themes concerning the adoption of GF and green technologies. The research also includes a network analysis of shortlisted articles to examine the overall citation trends. It is shown that several institutional theories are associated with the investigated area. As a final step, a framework is provided to illustrate how GF and GIs might be used to achieve supply chain circularity. The research findings provide a novel concept related to GF within the context of GI which are significant for environmentalists, policymakers, green investors, and researchers. Through its findings, the study provides a conceptual framework that promotes sustainable strategies to effectively balance financial considerations and environmental innovation. It helps to leverage the potential of green research and practice to create value for businesses and to benefit society at large. The analysis provides an unexplored and significant contribution to current literature in terms of delivering evidence of the past and present approaches to GF and GI in a circular economy. The results of this study will attract the attention of policymakers and stakeholders to develop and combine the two concepts in research and practice to attain environmental balance in the circular economy and to promote long term sustainability.

1. Introduction

In the United Nations Climate Change Conference (COP 21, the Conference of the Parties) held in 2015, 195 participating nations signed the Paris Agreement for the mitigation of environmental change by limiting the global temperature increase to below 2°C above pre-industrial level. To accomplish these long-term environmental aims, some nations have made efforts to accelerate the evolution of green industries and GI (Yang et al., 2020). The potential of industries in GI, however, are restricted by financial limitations. Challenges in securing financial resources may disrupt investment in environmental-friendly technology (Andersen, 2017). The GI of industries is subject to financial limitations since it generally has huge uncertainty and less returns. As a result of the global consensus on environmental action, GF explains the financial regulations in investment and loans to support environmentally sustainable development goals (Wang and Zhi, 2016); these goals have become

* Corresponding author.
E-mail address: A.Kumar@londonmet.ac.uk (A. Kumar).

https://doi.org/10.1016/j.gsf.2023.101669

increasingly important over the last few years. The intention is to create a favourable financial environment for green growth. Moreover, even if GF policies can encourage GI by solving the impacts of industrial practices, the limitations of existing finance is still challenging. GF creates opportunities to enable different agencies to take climatic and environmental responsibility. This requires funding for GI to produce renewable energy, thus helping to achieve sustainable growth.

In the market of increasing globalization and rapid change, it is essential to optimize resource consumption, minimize waste and to develop a successful business model to survive in a competitive market (Moore and Manring, 2009). From current literature, it is seen that a circular economy (CE) business model has been extensively explored to achieve sustainability (Pieroni et al., 2019). Many articles explore the barriers to adopting CE practices, such as the lack of availability of technologies and insufficient funding (Rizos et al., 2016; Gedam et al., 2021). To successfully adopt circular practices, it is important to adopt GF and GI (Acquah et al., 2023; Jinru et al., 2021; Triguero et al., 2022). GF and GI are two key concepts that are becoming more significant as the global population grapples with climate change and environmental degradation (Vaka et al., 2020). The importance of GF and GI cannot be overstated, as they play a major role in achieving a sustainable future.

GF refers to the provision of financial resources to support environmentally sustainable projects and initiatives, such as renewable energy, energy efficiency, and sustainable transportation (Soundarrajan and Vivek, 2016; Liu et al., 2022). GF helps to mobilize capital to support the transition to a low-carbon economy and to finance projects that promote environmental sustainability (Richardson, 2009). The need for GF arises from the fact that traditional financing sources may not be sufficient to sustain the shift to a comparatively low-carbon economy and finance projects that promote environmental sustainability (Campiglio, 2016). One of the main reasons for the need of GF is the significant investment required for the transition to a low-carbon economy. Traditional financing sources may not be able to support these investments fully; GF can help to mobilize additional capital to support the transition (Dorfleitner and Braun, 2019). There is a high risk associated with some environmentally sustainable projects. Many of these projects are considered high-risk due to their relatively untested nature and lack of a track record. GF can help to mitigate this risk by providing long term and patient capital to support the development and deployment of these projects (Bhatnagar et al., 2022). In addition, GF can help to encourage the development and deployment of products and trending technologies which promote environmental sustainability (Sadiq et al., 2022). For example, by providing funding for R&D of new technologies, GF can help to drive the expansion of those products and services which are more environmentally friendly. In a nutshell, GF is essential for achieving a sustainable future and addressing the challenges caused by climatic changes. When financial resources are provided to promote ecologically beneficial initiatives, GF can help to mobilize capital, mitigate risk, and drive the innovation of new technologies and products that promote environmental sustainability.

GI refers to the development of new technologies, products, and processes that promote environmental sustainability (Song and Yu, 2018). GI helps to drive the development of green technologies and products that can enhance energy efficiency and minimize greenhouse gas emissions (Gao et al., 2022). The need for GI arises from the fact that traditional technologies, products and processes may not be sufficient to achieve environmental sustainability and address the challenges of climate change (Rennings, 2000). One of the main reasons for the adoption of GI is the need to reduce greenhouse gas emissions and curb the impact of human activities on the environment (Ibrahim et al., 2022). GI can help to achieve this by driving the development of new technologies, products, and processes that are more energy efficient and less polluting. GI can help to address climate change by developing new technologies, products, and processes that can help communities and businesses adapt to the changing climate (Jesic et al., 2021). GI can help us in creating new business opportunities and spur economic growth. By developing new technologies, products, and processes that promote environmental sustainability, GI can help to create new markets and generate new jobs (Hsu et al., 2016). In essence, GI is essential for achieving a sustainable future and addressing the challenges of climate change. By driving the development of new technologies, products, and processes that promote environmental sustainability, GI can help to decrease the emissions of harmful gases due to the greenhouse effect and to adapt to the changing climate while creating new business opportunities.

Overall, GF and GI are essential for achieving a sustainable future and addressing the challenges caused by climatic changes. This can be achieved by providing the required financial assistance to promote environmentally sustainable projects and by driving the innovation of new technologies and products that promote environmental sustainability. We can move towards a more sustainable future. In a circular supply chain, GI and GF can help companies to design, produce, and use products and services in a way that minimizes waste and environmental impact while maintaining economic viability (Geissdoerfer et al., 2018). This means the development of closed-loop supply chains that recover and reuse materials, the utilization of renewable energy sources, and the promotion of sustainable practices in the production process and use of products (Govindan et al., 2016).

The potential benefits of this paper are as follows. Firstly, the review includes an integrated approach of bibliometric study and systematic literature review. Secondly, the article considers the nexus among three major dimensions to enhance sustainability - GF, GI and CE. This has not been previously explored in any study. Thirdly, this work suggests various future research questions to promote circularity in nations by adopting GF and GI. The article proposes related institutional theories that have not been discussed in previous research. This study will be helpful to academicians, policymakers, managers and practitioners in devising green technologies to combat climate-related challenges. It also provides the opportunity for future research directions in this area. In the present article, the following research questions are developed and their answers are explored throughout the study:

RQ1. How can GF and GI help in adopting CE practices?

RQ2. How can we develop a framework that integrates GF and GI practices for circular business models?

RQ3. What are the potential future research directions related to GF and GI in a CE business model?

To address these research questions, this paper presents a study of the applications of GF and GI to achieve a CE. The Scopus database is considered to identify and shortlist articles in the investigating field. A mixed approach of bibliometric analysis and an organised literature study is conducted to explore the relevant areas. The institutional theories that support the integration of GF and GI in achieving circular practices are also discussed. The remainder of this article includes a review of methodology and bibliometric analysis in section 2. A systematic literature review is conducted in section 3. Institutional theories supporting GF and GI are presented in section 4. Discussions and implications of the study are presented in section 5. Finally, conclusions are presented in section 6.

2. Research methodology

In the present study, we adopt a hybrid method by connecting bibliometric analysis and a systematic literature review (SLR). Bib-

liometric analysis helps to analyze the many types of statistics related to research publications and its citation analysis, while SLR attempts to provide an in-depth investigation of the chosen research area and answer some specific research questions (Agrawal et al., 2023). According to Mengist et al. (2020) "SLR differs from traditional narrative reviews by adopting a replicable, scientific and transparent producer and helps to collect all related publications and documents that fit our pre-defined inclusion criteria to answer a specific research question." SLR includes a systematic procedure that reduces bias in the results related to the search of articles, shortlisting, and summarising the article. Bibliometric, on the other hand, helps in analyzing the statistics of published research work. Moreover, "Bibliometric analysis is a popular and rigorous method for exploring and analyzing large volumes of scientific data" (Donthu et al., 2021). It allows us to explore the evolutionary nuances of a particular field and also directs us towards the emerging research areas in the specific field. Scholars have utilized bibliometric analysis for various purposes - to understand collaboration patterns, to identify emerging research trends, and to analyze statistics of published articles.

Thus, in the present article, a mixed review process has been adopted by amalgamating SLR and bibliometric analysis to carry out our study on GF and GI in a CE through a five step process: (i) explaining the research objectives, (ii) identifying search databases, (iii) applying inclusion and exclusion criteria, (iv) using bibliometric analysis, (v) synthesis of extracted literature based on classified qualities. Fig. 1 shows the flow chart of the study. The Scopus database is chosen in the review to search articles in the investigating field. It is one of the largest databases of abstracts and citations of peer-reviewed research articles globally, containing articles from all relevant publishers. Hence, considering the coverage and range of all available databases, Scopus is used to extract the relevant literature (Agrawal et al., 2023). Initially, before identifying the articles in the investigating field, we select keywords to search the research articles. The search string used to identify the research articles are:

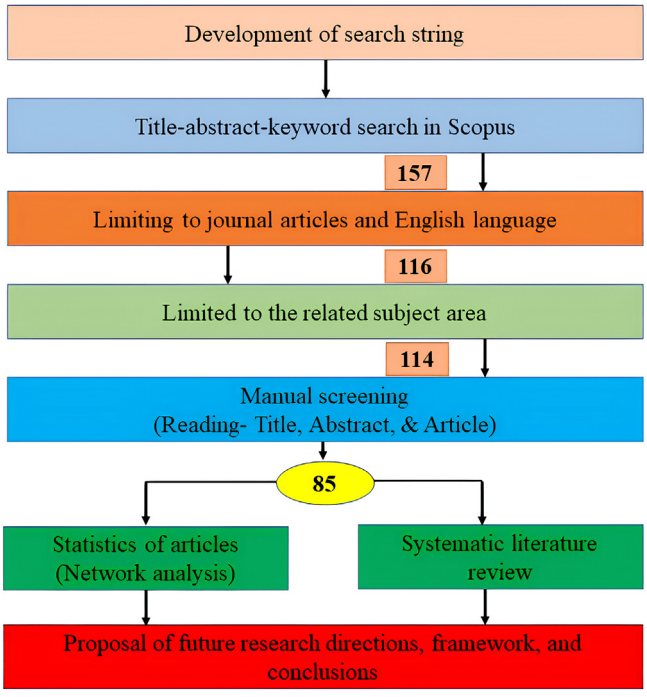

Fig. 1. Steps followed to perform a literature review.

String 1: "Green financ*" OR "Sustainable financ*" OR "Social Financ*" OR "Green innovation" OR "Sustainable Innovation" OR "Social Innovation".

String 2: "Circular economy" OR "Circular supply chain".

Both strings are inserted using a title-abstract-keyword search in the Scopus database.

From the developed search strings, we use the advanced search string option in the Scopus database. We use search strings in the title-abstract-keyword search of the Scopus database with 157 related research articles emerging. Thereafter, we apply inclusion criteria; it should be limited to the English language, it should be a journal article. This results in a reduction to 116 articles. Further, we consider only relevant field areas and neglected areas that are not relevant for our study e.g. medicines, chemical engineering, mechanical engineering, materials science, immunology and microbiology. This results in a further reduction to 114 articles. Finally, we shortlist the articles by reviewing the article title and reading the abstract. This gives a shortlist of 85 articles for further review and analysis. We apply the bibliometric analysis on the shortlisted article by using R statistical package. The statistics of research articles published in the area of GI and GF in CE are presented in Fig. 2.

From Fig. 2, it is found that the articles on GIs and GF in CE appear from 2016 to 2019, with a significant rise seen after the year 2019. From 2019 to 2022, a 480% increase in articles can be seen i.e. from 5 to 29. This may be due to the rise of interest in CE practices among researchers to achieve sustainable development goals (SDGs).

From Fig. 3, it is found that China (24) has published the maximum number of articles on GIs and GF in CE, followed by Italy (21), UK (14), Germany (12), Netherlands (11), and Spain (11).

Table 1 presents the top-cited research articles in the field of GIs and GF in CE. An article by Winans et al. (2017) received the highest citations of 442. The authors examine the history of the CE concept, tracing its roots to the 1970s and its development over the years. They also provide a detailed analysis of the current applications of the CE, highlighting its use in various industries and sectors, such as manufacturing, agriculture, and construction. Rizos et al. (2016) received the second highest number of citations, 409, providing valuable insights into the implementation of CE practices by SMEs. The authors present a list of comprehensive findings on the barriers and enablers to execute CE business models by SMEs. The authors conduct a thorough literature review and use a case study approach to explore the challenges and opportunities facing SMEs in the implementation of CE practices. Leising et al. (2018) achieved the third highest number of citations, 199, and provide a detailed analysis of the implementation of CE practices in the building sector. The authors present three case studies of CE initiatives in the building sector and develop a collaborative idea to facilitate the execution of CE practices.

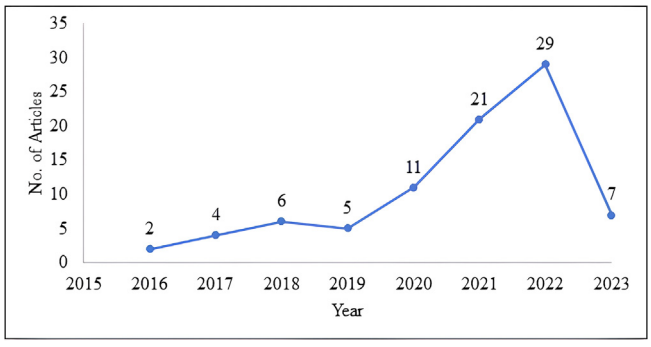

Fig. 2. Statistics of published research articles.

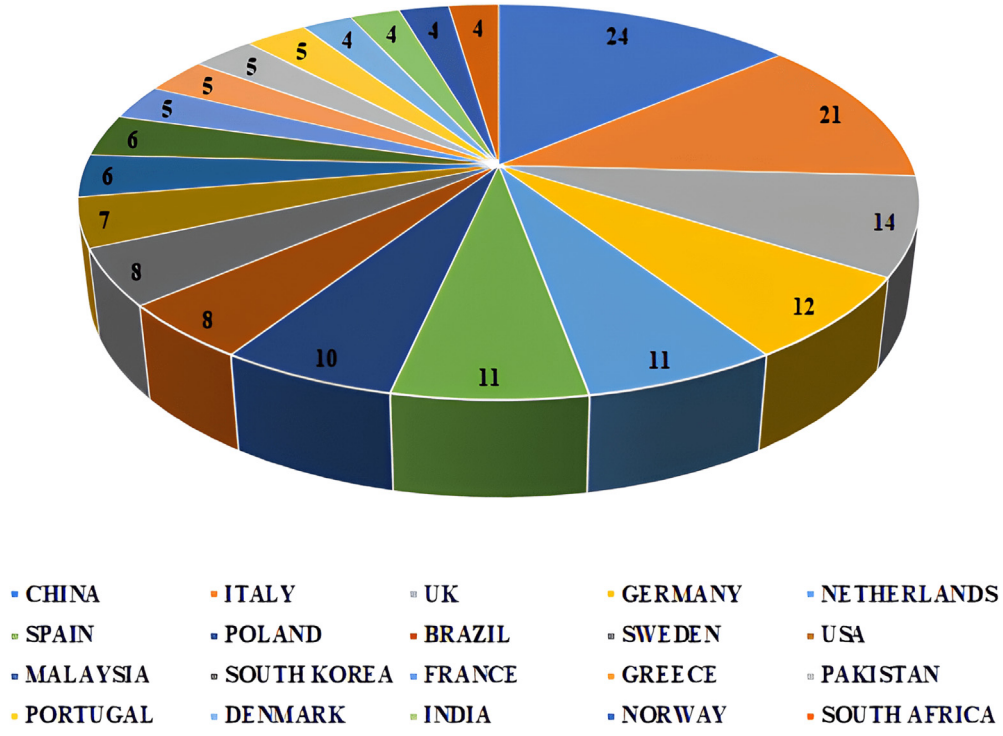

Fig. 3. Statistics of country-wise published research articles.

Table 2 indicates the top 20 keywords used by researchers in the field of GI and GF in CE. It is noted that sustainable development, innovation, circular economy, sustainability, and recycling are the most important keywords used by most researchers in their articles. The word cloud of keywords is also developed and is presented in Fig. 4.

3. Systematic literature review

3.1. Cluster 1: Sustainable innovation and development with GF

The significant use of GF is crucial for deriving GI to foster sustainable economic conversion and to address climate change. The adoption of green technologies plays a crucial role in attaining SDGs. Promoting socio-economic growth and environmental challenges requires sustainable innovation and investment in an economy. Sustainable innovation is an important driver in promoting an industry's goods and services to generate long-term environmental and social benefits. With greater awareness of the causes of ecological damage and climate change, the influence of GF and GI has emerged as a hotspot in finance and environmental studies.

Irfan et al. (2022) experimentally investigated the impact of policy implementation of GF on GI by using mediation effects and panel vector auto-regression models. The results show that GF and GI are positively associated. The most vital influence of GF on GI can be observed through materializing large-scale capital supply to balance capital requirements efficiently, creating a positive nexus among them. The results of policy intervention show that pilot zones for green financial innovation encourage GI and sustainable performance in targeted regions. Additionally, environmental capacity and resources restrict economic growth, meaning that GF can accumulate financial support for sustainable growth to enhance an innovative economic development. Wang et al. (2022a, 2022b, 2022c) assess the nexus between climate finance and sustainable development at a global level by applying the rolling-window Granger causality method. The research findings suggest that climate finance has a direct and positive influence on sustainable development and innovation of multiple sub-periods, supporting the interaction theory. The participation of stakeholders in GF projects is a method to evaluate its impact on sustainable development. The author suggests a role for government and international organisations to frame a superior eco-friendly investment along with risk avoidance policies under an umbrella of conceptual framework. This helps to improve classification and evaluation techniques, providing the required knowledge on GF to enable its contributions to achieve SDGs in both developing and developed countries. Ng (2018) aimed to identify a procedure for the implementation of sustainable financing and supervisory actions to create a GF era in the world of financial organisation that aligns with SDGs.

The Global Financial Centre of China (GFCC) proposed a local GF hub to develop a conceptual framework that contributes to the growth of a GF structure in the community. Adopting the framework enables a top-down approach of institution legality to enhance sustainability regulated by public policies. GFCC targets improvement from a market-driven GF perspective. Some authors propose the theoretical framework to reinforce the impact of legal strategy and market-oriented finance conditions to generate the convergence of the GF structure. The research implications of these studies highlight the integrity of the GF system in connection with sustainability control and cleaner production. Cui et al. (2020) applied an evolutionary game theory with stakeholders to investigate the impact of every indicator on the subject and expansion in the GF market; an analogue simulation method is applied. The influence mechanism and equilibrium strategy of involved entities are investigated. The findings of the study show that the coalition of green financial institutions has a direct impact on cleaner production and sustainable innovation. Secondly, it is vital to improve public policies and regulations. This means enabling financial organizations and industries to reduce GF production costs, an adoption

Table 1
Top cited articles on green innovations and green financing in circular economy.

Study	Title	Total citations	Total citations per year
Winans et al. (2017)	"The history and current applications of the circular economy concept"	442	63.143
Rizos et al. (2016)	"Implementation of Circular Economy Business Models by Small and Medium-Sized Enterprises (SMEs): Barriers and Enablers"	409	51.125
Leising et al. (2018)	"Circular Economy in the building sector: Three cases and a collaboration tool"	199	33.167
Guldmann and Huulgaard (2020)	"Barriers to circular business model innovation: A multiple-case study"	127	31.75
Chiappetta Jabbour et al. (2020)	"Stakeholders, innovative business models for the circular economy and sustainable performance of firms in an emerging economy facing institutional voids"	108	27
Lăzăroiu et al. (2020)	"Environmentally Responsible Behavior and Sustainability Policy Adoption in Green Public Procurement"	89	22.25
Peng et al. (2021)	"Can environmental regulation directly promote green innovation behavior? based on situation of industrial agglomeration"	81	27
García-Quevedo et al. (2020)	"Barriers to the circular economy in European small and medium-sized firms"	79	19.75
Aid et al. (2017)	"Expanding roles for the Swedish waste management sector in inter-organizational resource management"	54	7.714
Li et al. (2020)	"Green Innovation and Business Sustainability: New Evidence from Energy Intensive Industry in China"	46	11.5
Çetin et al. (2021)	"Circular Digital Built Environment: An Emerging Framework"	37	12.333

Table 2
Important words used in research articles on green innovation and green financing in circular economy.

Words	Occurrences	Words	Occurrences
Sustainable development	24	Carbon	6
Innovation	23	Economic development	6
Circular economy	17	Commerce	5
Sustainability	12	Economic system	5
Recycling	10	Europe	5
China	9	Food waste	5
Manufacturing	9	Green economy	5
Waste management	8	Pyrolysis	5
Industry	7	Stakeholder	5
Social innovations	7	Supply chain management	5

of compensation policies and efforts to minimize the administration costs. Integrating the GF system into society requires equal involvement and collaboration of government, financial organizations, industries and individuals.

Huang et al. (2022) analyzed the total causal effects of GF pilot zones (GFPZ) on sustainable innovation quality and identify whether GF affects GI by specific industries. GFPZ were launched by China to target regional SDGs. The empirical results of the study

Fig. 4. Word cloud of the reviewed articles.

suggest that GFPZ provide some stimulus but have restricted impact on industrial sustainability and the behaviour of GIs. They restrain industries from involvement in poor quality GI and motivate them to adopt high-quality systems for the long term. They also examine the intensifying peer-to-peer competition, reducing financial barriers and mitigating transaction costs in R&D. The study concludes that high-quality GI is a convincing mechanism for connecting GF with green development in regions by increasing green productivity growth. Dörry and Schulz (2018) explored the potential nexus between financing organizations and local industries that aspire to implement green economic practices. Based on the knowledge that climate investments are emerging in global investor markets, they analyze how sustainable green investment and green assets manage the logic of "financialised finance." The technologies of derivatives' trading, commodification and securitisation purportedly support the alternative economic indicators that facilitate economic sustainability via environmental and social benefits. Emerging GF industries recognise the positive influence on developing a nation's global branding in accordance with economic stimuli and greenwashing effects. Liu and Peng (2022) proposed an evolution game model among producers and e-commerce providers, explaining the strategy for selecting the most appropriate GI and GF platforms. The study merges numeric stimulation with the variables affecting GI and GF decisions. The results of the study show an equilibrium approach for strong decision-making approach among producers and e-commerce platforms; GI and GF are favourable to both players of the game. The policy provides GF services for producers; it is impacted by variables such as commissions, extra benefits brought by GI or GF, and financing cost. Huang et al. (2022) suggested that faster development of GI can be achieved through human resources for sustainable economic growth. Green industries enable green technology innovation to increase environmental sustainability and foster sustainable economic growth. Hence, cluster 1 shows an extensive analysis of the importance of sustainable innovation in GF.

3.2. Cluster 2: Financing in sustainable operations

In the current era, climate change is a serious threat to the environment, impacting on a range of social and economic events. It is causing huge damage in the supply chain, affecting industries' assets and operating efficiency; hence, physical risks are being taken. The only solution for these transitions is to follow the carbon family. The aim is to target a minimization in carbon emissions by implementing sustainable renewable energies. Investment in green products compels producers to follow GF practices. This enhances the demand to link producers in green supply chain (GSC) management. Although they may possess huge potential for a GSC, various industries and producers face demanding chal-

lenges in achieving their goals. Now, enterprises are promoting eco-friendly practices to improve GSC management throughout society. GSC management plays a significant role, since it has an environmental effect on every stage of the supply chain; an environmentally friendly atmosphere can be accomplished. The role of GIs in biodiversity protection, water usage, resources, waste treatment management and climate change alleviation assist in increasing a greener production in industries. Thus, to enhance green growth, industries should adopt GF by investing in ecology, carbon reduction and addressing climate change.

Fahim and Mahadi (2022) explored the implementation of green products and processes in the industrial sector to encourage GSC management. Their focus is on discovering new areas such as green information technology, green credit, green productivity and corporate environmental responsibility. In CE, the economic system supplant the "end-of-life" theme, stressing renewable sources of energy and reducing the use of dangerous chemicals in the production process. CE addresses the maximum utilization of consumption of goods and services and efficient production operations by reusing waste resources. It is based on the theory of sustainable financing and revitalizing the economic system.

Jinru et al. (2021) explored the role of GF and logistics in adapting CE and green production. The results suggest that GF and green logistics have a direct and significant impact on the CE and sustainable production. The authors propose the integration of GF and green logistics into institutional procuring and financial plans to produce sustainable products, with the goal of advancing the CE. To deal with disruptions in the supply chain, a series of research papers highlights the importance of designing inventory models by considering important parameters - the product itself, trade credit financing, demand structure and deterioration. Recently, trade credit financing has evolved as a significant tool for retailers and manufacturers because of its speciality in attracting customers and increasing demand for products. Shah and Shroff (2022) proposed an inventory model to reduce the cost faced by retailers for products of fixed-life duration by applying a time-dependent trapezoidal demand and two-level trade credit financing. They provide evidence that the sustainability of the inventory system is increased and that the overall cost of the ideal product quantity is lower, the longer the trade credit period. The emergence of GF supports the financing of energy conservation and allocation of resources from energy-consuming industries to efficient and green-consuming industries.

Wang et al. (2021) reviewed articles on GF and energy policy, discussing policy-related solutions in the energy field. The authors highlight four policies involving GF - green investment policy, carbon tax policy, green bond policy and government subsidy policy. Green investment policy promotes sustainable infrastructure, sustainable construction, and adopts solar PV power. A carbon tax policy promotes the minimization of greenhouse gases and encourages usage of clean energy. Green bond policy finances green projects, while the government subsidy policy promotes sustainable technology, sustainable development and increases the greenness of goods. Dikau and Volz (2021) identified the role of central banks that mandate sustainability objectives in the banking sector, as the climate risk negatively impacts the responsibilities of central banks. They identify the key factors in sustainable financing options - price stability, monetary stability, inflation targeting framework, supporting a competitive market-based financial system for sustainable growth and mainstreaming GF into a core policy framework.

3.3. Cluster 3: GF for innovative waste management

As a response to global environmental issues, governments and policymakers have implemented a cluster of public and international policies to motivate GIs, environmentally friendly technologies and green brands. GI is important in public management and in dealing with the negative externalities of the environment. Implementing GI helps to minimize industrial waste and production costs, which in turn, help to minimize the negative impact on the environment and help industries to improve their overall performance.

For sustainable development, the European Union (EU) is developing a resource-efficient sustainable economy. The method of "Closing the Loop," is integrated into EU law by a "CE Package" and emphasises reducing and recycling waste. As a result of speedy development, the EU has proposed its own raw material production (Wang et al., 2022a, 2022b, 2022c). The method of "waste management system" must be significantly changed to meet new waste management goals and to reduce prices for system users (citizens). Tomić and Schneider (2020) assess the effects of waste management on the time-dependent "Life Cycle Assessment" based on waste, energy flow tracking and material framework. The framework is designed to measure material and energy production that can be monetised. In terms of economic measurements, the yearly cash flow of the system is equalised with zero, considering the cumulative incomes (revenue from energy vectors, secondary materials, and compost material) and expenses (expenditure on investment and operation). According to the findings, product recovery-based scenarios have lower total cost and less susceptibility to system cost, whereas energy recovery of waste yields more revenue than material recovery. This shows that waste management systems are an efficient and effective tool for decision-makers to assess socio-economic sustainability. Bharadwaj et al. (2020) used plastic waste as a constituent of municipal solid waste (MSW) to identify the scope of initiating revenue to finance the MSW. Their study highlights that the costs of managing plastic garbage might be reduced by an additional 1% by improving recovery rates and collection efficiency. To impose a high taxation on imported plastic products may encourage the recovery of plastic garbage for recycling. When the effectiveness of plastic trash recovery and collecting rate is low, a 1% increase in the import tax on plastic would be adequate to pay for plastic-related waste management. The study aims to fully comprehend the potential for sustainable funding of MSW management and minimizing environmental damage in underdeveloped nations. In order to manage MSW more effectively for a longer duration, more policy formulations such as infrastructural development and the standardization of packing materials would be helpful. Chien et al. (2021) identified the hurdles, challenges and barriers to overcome challenges to GI in the United Arab Emirates. The study focuses on the selection of e-waste collection centres to sustain the long-term supply chain. It suggests sustainable planning for long-term impact by reducing e-waste collection expenditure. The authors suggest that governments should implement laws relating to extended producer responsibility to minimise the amount of electronic trash. To help in the collection of e-waste, the government should propose action-oriented recommendations. The application of technological innovation in industries helps to overcome such hurdles.

3.4. Cluster 4: Financing in energy efficient technologies for sustainable development

At the present time, economic growth and industrialization have resulted in an increase in the usage of fossil fuels. The increased demand will simultaneously increase the production and consumption of fossil fuels, which affects the environment in terms of global warming, health risks, climate change and pollution. While the "Organisation for Economic Co-operation and Development" (OECD) contends that, in future, fossil fuels will continue to influence the energy supply due to its higher energy den-

sity and longer duration to innovate, OECD countries do acknowledge the priority to move to new sources of energy. OECD nations understand that huge investments in innovative "low-carbon automation", "renewable energy", and "energy infrastructure" are required to meet this goal. Energy consumption and energy efficiency could significantly drop as a result of environmental technology advancement. These technologies can help in reducing the harmful impacts of energy use and inspire governments to reconsider how energy is used for various purposes. Effective utilization of resources through reusing and removing waste helps to minimize the consumption of energy.

Paramati et al. (2022) investigated the importance of energy efficiency and environmental-related technologies on energy demand. Their findings across estimations show that environmental technology significantly increases energy intensity; this has a negative impact on energy consumption and a positive effect on energy efficiency. This evidence indicates that environmental technology aids OECD economies in reducing total energy consumption and enhancing total energy efficiency within individual nations. Extensive empirical findings show that income and financial development are the major factors affecting energy demand. Azhgaliyeva et al. (2020) reviewed green bond issuance and green bond policies in the "Association of South-East Asian Nations" (ASEAN). The allocation of green bonds is effectively encouraged by ASEAN's green bond policies. However, it does not imply that green bond policies are successful in encouraging energy-efficient project development in ASEAN. The findings of the study suggest that GIs are not always encouraged in ASEAN, as proceeds from green bonds issued in the region may be used to fund other projects or refinance previous debts. Policymakers must regulate eligibility requirements to only country-based projects and/or stipulate re-financing to ensure that the green bond award supports local decarbonisation. Polzin and Sanders (2020) focused on grid investments, renewable energy and energy efficiency. Their research demonstrates that green finance is an important element for a successful energy transition when it is accessible under the current investment mandates and lending standards. In reality, the range of available financing options is between two and six times greater than what is required. However, due to anticipated (regulatory) discontinuities, many institutional investors, pension funds and banks are reluctant to invest in renewable energy.

Venture capital from households is required to finance "low-risk small-ticket projects" in the initial stages of innovation in clean energy technologies; this is needed to supplement a readily obtainable abundance of finances for substantial investment. Song et al. (2021) highlighted that "green credit", "industrial structure", "environmental regulation" and "technological progress" are positively influenced by the high-efficiency utilization of energy and are apparent in the credit scale. They show that green credit positively impacts the high-efficiency utilization of energy. Di Foggia (2018) identified the drivers that affect the demand and supply of energy efficiency measures such as standardization, low transaction costs, energy prices, and stability of the regulatory framework. This study shows that energy policy provides reliable information to consumers that affects their investment behaviour and a possible switch towards sustainable building choices. The nexus between energy efficiency measures and SDGs promotes global environmental well-being.

4. Related institutional theories

4.1. Diffusion of innovation perspective theory

One important theory that helps to understand GF and GI concepts is the diffusion of innovation perspective theory. This theory suggests that innovation is a key driver of economic growth and development and that it can also be used to promote environmental sustainability (Feng et al., 2022). The theory argues that innovation can lead to the development of new technologies and products that are more energy efficient and less polluting, as well as the creation of new business models and policies that promote environmental sustainability. The diffusion of innovation perspective theory ensures the use of market-based mechanisms, such as carbon taxes and emissions trading schemes, to create financial incentives for all stakeholders and companies to invest in sustainable projects.

This theory also supports GF and GI through public–private partnerships. These partnerships bring together the resources and expertise of both the public and private sectors to support research and deployment of new technologies while promoting sustainable products. This includes funding towards research and development, and incentives for companies to invest in environmentally sustainable projects. By utilizing the strengths of both public and private sectors, the diffusion of innovation perspective theory ensures the adoption of environmentally sustainable products, leading to a more sustainable future.

4.2. Cost-efficiency perspective theory

The cost-efficiency perspective theory is very important in understanding how GF and GI promote environmental sustainability. This theory suggests that the most effective way to promote GI is by finding the most cost-efficient solutions (Dehnokhalaji et al., 2017). In other words, the goal is to achieve environmental sustainability while minimizing costs. This theory uses life-cycle cost analysis (LCCA) to identify the most cost-efficient solutions for achieving sustainable environment. This approach considers all costs associated with a product throughout its entire life, including acquisition, operation, maintenance, and disposal costs.

The cost-efficiency perspective theory also considers performance-based incentives. These incentives are designed to encourage companies and individuals to invest in environmentally sustainable projects (Yu et al., 2009). Another key element is the use of cost-benefit analysis (CBA) in evaluating sustainable projects and initiatives. CBA is a method of evaluating the costs and benefits of a project or policy; it allows policymakers and decision-makers to compare the costs of a green initiative to its potential benefits, such as energy savings and environmental benefits. This helps in identifying the most cost-efficient solutions for achieving environmental sustainability.

4.3. Resource-based perspective theory

In the context of GF and GI, resource-based perspective theory helps companies in identifying and leveraging their resources and capabilities to develop and implement environmentally sustainable initiatives. The resource-based perspective theory recognize a company's unique resources and capabilities (Ray et al., 2004). These include physical assets, such as renewable energy technology, as well as intangible assets, such as a strong reputation for environmental sustainability. By identifying these resources and capabilities, a firm can develop and implement green initiatives that are well-suited to their strengths and are more likely to be successful. Another aspect of this theory is the importance of a company's organizational capabilities. This includes its ability to manage and coordinate resources, as well as its ability to innovate. A company with strong organizational capabilities is better able to develop and implement green initiatives and is more likely to be able to adapt to changes in the market and regulatory environment.

The resource-based perspective theory also emphasizes the importance of a company's relationships with external stakeholders (Miemczyk et al., 2016). This includes suppliers, customers, and other companies within the industry. By building strong relationships with these stakeholders, a company can access additional resources and capabilities that can help it to develop and implement green initiatives.

4.4. Institutional perspective theory

Institutional perspective theory suggests that the institutional environment in which companies operate plays a critical role in shaping their behaviour and ability to innovate and finance green initiatives. The role of formal institutions, such as laws, regulations, and policies, in shaping a company's behaviour is one important aspect of this theory (Welter and Smallbone, 2011). The institutional perspective also suggests that the effectiveness of these regulations and policies depends on their design, implementation and enforcement.

Another aspect of this theory is the role of informal institutions, such as social norms, values, and beliefs, in shaping a company's behaviour. The institutional perspective theory also emphasizes the importance of the interactions between formal and informal institutions (Welter and Smallbone, 2011).

4.5. Comparison of different theories

Each theory offers a unique perspective on how businesses and individuals adopt and implement environmentally friendly practices. The diffusion of innovation perspective theory and institutional perspective theory seems to have particular relevance for green finance and green innovation, as they emphasize the importance of social norms and regulatory frameworks in driving adoption and implementation of environmentally friendly practices. The cost-efficiency perspective theory and resource-based perspective theory, on the other hand, are more focused on the economic benefits of green practices and may be more applicable to the business case for green finance and green innovation. A comparison of all suggested theories is set out in Table 3.

The institutional perspective theory is considered to be the most prominent in the context of green finance and green innovation. This is because institutional perspective theory recognizes the role of social norms, regulations, and institutional pressures in shaping the behavior of businesses and individuals with respect to environmental practices. Institutional pressures can come from various sources such as government regulations, industry standards, and social norms. For example, the introduction of policies such as carbon pricing or emission targets can put pressure on businesses to adopt environmentally friendly practices. Similarly, the adoption of sustainable business practices by industry leaders can create social norms that other businesses feel compelled to follow. The institutional perspective theory suggests that these pressures can lead to a form of isomorphism where businesses adopt similar practices to conform to the expectations of the institutional environment.

5. Discussion

The present study formulates a conceptual framework of GF and GI to investigate the unknown roles among their technologies for a circular business model. The given scope of GF and GI can impart immense benefit to society in achieving sustainable development goals. The developed framework integrates resources and technologies to achieve circularity in the business models that help to enhance sustainability and promote the green agenda in the industrial sector. The framework is anchored in the technologies and themes found in the systematic literature review, bringing out the interconnection between GF and GI. Thus, the conceptual framework is the result of a comprehensive investigation of the research theme and the viability of the system. A research framework is proposed as shown in Fig. 5. This shows the related theories with green finance techniques and green innovation techniques needed to achieve circularity; it also addresses the second research question of the study.

Table 3
Comparison of related theories and associated challenges.

Theories	Main focus	Key factors	Relevance for green finance and innovation	Challenges faced in adopting green finance and innovation
Diffusion of Innovation perspective theory	Adoption of new innovations	Perceived benefits, social norms, and characteristics of adopters	Successful adoption of environmentally friendly practices through gradual process and perceived benefits	The adoption process can be influenced by various factors, such as perceived benefits and social norms, which can make it difficult to identify the most important factors to consider. Additionally, the adoption process can be slow, making it difficult to collect data over a short period of time.
Cost-efficiency perspective theory	Cost-effectiveness of environmentally friendly practices	Financial benefits, cost savings	Adoption of environmentally friendly practices that save money or resources	One challenge of using the cost-efficiency perspective theory is that not all environmentally friendly practices are cost-effective in the short term. For example, investing in renewable energy may have high upfront costs, but provide long-term cost savings. This can make it difficult to evaluate the financial benefits of adopting environmentally friendly practices and can impact the adoption rate.
Resource based perspective theory	Competitive advantage through sustainable practices	Resource capabilities, innovation	Development of innovative and sustainable practices for competitive advantage	The difficulty in identifying the key resources and capabilities required for sustainable innovation. Additionally, there may be a lack of access to these resources, particularly for smaller firms, which can limit their ability to innovate sustainably.
Institutional perspective theory	Influence of social norms, regulations, and institutional pressures on behavior	Government policies, industry standards, and social norms	Adoption of environmentally friendly practices through institutional pressures	Institutional pressures can vary between different countries and regions. This can make it difficult to generalize findings from one context to another. Additionally, the effectiveness of institutional pressures may depend on the specific policy or standard being implemented, and the level of enforcement.

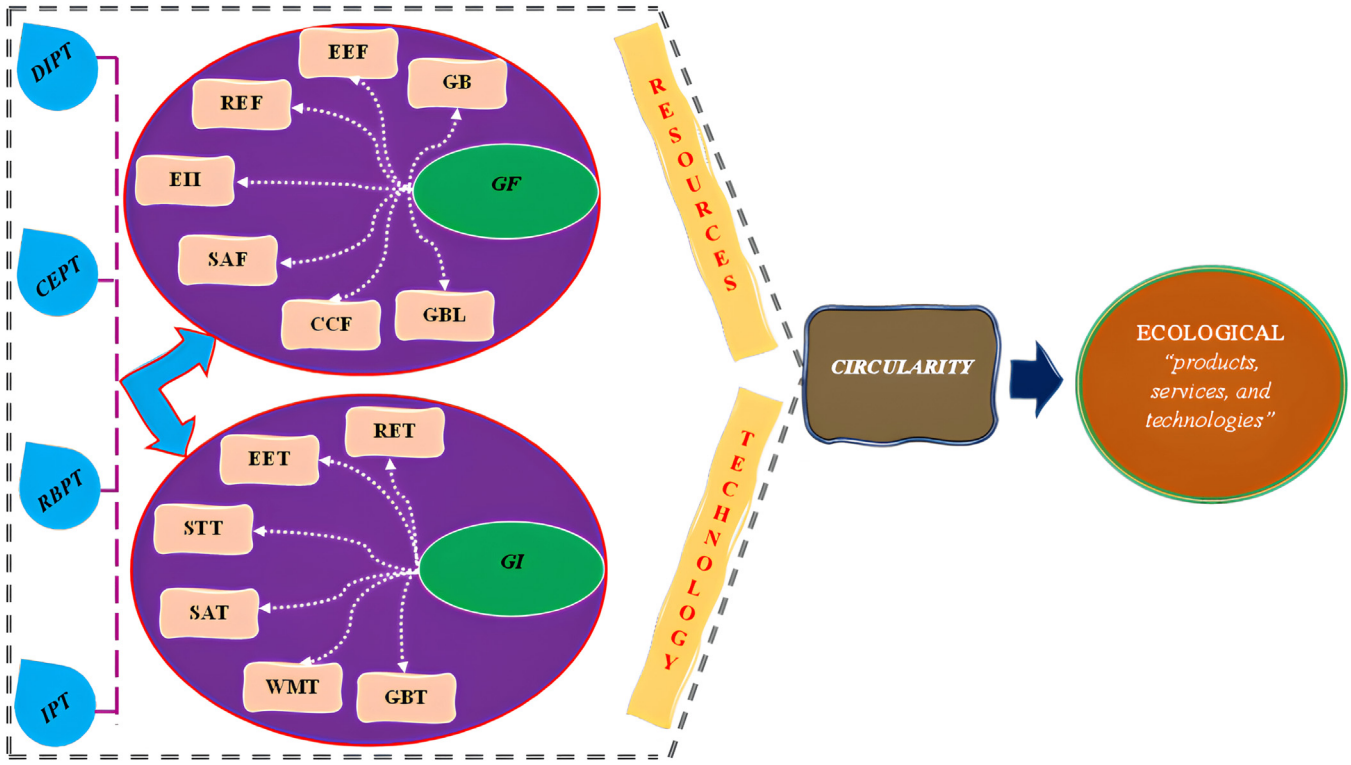

Fig. 5. Proposed framework for integration of GF and GIs in CE.

The dimensions of GF are important while making investment decisions in the finance sector; decisions may lead to long-term investment in green and sustainable economic activities (Dhayal et al., 2023). A clientele of investors who understand the long-term environment values are drawn to green bond issuances, succeeded by favourable stock market reactions (Azhgaliyeva et al., 2020). For the green bond market, it is vital to make certain that the issue of green bonds is utilizing financing budgets for environmentally friendly products. To ensure this, monitoring regimes are necessary, such as voluntary certification standards proposed by various organizations and associations (Fatica and Panzica, 2021; Wang et al., 2021). Thus, we should eventually notice an improvement in the environmental performance of those businesses soliciting money on the green segment if green bonds are genuinely issued to finance environmentally favourable initiatives (Mankata et al., 2020; Sahoo et al., 2023). Energy efficiency activities, such as the creation of key performance indicators or tracking energy use, can reduce greenhouse gas emissions and make a favourable impact on the environment. In addition, in every business model, either customer value or the value network are more likely to be associated with different benefits (Mangla et al., 2020).

If a business model adopts an energy efficiency financing practice or friendly material usage-driven practices, the model will result in reduced costs and make an environmental impact; there will also be reductions in business risks and supply chain complexity (Camarasa et al., 2019; Yadav et al., 2023). Renewable energy financing needs a relationship between people who have better knowledge of different types of finance and their willingness to invest in renewable energy. The extent of the expansion of renewable energy finance is substantially correlated with the degree of eco-friendliness; the extent of environmental deterioration is negatively correlated with GF (Mutezo and Mulopo, 2021).

A corporate ecology structure is required to address local governance in enhancing the proficiency of renewable energy finance that ultimately increases green recovery in organizations. Environmental impact investing involves investing in companies and projects that have a positive environmental impact, such as companies that are developing environmentally friendly products and technologies (Sawe et al., 2021). Sustainable agriculture financing helps to limit deforestation, motivate climate resilience and generate income. It will create new mechanisms and adjust existing ones to harness additional public and private funding streams that can be used to fund investments in agriculture that are climate-smart (Mushi et al., 2022). It supplies the essential technical help to enable both lenders and borrowers to develop their capacities in the financial ecosystem. Sustainable agricultural funding may facilitate inclusive economic development, especially in developing nations (Hernandez-Aguilera et al., 2018). Carbon credit financing aims to reduce greenhouse gas emissions and enable the trading of emission units, resulting in emission reduction (Velvizhi et al., 2023). It is essential to adopt such practices that purposefully reduce business-as-usual emissions (Anjos et al., 2022). Green bank loans integrate the operational changes, required technology and converting client habits in banking business. It promotes environmental-friendly practices and gives a smooth transition to net zero and clean energy in the future (Mir and Bhat, 2022). It helps to bridge the gap between private capital and demonstrable public interest and inclination toward clean energy and sustainable development.

The technology of GI marks a transition to CE, maintaining controls and set routines to implement green innovation; it thus makes a circular business model. It resonates changes for industries in established practice, environmental awareness, manufacture of green products and environmental management to maintain natural resources (Gawusu et al., 2022; Khan et al., 2023) Renewable energy technology refers to the generation of energy from renewable sources such as wind, water, the sun, and biomass. The adoption of energy efficiency technologies in businesses can minimize greenhouse gas emissions and other pollutants along with a reduction in water use (Gawusu et al., 2022).

Table 4
Green Finance and Green Innovation Technologies: Challenges and future research propositions.

Clusters	Challenges	Proposed research questions (PRQs)
Sustainable Innovation and Development with Green Financing	1. Green technology innovation has become a critical issue for politicians to allocate scarce financial revenues toward green projects, reducing financial help for polluters and motivating industries to engage in green projects. 2. Financial constraints are there to hinder the green innovation transition process. 3. To achieve the carbon peak and neutralization" targets. 4. To encourage through modifying the regulatory frameworks of nations. 5. Aiming to direct government funding in the right direction. 6. Harmonization of public sector funding policies with sustainability goals. 7. Investment in low-carbon, climate-resilient green economies and blue economies that make efficient use of natural resources.8. Generalization of green financing in different industrial and geographical settings.	PRQ1. How green innovation can bridge the gap between economic development and ecological construction? PRQ2. What green finance shocks are required in an economy that promotes economic growth and industrial structure? PRQ3. How can government policies divert the interest of investors to invest in green finance projects? PRQ4. How to encourage financial institutions increase green credit and loan support for green environmental protection projects? PRQ5. What are the initiatives required to promote green financing in the better adoption of various nations' regulatory frameworks? PRQ6. How flexibility in green financing can generalise its adoption to deliver better sustainable outcomes in different geographical settings? PRQ7. How green financing can help firms transition from circularity to carbon neutrality? PRQ8. What are the initiatives required to improve the efficient use of natural resources? PRQ9. How could the definition and interpretation of green financing be generalized in a different context?PRQ10. How can sustainable community development benefit from green innovation in the domains of domestic energy use and individual mobility?
Financing in Sustainable Operations	1. Excluding the cost incurred by the merchant to maintain sustainable inventory operations from the total cost. 2. Many firms and small and medium enterprises are unable to adopt green supply chain management. 3. Implementation of a sustainable supply chain to motivate reverse logistics. 4. Impact of green financing and green logistics on the circular economy. 5. Role of green finance in transition from linear to circular business model.	PRQ11. What could be the cost-minimization techniques that can diminish the negative impacts on the ecology due to inventory-related issues? PRQ12. How can industries link suppliers' environmental performance to green supply chain management? PRQ13. What policies can improve the organization's efficiency and productivity that is resolute by the logistic performances of the firm? PRQ14. How to integrate green financing and green logistics into organizational procuring for producing green and sustainable goods and promoting the circular economy goals. PRQ15. How may the use of green bonds work to discourage carbon-intensive endeavours? PRQ16. What steps need to be taken to investigate potential regulatory incentives, such as discounted rediscount prices or green loans? PRQ17. How to encourage regional financial firms to provide green financial products to the public, helping to close the gap between public and private funding sources for environmental protection. PRQ18. In what ways can green financing motivate businesses to adopt the circular economy and promote environmentally friendly production practices? PRQ19. How funds are generated to support the transition to a more circular business model, and how that investment may influence the direction that the economy takes as it evolves from linear to circular and eventually to circularity.PRQ20. How can we surpass the common perception that circular business models are unprofitable due to their high initial investment costs?
Green Financing for Innovative Waste Management	1. Developing countries face the environmental impact of occurring large amounts of solid waste. 2. Lack of a municipal budget and less interest in private investors in waste management 3. The general citizens in developing countries consider wastes as valueless product and disposes of them through open burning, stream dumping, or as conveniently as possible. 4. Misalignment of innovation and organizational goals.5. Misconception of the extra burden of waste management within the firm.	PRQ21. How to create a paradigm shift toward developing technologies that transform solid waste into cheap and clean energy? PRQ22. How barriers to implementing smart and innovative waste management systems be adopted without affecting financial constraints? PRQ23. Can the green technology approach increase adaptation and resilience among climate change-displaced populations to set up microenterprises on vital end products? PRQ24. Can industries involve in the recycling cluster to share resources and enhance sustainability? PRQ25. How to promote "Waste to Wealth" and "Waste to Energy" technologies in developing countries PRQ26. What steps need to be taken so that "green banking and renewable finance" become established as subsectors? PRQ27. What role can green finance play in assisting small and medium-sized businesses with their waste management efforts? PRQ28. Why is it necessary to have an innovation policy in order to solve systemic problems and find out why companies are not allowed to participate in innovation competitions? PRQ29. Which actions are necessary to bring the innovation objectives and the organisational strategies into alignment with one another?PRQ30. When attempting to implement green finance and green innovation, how can we get around the absence of sustainability protocols and relevant regulations?

Table 4 (*continued*)

Clusters	Challenges	Proposed research questions (PRQs)
Financing in Energy Efficient Technologies for Sustainable Development	1. The environmental technology has a significant negative influence on energy consumption. 2. The energy-intensive and pollution-creating industries are facing the problem of transformation and up gradation in the context of green and sustainable development. 3. Deploying renewable energy in energy security and climate change.	PRQ31. How can the different economies adopt environmental technology that helps to reduce energy consumption and improves energy efficiency in their respective nations? PRQ32. How does green credit affect the high-efficiency utilization of energy in developing and developed countries?PRQ33. How to examine the impact of green finance on the deployment of renewable energy (RE) . PRQ34. Is there a way to provide green finance that is adaptable, as well as green innovation, to deal with skewed budgetary priorities? PRQ35. How can we get over a shortage of technical competence in embracing and implementing green financing and green innovation? PRQ36. In order to increase the efficacy of the current regulatory framework, what steps may be taken by individual nations to strengthen legislative provisions, norms and principles, and energy efficiency-specific programmes and policies? PRQ37. How much effort is required to change banks' attitudes on energy efficiency finance, and how can the perceived risk of such investments be mitigated? PRQ38. Why the cost of energy should be one of the primary considerations when making investments in conservation? PRQ39. Is there a difference in how those working on environmentally friendly initiatives in the developed and developing world see the elements that influence the adoption of renewable energy sources?PRQ40. What are the most effective ways to raise investment and funding for energy efficiency projects?

It also helps in improving energy efficiency that can lessen the burden of utility bills, create jobs, and stabilize electricity prices and volatility (Gielen et al., 2019). The designing of energy-efficient buildings helps to reduce energy consumption of the buildings. The emergence of the sustainable lifestyle has led to an attempt to introduce sustainable transportation technology to produce green vehicles competitively (Wang et al., 2022a, 2022b, 2022c). It postulates a strategic solution to develop a supplementary service for e-cars. This includes the designing of a sustainable smart grid that efficiently controls the supply of electricity between parties while saving energy. By switching the industries' emphasis from being "product-oriented" to being "service-oriented", it promotes the centrality of the consumer (Abdalazeem et al., 2022). The aim is for a "zero-impact sustainable transportation" technology composed of affordable vehicles with low depreciation value (Epicoco and Falagario, 2022). Sustainable agriculture technologies are agriculture practices that ensure increased farm production and an increase in a farmer's income while protecting the environment (Qin et al., 2022). It focuses on business models for more profit by reducing the usage of agrochemicals to ensure a green environment and good production quality (Khan et al., 2022). Water management technologies involve the development of technologies for the effective management of waste, such as recycling and composting. Green building technologies are helpful in highlighting the environmental pollution issues of certain industries. The value is reflected in a healthy environment. The development of ecological and financial value is viewed as requiring a sustainable and creative business model for green construction (Lu et al., 2022). The proposed future research questions are also developed in the area of GF and GI, as presented in Table 4. Table 4 addresses the third research question of the study.

Table 5 offers the interpretation of coding used in Fig. 5 to gain a better understanding of the proposed framework.

Table 5
Coding interpretation of the proposed framework.

Coding classification	Coding	Coding interpretation
Theory-based coding	DIPT	Diffusion of Innovation Perspective Theory
	CEPT	Cost-Efficiency Perspective Theory
	RBPT	Resource Based Perspective Theory
	IPT	Institutional Perspective Theory
Coding used in 'Green Financing'	GB	Green Bonds
	EEF	Energy Efficiency Financing
	REF	Renewable Energy Financing
	EII	Environmental Impact Investing
	SAF	Sustainable Agricultural Financing
	CCF	Carbon Credits Financing
	GBL	Green Bank Loans
Coding used in 'Green Innovation'	RET	Renewable Energy Technologies
	EET	Energy Efficiency Technologies
	STT	Sustainable Transportation Technologies
	SAT	Sustainable Agricultural Technologies
	WMT	Water Management Technologies
	GBT	Green Building Technologies

6. Implications of the study

6.1. Theoretical and research implications

The present study offers a comprehensive overview on how GF and GI can fit into a circular society; it contributes to existing literature on all three dimensions. i.e. GF, GI and circularity. The study is a trailblazing analysis of research introduction and the application of GF and GI to circular business models to improve environmental conditions. In the overview of the findings, we present six theoretical implications that give a future direction on circular business models. Firstly, the findings of the study help future researchers to understand the scope and drawbacks of this study. As a consequence, this study provides academics, managers, and policymakers with a basic and impartial foundation for comprehending the notion of sustainability in business models and gives an insight into on-going research trends in this area.

Secondly, the findings are beneficial for researchers by drawing their attention to the emerging and under-researched domains

that are important in motivating the adoption of circular business models in the initial stages. Thirdly, researchers are given advanced knowledge about the most influential authors, sources and institutions in this domain. Potential research partners can be identified for further study in this area. Fourthly, the findings of the cluster analysis provide researchers with pivotal information about seminal papers that can be considered as the base of this research topic. Fifthly, the identified research propositions identify emerging research themes that future researchers should carry forward. Sixthly, this article proposes a conceptual framework that provides guidance on how GF and GI technologies can enable a business to produce environmentally friendly products and services. In future, researchers and academicians can consider this present study as a valuable reference source.

6.2. Practical implications

The present study offers significant implications for investors, entrepreneurs, practitioners and governments. Public and private investors should understand the importance of investing in green projects and promote green funding alternatives. This research encourages backers to invest in industries and green buildings at earlier phases and asks them to "move out of their comfort zone" of traditional practices. Their decisions can deliver clean energy and green production. Institutional investors should be mindful of the long-term capital commitments inherent in GF and must be prepared to enforce financial regulations. Policy makers also play a significant role in developing strategies such as tax rebates, carbon tax and subsidies in adopting environmental conscious technologies and supports for sustainable development. The government should invest in research and development, take regulatory actions in the green sector, encourage large-scale green projects, invite direct foreign investment and make procurement decisions for the benefit of society at large. A joint effort of academia, government, and industries is needed to establish a resilient circular economy that can prepare for GI and GF.

6.3. Managerial implications

A major concern in circular business models is to mitigate the transaction cost of research and development for new technologies, thus minimizing financial barriers. The suggested framework in this study has important managerial consequences. Firstly, the study aims to inform businesses on the various GI technologies they can adopt to make their business models ecological and sustainable. Secondly, on the basis of various GF opportunities and their effects on circular business models, this paper can assist stakeholders in prioritizing their GF strategies. Thirdly, the research may help firms to allocate resources more effectively by emphasising the areas that need most attention and investment. Fourthly, it encourages managers to adopt digital technologies, design thinking, and sustainability-oriented innovation products to cope with climatic conditions. Fifthly, the research findings can be used as a business benchmark, enabling other businesses to evaluate how many ecological products, services and technologies they have invented, adopted or marketed in comparison with their competitors.

7. Conclusion

In the current world of commerce, GF policies and GI present a relatively new approach to environmental governance. Regulations impose hefty financial fines and investment restrictions when investment leads to pollution. By penalising polluting industries and motivating clean industries via green investment and financing, economies can achieve environmental protection. This helps nations to break the old development pattern and encourages transformations in business models. The impact of environmental regulations will differ from region to region and their degree of impact will vary throughout these regions. The main aim of this research is to evaluate the nexus between GF and GI technologies in the context of circular business models by (i) recognizing influential authors, sources, and institutions in this domain; (ii) recognizing the most commonly used keywords in this research area and emerging research themes; (iii) proposing latent future research propositions along with their challenges by conducting bibliometric and network analysis.

The present study has carried out a comprehensive SLR to better understand the intellectual theory in the field of GF and GI. From this extensive review, we identify four major clusters, namely, (i) Sustainable Innovation and Development with GF, (ii) Financing in Sustainable Operations, (iii) GF for Innovative Waste Management, (iv) Financing in Energy Efficient Technologies for Sustainable Development. The present study provides academicians, stakeholders, industry managers, government, venture capitalists, investors, financial markets, policymakers and funding companies with an extensive knowledge of GF and GI together with the related institutional theories. In addition, new researchers have a detailed insight to GF and GI technologies, their challenges and 40 future research propositions. A conceptual framework is proposed to guide the implementation of GF and GI technologies to promote circularity for ecological products, services and technologies and to assist policymakers and academicians.

There are several empirical limitations of the present study that may be considered in further research. Firstly, this study considers only one database, Scopus, limiting the search scope of articles. Subsequent bibliometric analysis may consider other search databases, including Web of Science, Google Scholar and IEEE Xplore. Secondly, the final articles do not consider any conference articles, book reviews, book chapters, working papers, notes or editorials. Thirdly, future research studies may consider analysis by different software, such as Gephi, BibExcel, CiteSpace etc. to execute a more detailed cluster analysis. Fourthly, we consider the articles that are published only in the English language, thus omitting some articles that can be considered in future.

CRediT authorship contribution statement

Rohit Agrawal: Formal analysis, Methodology, Writing – original draft. **Shruti Agrawal:** Methodology, Investigation, Writing – original draft. **Ashutosh Samadhiya:** Data curation, Writing – review & editing. **Anil Kumar:** Writing – review & editing, Supervision. **Sunil Luthra:** Visualization, Validation. **Vranda Jain:** Conceptualization, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

Abdalazeem, M.E., Hassan, H., Asawa, T., Mahmoud, H., 2022. Review on integrated photovoltaic-green roof solutions on urban and energy-efficient buildings in hot climate. Sustain. Cities Soc. 82, 103919. https://doi.org/10.1016/j.scs.2022.103919.

Acquah, I.S.K., Baah, C., Agyabeng-Mensah, Y., Afum, E., 2023. Green procurement and green innovation for green organizational legitimacy and access to green finance: The mediating role of total quality management. Glob. Bus. Organ. Excell. 42 (3), 24–41. https://doi.org/10.1002/joe.22183.

Agrawal, R., Surendra Yadav, V., Majumdar, A., Kumar, A., Luthra, S., Arturo Garza-Reyes, J., 2023. Opportunities for disruptive digital technologies to ensure circularity in supply Chain: A critical review of drivers, barriers and challenges. Comput. Ind. Eng. 178, 109140. https://doi.org/10.1016/J.CIE.2023.109140.

Aid, G., Eklund, M., Anderberg, S., Baas, L., 2017. Expanding roles for the Swedish waste management sector in inter-organizational resource management. Resour. Conserv. Recycl. 124, 85–97. https://doi.org/10.1016/j.resconrec.2017.04.007.

Andersen, D.C., 2017. Do credit constraints favor dirty production? Theory and plant-level evidence. J. Environ. Econ. Manag. 84, 189–208. https://doi.org/10.1016/J.JEEM.2017.04.002.

Anjos, M.F., Feijoo, F., Sankaranarayanan, S., 2022. A multinational carbon-credit market integrating distinct national carbon allowance strategies. Appl. Energy 319, 119181. https://doi.org/10.1016/j.apenergy.2022.119181.

Azhgaliyeva, D., Kapoor, A., Liu, Y., 2020. Green bonds for financing renewable energy and energy efficiency in South-East Asia: a review of policies. J. Sustain. Finance Invest. 10 (2), 113–140. https://doi.org/10.1080/20430795.2019.1704160.

Bharadwaj, B., Rai, R.K., Nepal, M., 2020. Sustainable financing for municipal solid waste management in Nepal. PLoS One 15 (8), e0231933.

Bhatnagar, M., Taneja, S., Özen, E., 2022. A wave of green start-ups in India—The study of green finance as a support system for sustainable entrepreneurship. Green Finance 4 (2), 253–273. https://doi.org/10.3934/GF.2022012.

Camarasa, C., Nägeli, C., Ostermeyer, Y., Klippel, M., Botzler, S., 2019. Diffusion of energy efficiency technologies in European residential buildings: A bibliometric analysis. Energ. Build. 202, 109339. https://doi.org/10.1016/j.enbuild.2019.109339.

Campiglio, E., 2016. Beyond carbon pricing: The role of banking and monetary policy in financing the transition to a low-carbon economy. Ecol. Econ. 121, 220–230. https://doi.org/10.1016/j.ecolecon.2015.03.020.

Çetin, S., de Wolf, C., Bocken, N., 2021. Circular digital built environment: An emerging framework. Sustainability 13 (11), 6348. https://doi.org/10.3390/su13116348.

Chiappetta Jabbour, C.J., Seuring, S., de Sousa, L., Jabbour, A.B., Jugend, D., de Camargo Fiorini, P., Latan, H., Izeppi, W.C., 2020. Stakeholders, innovative business models for the circular economy and sustainable performance of firms in an emerging economy facing institutional voids. J. Environ. Manage. 264, 110416. https://doi.org/10.1016/j.jenvman.2020.110416.

Chien, F., Ngo, Q.-T., Hsu, C.-C., Chau, K.Y., Iram, R., 2021. Assessing the mechanism of barriers towards green finance and public spending in small and medium enterprises from developed countries. Environ. Sci. Pollut. Res. 28 (43), 60495–60510. https://doi.org/10.1007/s11356-021-14907-1.

Cui, H., Wang, R., Wang, H., 2020. An evolutionary analysis of green finance sustainability based on multi-agent game. J. Clean. Prod. 269, 121799. https://doi.org/10.1016/J.JCLEPRO.2020.121799.

Dehnokhalaji, A., Ghiyasi, M., Korhonen, P., 2017. Resource allocation based on cost efficiency. J. Oper. Res. Soc. 68 (10), 1279–1289. https://doi.org/10.1057/s41274-016-0020-7.

Dhayal, K.S., Giri, A.K., Esposito, L., Agrawal, S., 2023. Mapping the significance of green venture capital for sustainable development: A systematic review and future research agenda. J. Clean. Prod. 396, 136489. https://doi.org/10.1016/j.jclepro.2023.136489.

Di Foggia, G., 2018. Energy efficiency measures in buildings for achieving sustainable development goals. Heliyon 4 (11), e00953.

Dikau, S., Volz, U., 2021. Central bank mandates, sustainability objectives and the promotion of green finance. Ecol. Econ. 184, 107022. https://doi.org/10.1016/J.ECOLECON.2021.107022.

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., Lim, W.M., 2021. How to conduct a bibliometric analysis: An overview and guidelines. J. Bus. Res. 133, 285–296. https://doi.org/10.1016/j.jbusres.2021.04.070.

Dorfleitner, G., Braun, D., 2019. Fintech, Digitalization and Blockchain: Possible Applications for Green Finance, pp. 207–237. https://doi.org/10.1007/978-3-030-22510-0_9.

Dörry, S., & Schulz, C. (2018). Green financing, interrupted. Potential directions for sustainable finance in Luxembourg. 23(7), 717–733. 10.1080/13549839.2018.1428792

Epicoco, N., Falagario, M., 2022. Decision support tools for developing sustainable transportation systems in the EU: A review of research needs, barriers, and trends. Res. Transp. Bus. Manag. 43, 100819. https://doi.org/10.1016/j.rtbm.2022.100819.

Fahim, F., Mahadi, B., 2022. Green supply chain management/green finance: a bibliometric analysis of the last twenty years by using the Scopus database. Environ. Sci. Pollut. Res. 29 (56), 84714–84740. https://doi.org/10.1007/s11356-022-21764-z.

Fatica, S., Panzica, R., 2021. Green bonds as a tool against climate change? Bus. Strateg. Environ. 30 (5), 2688–2701. https://doi.org/10.1002/bse.2771.

Feng, Y., Lai, K., Zhu, Q., 2022. Green supply chain innovation: Emergence, adoption, and challenges. Int. J. Prod. Econ. 248, 108497. https://doi.org/10.1016/j.ijpe.2022.108497.

Gao, D., Li, Y., Li, G., 2022. Boosting the green total factor energy efficiency in urban China: Does low-carbon city policy matter? Environ. Sci. Pollut. Res. 29 (37), 56341–56356. https://doi.org/10.1007/s11356-022-19553-9.

García-Quevedo, J., Jové-Llopis, E., Martínez-Ros, E., 2020. Barriers to the circular economy in European small and medium-sized firms. Bus. Strateg. Environ. 29 (6), 2450–2464. https://doi.org/10.1002/bse.2513.

Gawusu, S., Zhang, X., Ahmed, A., Jamatutu, S.A., Miensah, E.D., Amadu, A.A., Osei, F. A.J., 2022. Renewable energy sources from the perspective of blockchain integration: From theory to application. Sustainable Energy Technol. Assess. 52, 102108. https://doi.org/10.1016/j.seta.2022.102108.

Gedam, V.V., Raut, R.D., de Sousa, Lopes, Jabbour, A.B., Tanksale, A.N., Narkhede, B.E., 2021. Circular economy practices in a developing economy: Barriers to be defeated. J. Clean. Prod. 311, 127670. https://doi.org/10.1016/j.jclepro.2021.127670.

Geissdoerfer, M., Morioka, S.N., de Carvalho, M.M., Evans, S., 2018. Business models and supply chains for the circular economy. J. Clean. Prod. 190, 712–721. https://doi.org/10.1016/j.jclepro.2018.04.159.

Gielen, D., Boshell, F., Saygin, D., Bazilian, M.D., Wagner, N., Gorini, R., 2019. The role of renewable energy in the global energy transformation. Energ. Strat. Rev. 24, 38–50. https://doi.org/10.1016/j.esr.2019.01.006.

Govindan, K., Jha, P.C., Garg, K., 2016. Product recovery optimization in closed-loop supply chain to improve sustainability in manufacturing. Int. J. Prod. Res. 54 (5), 1463–1486. https://doi.org/10.1080/00207543.2015.1083625.

Guldmann, E., Huulgaard, R.D., 2020. Barriers to circular business model innovation: A multiple-case study. J. Clean. Prod. 243, 118160. https://doi.org/10.1016/j.jclepro.2019.118160.

Hernandez-Aguilera, J.N., Gómez, M.I., Rodewald, A.D., Rueda, X., Anunu, C., Bennett, R., van Es, H.M., 2018. Quality as a driver of sustainable agricultural value chains: The case of the relationship coffee model. Bus. Strateg. Environ. 27 (2), 179–198. https://doi.org/10.1002/bse.2009.

Hsu, C.-C., Tan, K.-C., Mohamad Zailani, S.H., 2016. Strategic orientations, sustainable supply chain initiatives, and reverse logistics. Int. J. Oper. Prod. Manag. 36 (1), 86–110. https://doi.org/10.1108/IJOPM-06-2014-0252.

Huang, H., Mbanyele, W., Wang, F., Song, M., Wang, Y., 2022. Climbing the quality ladder of green innovation: Does green finance matter? Technol. Forecast. Soc. Chang. 184, 122007. https://doi.org/10.1016/J.TECHFORE.2022.122007.

Ibrahim, R.L., Ozturk, I., Al-Faryan, M.A.S., Al-Mulali, U., 2022. Exploring the nexuses of disintegrated energy consumption, structural change, and financial development on environmental sustainability in BRICS: Modulating roles of green innovations and regulatory quality. Sustainable Energy Technol. Assess. 53, 102529. https://doi.org/10.1016/j.seta.2022.102529.

Irfan, M., Razzaq, A., Sharif, A., Yang, X., 2022. Influence mechanism between green finance and green innovation: Exploring regional policy intervention effects in China. Technol. Forecast. Soc. Chang. 182, 121882. https://doi.org/10.1016/J.TECHFORE.2022.121882.

Jesic, J., Okanovic, A., Panic, A.A., 2021. Net zero 2050 as an EU priroty: modeling a system for efficient investments in eco innovation for climate change mitigation. Energy Sustainab. Soc. 11 (1), 50. https://doi.org/10.1186/s13705-021-00326-0.

Jinru, L., Changbiao, Z., Ahmad, B., Irfan, M., Nazir, R., 2021. How do green financing and green logistics affect the circular economy in the pandemic situation: key mediating role of sustainable production. Economic Res.-Ekonomska Istraživanja 35 (1), 3836–3856. https://doi.org/10.1080/1331677X.2021.2004437.

Khan, P.A., Johl, S.K., Kumar, A., Luthra, S., 2023. Hope-hype of green innovation, corporate governance index, and impact on firm financial performance: a comparative study of Southeast Asian countries. Environ. Sci. Pollut. Res. 30 (19), 55237–55254. https://doi.org/10.1007/S11356-023-26262-4/TABLES/8.

Khan, N., Ray, R.L., Kassem, H.S., Zhang, S., 2022. Mobile internet technology adoption for sustainable agriculture: evidence from wheat farmers. Appl. Sci. 12 (10), 4902. https://doi.org/10.3390/app12104902.

Lăzăroiu, G., Ionescu, L., Uță, C., Hurloiu, I., Andronie, M., Dijmărescu, I., 2020. Environmentally responsible behavior and sustainability policy adoption in green public procurement. Sustainability 12 (5), 2110. https://doi.org/10.3390/su12052110.

Leising, E., Quist, J., Bocken, N., 2018. Circular Economy in the building sector: Three cases and a collaboration tool. J. Clean. Prod. 176, 976–989. https://doi.org/10.1016/j.jclepro.2017.12.010.

Li, L., Msaad, H., Sun, H., Tan, M.X., Lu, Y., Lau, A.K.W., 2020. Green innovation and business sustainability: new evidence from energy intensive industry in China. Int. J. Environ. Res. Public Health 17 (21), 7826. https://doi.org/10.3390/ijerph17217826.

Liu, L., Peng, Q., 2022. Evolutionary game analysis of enterprise green innovation and green financing in platform supply chain. Sustainability 14 (13), 7807. https://doi.org/10.3390/su14137807.

Liu, H., Yao, P., Latif, S., Aslam, S., Iqbal, N., 2022. Impact of Green financing, FinTech, and financial inclusion on energy efficiency. Environ. Sci. Pollut. Res. 29 (13), 18955–18966. https://doi.org/10.1007/s11356-021-16949-x.

Lu, W., Du, L., Tam, V.W.Y., Yang, Z., Lin, C., Peng, C., 2022. Evolutionary game strategy of stakeholders under the sustainable and innovative business model: A case study of green building. J. Clean. Prod. 333, 130136. https://doi.org/10.1016/j.jclepro.2021.130136.

Mangla, S.K., Luthra, S., Jakhar, S., Gandhi, S., Muduli, K., Kumar, A., 2020. A step to clean energy - Sustainability in energy system management in an emerging economy context. J. Clean. Prod. 242, 118462. https://doi.org/10.1016/J.JCLEPRO.2019.118462.

Mankata, L. M., Owusu-Manu, D. G., Hosseini, M. R., & Edwards, D. J. (2020). Analysis of success-dependent factors for green bond financing of infrastructure projects in Ghana. *10.1080/20430795.2020.1803640*, *12*(3), 832–848. 10.1080/20430795.2020.1803640

Mengist, W., Soromessa, T., Legese, G., 2020. Method for conducting systematic literature review and meta-analysis for environmental science research. MethodsX 7, 100777. https://doi.org/10.1016/j.mex.2019.100777.

Miemczyk, J., Howard, M., Johnsen, T.E., 2016. Dynamic development and execution of closed-loop supply chains: a natural resource-based view. Suppl. Chain Manage. Internat. J. 21 (4), 453–469. https://doi.org/10.1108/SCM-12-2014-0405.

Mir, A.A., Bhat, A.A., 2022. Green banking and sustainability – a review. Arab Gulf J. Sci. Res. 40 (3), 247–263. https://doi.org/10.1108/AGJSR-04-2022-0017.

Moore, S.B., Manring, S.L., 2009. Strategy development in small and medium sized enterprises for sustainability and increased value creation. J. Clean. Prod. 17 (2), 276–282. https://doi.org/10.1016/j.jclepro.2008.06.004.

Mushi, G.E., di Marzo Serugendo, G., Burgi, P.-Y., 2022. Digital Technology and Services for Sustainable Agriculture in Tanzania: A Literature Review. Sustainability 14 (4), 2415. https://doi.org/10.3390/su14042415.

Mutezo, G., Mulopo, J., 2021. A review of Africa's transition from fossil fuels to renewable energy using circular economy principles. Renew. Sustain. Energy Rev. 137, 110609. https://doi.org/10.1016/j.rser.2020.110609.

Ng, A.W., 2018. From sustainability accounting to a green financing system: Institutional legitimacy and market heterogeneity in a global financial centre. J. Clean. Prod. 195, 585–592. https://doi.org/10.1016/j.jclepro.2018.05.250.

Paramati, S.R., Shahzad, U., Doğan, B., 2022. The role of environmental technology for energy demand and energy efficiency: Evidence from OECD countries. Renew. Sustain. Energy Rev. 153, 111735. https://doi.org/10.1016/j.rser.2021.111735.

Peng, H., Shen, N., Ying, H., Wang, Q., 2021. Can environmental regulation directly promote green innovation behavior?—— based on situation of industrial agglomeration. J. Clean. Prod. 314, 128044. https://doi.org/10.1016/j.jclepro.2021.128044.

Pieroni, M.P.P., McAloone, T.C., Pigosso, D.C.A., 2019. Business model innovation for circular economy and sustainability: A review of approaches. J. Clean. Prod. 215, 198–216. https://doi.org/10.1016/j.jclepro.2019.01.036.

Polzin, F., Sanders, M., 2020. How to finance the transition to low-carbon energy in Europe? Energy Policy 147, 111863. https://doi.org/10.1016/j.enpol.2020.111863.

Qin, T., Wang, L., Zhou, Y., Guo, L., Jiang, G., Zhang, L., 2022. Digital Technology-and-Services-Driven Sustainable Transformation of Agriculture: Cases of China and the EU. Agriculture 12 (2), 297. https://doi.org/10.3390/agriculture12020297.

Ray, G., Barney, J.B., Muhanna, W.A., 2004. Capabilities, business processes, and competitive advantage: choosing the dependent variable in empirical tests of the resource-based view. Strateg. Manag. J. 25 (1), 23–37. https://doi.org/10.1002/smj.366.

Rennings, K., 2000. Redefining innovation — eco-innovation research and the contribution from ecological economics. Ecol. Econ. 32 (2), 319–332. https://doi.org/10.1016/S0921-8009(99)00112-3.

Richardson, B.J., 2009. Climate finance and its governance: moving to a low carbon economy through socially responsible financing? Internat. Comp. Law Quart. 58 (3), 597–626. https://doi.org/10.1017/S0020589309001213.

Rizos, V., Behrens, A., van der Gaast, W., Hofman, E., Ioannou, A., Kafyeke, T., Flamos, A., Rinaldi, R., Papadelis, S., Hirschnitz-Garbers, M., Topi, C., 2016. Implementation of Circular Economy Business Models by Small and Medium-Sized Enterprises (SMEs): Barriers and Enablers. Sustainability 8 (11), 1212. https://doi.org/10.3390/su8111212.

Sadiq, M., Amayri, M.A., Paramaiah, C., Mai, N.H., Ngo, T.Q., Phan, T.T.H., 2022. How green finance and financial development promote green economic growth: deployment of clean energy sources in South Asia. Environ. Sci. Pollut. Res. 29 (43), 65521–65534. https://doi.org/10.1007/s11356-022-19947-9.

Sahoo, S., Kumar, A., Upadhyay, A., 2023. How do green knowledge management and green technology innovation impact corporate environmental performance? Understanding the role of green knowledge acquisition. Bus. Strateg. Environ. 32 (1), 551–569. https://doi.org/10.1002/BSE.3160.

Sawe, F.B., Kumar, A., Garza-Reyes, J.A., Agrawal, R., 2021. Assessing people-driven factors for circular economy practices in small and medium-sized enterprise supply chains: Business strategies and environmental perspectives. Bus. Strateg. Environ. 30 (7), 2951–2965. https://doi.org/10.1002/BSE.2781.

Shah, B.J., Shroff, A., 2022. Inventory model for sustainable operations of fixed-life products: Role of trapezoidal demand and two-level trade credit financing. J. Clean. Prod. 380, 135093. https://doi.org/10.1016/j.jclepro.2022.135093.

Song, M., Xie, Q., Shen, Z., 2021. Impact of green credit on high-efficiency utilization of energy in China considering environmental constraints. Energy Policy 153, 112267. https://doi.org/10.1016/j.enpol.2021.112267.

Song, W., Yu, H., 2018. Green Innovation Strategy and Green Innovation: The Roles of Green Creativity and Green Organizational Identity. Corp. Soc. Respon. Environ. Manag. 25 (2), 135–150. https://doi.org/10.1002/csr.1445.

Soundarrajan, P., Vivek, N., 2016. Green finance for sustainable green economic growth in India. Agric. Econ. (Zemědělská Ekonomika) 62 (1), 35–44. https://doi.org/10.17221/174/2014-AGRICECON.

Tomić, T., Schneider, D.R., 2020. Circular economy in waste management – Socio-economic effect of changes in waste management system structure. J. Environ. Manage. 267, 110564. https://doi.org/10.1016/j.jenvman.2020.110564.

Triguero, Á., Cuerva, M.C., Sáez-Martínez, F.J., 2022. Closing the loop through eco-innovation by European firms: Circular economy for sustainable development. Bus. Strateg. Environ. 31 (5), 2337–2350. https://doi.org/10.1002/bse.3024.

Vaka, M., Walvekar, R., Rasheed, A.K., Khalid, M., 2020. A review on Malaysia's solar energy pathway towards carbon-neutral Malaysia beyond Covid'19 pandemic. J. Clean. Prod. 273, 122834. https://doi.org/10.1016/j.jclepro.2020.122834.

Velvizhi, G., Nair, R., Goswami, C., Arumugam, S.K., Shetti, N.P., Aminabhavi, T.M., 2023. Carbon credit reduction: A techno-economic analysis of "drop-in" fuel production. Environ. Pollut. 316, 120507. https://doi.org/10.1016/j.envpol.2022.120507.

Wang, M., Li, X., Wang, S., 2021. Discovering research trends and opportunities of green finance and energy policy: A data-driven scientometric analysis. Energy Policy 154, 112295. https://doi.org/10.1016/J.ENPOL.2021.112295.

Wang, X., Li, W., Luo, Z., Wang, K., Shah, S.P., 2022c. A critical review on phase change materials (PCM) for sustainable and energy efficient building: Design, characteristic, performance and application. Energ. Buildings 260, 111923. https://doi.org/10.1016/j.enbuild.2022.111923.

Wang, Q.-J., Wang, H.-J., Chang, C.-P., 2022b. Environmental performance, green finance and green innovation: What's the long-run relationships among variables? Energy Econ. 110, 106004. https://doi.org/10.1016/j.eneco.2022.106004.

Wang, K.H., Zhao, Y.X., Jiang, C.F., Li, Z.Z., 2022a. Does green finance inspire sustainable development? Evidence from a global perspective. Economic Analysis and Policy 75, 412–426. https://doi.org/10.1016/j.eap.2022.06.002.

Wang, Y., Zhi, Q., 2016. The Role of Green Finance in Environmental Protection: Two Aspects of Market Mechanism and Policies. Energy Procedia 104, 311–316. https://doi.org/10.1016/J.EGYPRO.2016.12.053.

Welter, F., Smallbone, D., 2011. Institutional Perspectives on Entrepreneurial Behavior in Challenging Environments. J. Small Bus. Manag. 49 (1), 107–125. https://doi.org/10.1111/j.1540-627X.2010.00317.x.

Winans, K., Kendall, A., Deng, H., 2017. The history and current applications of the circular economy concept. Renew. Sustain. Energy Rev. 68, 825–833. https://doi.org/10.1016/j.rser.2016.09.123.

Yadav, S., Choi, T.M., Kumar, A., Luthra, S., Naz, F., 2023. A meta-analysis of sustainable supply chain practices and performance: the moderating roles of type of economy and innovation. Int. J. Oper. Prod. Manag. 43 (5), 802–845. https://doi.org/10.1108/IJOPM-05-2022-0328/FULL/PDF.

Yang, Y.Cong, Nie, P. Yan, Huang, J. Bo, 2020. The optimal strategies for clean technology to advance green transition. Sci. Total Environ. 716, 134439. https://doi.org/10.1016/J.SCITOTENV.2019.134439.

Yu, W., Jamasb, T., Pollitt, M., 2009. Willingness-to-pay for quality of service: an application to efficiency analysis of the UK electricity distribution utilities. Energy J. 30 (4). https://doi.org/10.5547/ISSN0195-6574-EJ-Vol30-No4-1.