Innovative Technological Solutions for Environmental Sustainability in Chinese Engineering Practices

Azhar Ud Din
School of Management, Harbin Institute of Technology, China
azhar.marwat@hit.edu.cn (corresponding author)

Yang Yang
School of Management, Harbin Institute of Technology, China
yfield@hit.edu

Muhammad Inam Makki Khan
School of Economics and Management, Chang'an University, China
inamkhan@chd.edu.cn

Waqas Khuram
School of Management, Harbin Institute of Technology, China
waqaskhuram@hit.edu.cn

Received: 20 January 2024 | Revised: 9 February 2024 | Accepted: 24 February 2024

 DOI: https://doi.org/10.48084/etasr.6935

ABSTRACT

The Chinese government announced the clear goal of attaining carbon neutrality by 2060, in order to gradually achieve net-zero carbon dioxide (CO_2) emissions, whose impact on global warming needs to be reduced while also a sustainable industry needs to be promoted. Recognizing the critical role of Green Human Resource Management (GHRM) in supporting green innovation and achieving the carbon neutrality agenda, this study aims to fill a research gap by emphasizing this overlooked nexus. The former examines the influence of GHRM, green innovation, and carbon neutrality on environmental performance by carefully analyzing the current literature on China's achievement of carbon neutrality and its implications for environmentally friendly performances. The current study assesses the planning frameworks of the country, explores the concept of achieving carbon neutrality, and evaluates the practical implications.

Keywords-green human resource management; carbon neutrality; environmental performance; green innovation; China

I. INTRODUCTION

Environmental pollution and the necessity for sustainable resource utilization are considered important worldwide issues due to environmental concerns and resource limitations and constitute a top priority for communities, governments, and residents. Businesses must take responsibility to address these challenges. Many businesses adopt environmentally friendly initiatives to gain a competitive edge and enhance their Environmental Performance (EP). These organizations allocate resources to address sustainability challenges and respond to the demands of stakeholders [1, 2]. Implementing Green Human Resource Management (GHRM), Green Innovation (GI), and carbon neutrality policies can help leverage the impact of these difficulties. GHRM refers to adopting environmentally friendly practices in various aspects of employee management, such as recruitment, training, involvement, leadership, rewards, compensation, performance appraisal, and orientation to environmental corporate social responsibility. These practices aim to assist a company in achieving its environmentally friendly goals [3-5]. Researchers have investigated the impact of GHRM on financial performance [6], EP [7], and workplace practices [8]. It is widely recognized that the environmental effects of GHRM procedures can be considered at every stage of the process because GHRM practices help organizations implement and maintain an Environmental Management System (EMS), which in turn helps individuals achieve better EP [9]. GHRM is essential to company administration for various reasons,

including environmental benefits, professionality, and enhancing the company's appeal. Human Resource Management (HRM) used to be concentrated on the influence of particular practices on organizational effectiveness [10]. Aligning GHRM policies can significantly impact the environment and organizational performance [11]. As a result, most current research on GHRM focuses on how GHRM practices affect efficiency, since they can potentially improve an organization's financial effectiveness, productivity and hence its economic performance [12-14].

GI is an innovation strategy for green processes and products that seeks to reduce energy use, stop pollution, create environmentally friendly products, recycle waste, and manage the environment [15, 16]. To enhance the performance of a business, green operational practices might be employed to mitigate environmental consequences. These initiatives include implementing GI and utilizing green technology to develop environmentally friendly products. The GI classification entails elements of the manufacturing process and product design. GI in manufacturing can minimize environmental impact throughout product acquisition, production, and delivery, whereas it is able to modify existing product designs to minimize the environmental impact [17].

Carbon neutrality is the process of lowering emissions of greenhouse gases (GHG) by the implementation of various strategies, including energy efficiency, the use of renewable energy sources, carbon offsetting, and carbon sequestration methods [18]. Carbon neutrality currently involves offsetting an equivalent amount of carbon and remarkably reducing gross carbon emissions, resulting in nearly zero impact on the ecosystem. Carbon neutrality is crucial for sustainable financial growth as most governments including China strive for ensuring sustainable EP [19-20]. China is presently the globe's biggest carbon emitter, having contributed 28% of all CO_2 emissions in 2019 due to its rapid economic expansion. Carbon intensity has increased by 45% since the preceding decade, surpassing the emissions produced by the US in 2007, the EU, and the UK collectively [21]. The downward economic development from 2013 to 2016 indicated that China's CO_2 emissions reduced [21, 22]. After that, however, emissions began to increase again [22, 23] suggesting that long-term reduction remains a significant policy issue for China as for the rest of the globe. The fast economic growth of China over the past three decades has resulted in several adverse side effects, such as resource depletion and environmental degradation, making it extremely difficult for the country's economy and society to expand sustainably [24]. Carbon Dioxide Emissions (CDE) are an important contributor to the climate state [25]. China is under intense pressure to reduce emissions because it is the largest producer of CDE in the world and one of the nations which have determined to attain carbon neutrality and eradicate carbon emissions by 2060 [26].

Human resources have long been acknowledged as essential to economic success for developed and developing countries [27]. However, there are always expenses associated with using commodities for the economy, which are are more evident for the ecosystem [27, 28].

Eco-design is the implementation of environmental considerations at every stage of the product creation process, aiming to diminish the environmental effects during the whole lifespan of the product [30]. The former is a component of environmentally friendly advancements and has been discovered to positively affect financial productivity [31]. Eco-friendly and good green performance influences vendor and consumer behavior, improving the financial success of worldwide operations [26, 32, 33]. Companies may be able to supply items that are barely damaging to the environment, boosting their EP by monitoring and teaching suppliers [34]. Emphasis on GI that uses eco-friendly manufacturing methods and reduces actual prices might help businesses achieve greater effectiveness while consuming fewer commodities. Nevertheless, the relationship between GHRM, carbon neutrality, GI, and green advantages needs further investigation. In order to look into the inverse relationships between various functions, the way green management is scattered throughout multiple functional areas is studied in [35]. Even though GI and GHRM are widely acknowledged to benefit their surroundings, there has not been much investigation into how these can be combined [36].

Although academics have mainly concentrated on firms' external difficulties, GHRM practice describes the inner procedures. The impact of carbon neutrality and GHRM on the EP or innovation is scarcely highlighted. This domain needs more research to determine how GHRM and GI help the triple bottom line and a company's economic and ecological efficiency. After acknowledging the need for carbon neutrality for sustainable EP, China's path to carbon neutrality should be more thoroughly examined. There is a big research gap, so, a review of the studies in this field is needed. Such a review would assist researchers in identifying significant concerns and research barriers and improve follow-up research. This study explores green management systems' effects on human resources, innovation, carbon neutrality, and green performance in China.

II. RESEARCH METHOD

Given the growing significance of sustainability, businesses must attain higher levels of economic growth and environmental and social performance. This necessity also emerges due to innovations and the critical role that GHRM functions and carbon neutrality can play in the latter. This paper explores the link between GHRM and carbon neutrality on the EP in the presence of GI. A conceptual model that connects these crucial functions and structures with the corresponding elements and dimensions is created. Additionally, this research explicitly utilizes the conceptual framework developed in [11], which combines HRM, i.e. organizational sustainability, and green organizational activities that further modify and extend the EP, which is a crucial aspect of environmental sustainability. Earlier studies have not made connections between the elements of EP and the elements of GHRM and carbon neutrality. The research steps are:

- Step 1: Problem identification by reviewing the existing literature for an integrative model connecting the concepts.

- Step 2: An analysis of specific sources or studies on the topic.
- Step 3: An idea for integrating carbon neutrality, GHRM, and EP based on the traits of GI is presented.
- Step 4: Presentation of the results with recommendations for additional study and their implications for model implementation and knowledge advancement.

The lack of existing research connecting carbon neutrality, GHRM, and EP led to the creation of a theoretical or conceptual model combining the three components of operations management (step 1). The need to approach the topic holistically is reinforced to ensure that the model is helpful for academics and practitioners and has significant future research potential (steps 2–4). This approach should be guided by existing theory and research.

The databases and search engines utilized for this study included Google Scholar, Web of Science, Science Direct, Emerald, Springer, MDPI, and Wiley. Every database needed a unique and specific approach. Our analysis focused on the following basic keyword combinations: "green human resource management," "GI," "EP," and "carbon neutrality." All references were gathered into a Mendeley database. Three different researchers independently assessed the references and chose the final collection of papers for further study. To ascertain the inclusion of documents in this review that encompassed contemporary subjects and concerns within the sectors of interest, the researchers carefully examined the titles and abstracts of each article to determine their suitability for inclusion in the selection. The relevant literature was carefully selected manually. The text was rigorously analyzed to identify themes and terminology related to the current study.

III. GREEN HUMAN RESOURCE MANAGEMENT

GHRM refers to a system that develops and executes HRM practices to emphasize the influence of the actions of an organization on the surrounding environment [37]. GHRM refers to implementing environmentally friendly practices in various aspects of employee management, such as recruitment, training, involvement, leadership, rewards, compensation, performance appraisal, and orientation to environmental corporate social responsibility. These practices aim to assist a company in achieving its environmentally friendly goals [3, 4]. Previous studies have investigated the relationship between GHRM and an entity's economic success [6], sustainability practices [7], and personnel attributes [38-40]. However, there is a lack of research on the organizational social aspect. This research aims to determine the fundamental connection between GHRM practices, GI, and carbon neutrality. The study also tries to fill the gap between GHRM and sustainable innovation literature.

Sustainable development and social consciousness have led to an increased focus on human resource departments, along with the economic, regulatory, and other components of greener manufacturing. Although human resources are increasingly viewed as "the soul of the company," particularly in the context of the environment, finance is still commonly acknowledged as the lifeblood of business [41]. A business can be rebuilt from the rubble with an identical replica of its previous structure and still function successfully. However, losing crucial human capital may cause a business to slow down. So, human resources serve as a company's knowledge foundation [42], inspiring other businesses to make additional investments in its potential. International employment practices necessitate the creation and managerial staff of global HR proficiency in a way that guarantees the attributes influencing their business strategy endorses the accomplishment of green growth goals. These practices give an enterprise significant dominance in the focus of a competitive environment. All firms will undoubtedly see a boost in their productivity, profitability, and long-term growth and development when they employ optimal resource allocation techniques [43]. Yet, the main issues are locating the benchmarks and implementing best practices. Considering human resources' attitudes, ideas, disposition, and behavior in achieving their institution's objectives related to sustainable development, an important question still has to be answered. The current corporate world regularly uses phrases like going green and sustainability, demanding that every corporation follow the highest eco-friendly and resource-efficient standard practices. The Go-Green Movement has produced green jobs in businesses by advocating the most efficient manufacturing techniques that decrease the adverse consequences of environmental contamination, wastage, and other dangerous substances. According to UBLS (US Bureau of Labor Statistics) (2013), green jobs address to either the manufacturing or the provision of services that contribute to the conservation and preservation of our precious resources. Also, green jobs may refer to a type of employment where the institutional staff is responsible for making their firms' production process more reliable, sustainable and eco-friendly, thereby reducing its negative impact on the planet. Reduced negative ecological impacts have been achieved by investments in green resources and cleaner production methods [44]. The "green wave" [45] across nations has strengthened the significance of producing higher possibilities, especially in businesses with a reliable strategy and management objectives. Subsequently, GHRM appeared as a unique discipline from both theory and practice standpoints due to the rising ecologic concerns [46, 47]. Managers are willing to make investments in maintaining and expanding their understanding in hopes of transforming their organization into one that is economically viable via eco-innovation and individual development [24]. By aiding an organization in sustaining its understanding through optimal eco-friendly practices that produce no emissions of ecological disharmony, GHRM delivers additional economic strategies for accomplishing sustainability objectives [48].

Green rewards and performance administration practices can help align employees' behavior with an institution's operational objectives [49]. Although GI is the element of ecological administration that identifies specific sustainability problems, green performance is an effective source to boost executive environmental responsibility and, as a result, the eagerness to participate in eco-friendly innovation [46]. Moreover, encouraging innovative green products, process ideas, and environmental activities can foster an innovative work atmosphere [50]. According to the relevant research,

HRM systems can positively impact the development of new products or processes [51]. Hence, combining HRM practices with other practices can significantly affect innovation more than using individual techniques alone [52]. Even though GHRM research has attracted a great amount of attention recently, much of the earlier work in this area [53] focuses on how businesses can become aware of, adopt, and apply GHRM strategies [49]. A literature review is necessary to research the potential influence of applying GHRM practices in organizations. An in-depth tool enables categorizing and reducing a sizable quantity of information previously obtained using qualitative assessment methods that use precise and consistent decision standards to find relevant gaps in the literature [54].

IV. GREEN INNOVATION

Innovation refers to the systematic conversion of ideas into novel products, services, or processes that enable a company to gain a competitive advantage in the market [55]. GI (GI) is crucial for promoting green growth [56]. GI includes different aspects of innovation that specifically target energy conservation, recycling of waste materials, prevention of pollution, reduction of waste, creation of eco-friendly products, and implementation of an EMS [57]. The concept of GI aims to mitigate the adverse environmental impacts of production and activities by improving methods, techniques, structures, products, and management strategies [58, 59]. By utilizing these innovations, businesses are better able to encourage green growth and address environmental protection issues. GI can be categorized into three distinct forms: process innovation, product innovation, and Green Management Innovation (GMI) [17, 60]. Green Process Innovation (GPI) uses green process technologies, including clean production, pollution control, pollution prevention, environmental efficiency, and recirculation. These technologies involve the implementation of novel or enhanced activities that contribute to creating goods or services from a sustainability perspective [61, 62]. At the same time, GPI refers to developing goods or services by an enterprise that exhibits novel or significantly enhanced environmental characteristics [63, 64]. On the other hand, GMI involves implementing innovative environmental management practices within a corporation [17, 65]. GMI focuses on green management techniques within organizations, emphasizing novelty-level invention, whether initiated or adopted by other firms. Businesses with GI are remarkably successful and perform better than their rivals [66]. These businesses employ environmentally friendly resources and expertise to efficiently and promptly meet consumers' needs and serve as sources for organizations to increase their EP [1] while providing intangible assets and resources.

The effectiveness of EP is contingent upon organizational innovativeness and creativity, as highlighted in [67, 68]. This implies that EP should go beyond simply complying with established standards and policies [69, 71]. An organization's EP is influenced by various factors, including the ecological impact of its products, processes, resource allocation, and compliance with environmental regulations [72]. According to the literature, the effectiveness of ecological environment performance depends on several factors, which include the quality of eco-friendly products, implementing green procedures and innovations in merchandise, incorporating nature-consistent elements into organizational operation models, and integrating these elements into merchandise development processes [71-74]. GI is commonly integrated into an organization's environmental management plan to enhance the EP [75, 77]. Authors in [78] emphasized that innovation in the context of environmentally friendly practices involves implementing strategies to minimize waste, mitigate global warming, and optimize the utilization of natural resources. The non-manufacturing/service businesses, such as banks, hotels, and manufacturing industries, can prioritize GIs to ensure their investments are directed toward sustainable resources.

V. CARBON NEUTRALITY

Carbon neutrality is the process of lowering GHG emissions by the implementation of various strategies, including energy efficiency improvements, the use of renewable energy sources, carbon offsetting, and carbon sequestration methods [18, 80]. The state of carbon neutrality is reached when human activities take in the same amount of carbon dioxide (CO_2) they release [79]. Since it is not possible to attain zero CO_2 emissions, it is necessary to achieve a balance between residual emissions and removal emissions through the use of carbon offsetting or renewable energy [81]. The elimination of anthropogenic GHG emissions is referred to as net-zero emissions and the climatic indices that are utilized to monitor these emissions are those that determine the phrase [82]. In general, the objective of carbon neutrality is to reduce carbon emission's impact on the climate by lowering and compensating for those emissions.

VI. PATHWAY TOWARD CARBON NEUTRALITY

A. Negative Emission Technology (NET)

NETs, concerned with ecological security and international climate policy, are crucial for meeting the 1.5 °C temperature reduction goal. Ecological development and environmental impact are key research areas of NET and GHRM. Research studies of NETs focus on the expenses and advantages of technological innovations and the socioeconomic effects of NET deployment. A range of approaches, such as geoinformation research, lifecycle evaluation, and raw material analysis, are employed to study the accessibility of the financial support needed to facilitate the creation of NETs and their external environmental repercussions [83, 86, 87].

B. Zero-Carbon Technology

The carbon peak and neutrality objectives will force previously carbon-intensive firms to innovate and go through many transitions because businesses have historically been the biggest emitters of GHG emissions. Present investigations concentrate on microbial synthetic structures, carbon-neutral methanol innovation, advanced biofuel, photoelectrically degradation, and zero-carbon construction materials. Green manufacturing is an essential first step in predominant view and modernizing traditional industries. Investigators should consider conventional construction and scientific constraints to determine whether these processes have low or zero carbon

emissions. To promote the decarbonization of activities, appropriate carbon emission assessment and accounting practices must be adopted [88, 90].

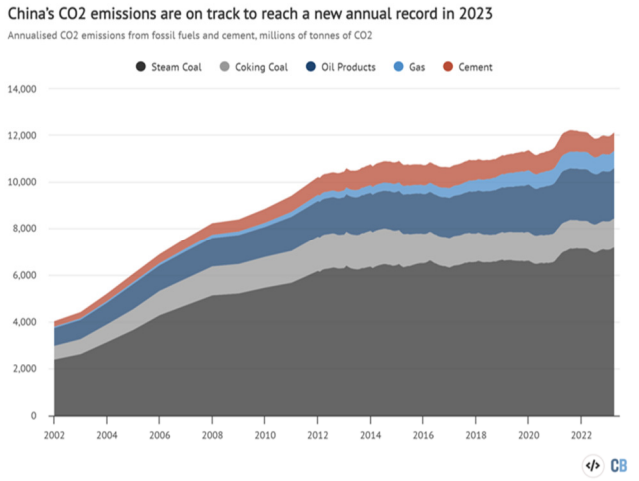

Fig. 1. China's CO_2 emissions, categorized into cement, gas, oil, coking coal, and steam coal. Emissions are calculated using data from the National Bureau of Statistics regarding the production of various fuels and cement, China Customs data on imports and exports, and WIND Information data on inventory changes. The calculations utilize default emission factors provided by the Intergovernmental Panel on Climate Change (IPCC) and annual emissions factors per ton of cement production up until 2019. The monthly readings are converted to yearly fuel consumption data in the Statistical Communiques and the annual Yearbooks published by the National Bureau of Statistics. Chart created by Carbon Brief [87].

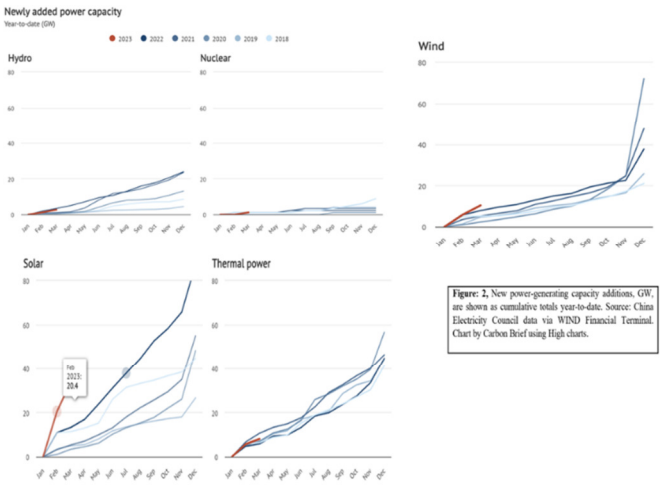

Fig. 2. Total number of new power-generating capacity additions, measured in GW. Source: China Electricity Council data via WIND Financial Terminal. Chart created by Carbon Brief [87].

C. Carbon Pricing Mechanism

There is a strong record of using economic incentives to decrease CO_2 emissions. By 2020, 61 carbon pricing schemes, which will account for 22% of global GHG emissions, were expected to be globally implemented. Due to the novel features of every state, different pricing techniques can be applied to various economic sectors in different ways. Implementing carbon pricing plans would be costly, whereas the fairness of the upcoming regional and industrial growth is a concern. Determining the types of organizations that must reduce emissions and validating and maintaining a watchful eye on carbon emission data are essential to efficient corporate carbon management. The guiding principles of market mechanism and design should ensure that market forces reduce emissions regardless of the pricing mechanism and efficiency [91, 94].

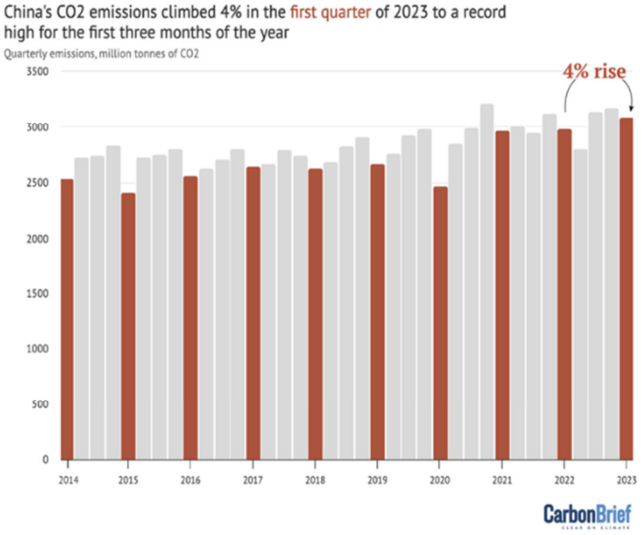

Fig. 3. China's quarterly emissions from fossil fuels and cement, measured in million tons of CO_2. Emissions are calculated using data from the National Bureau of Statistics regarding fuel and cement production, China Customs data on imports and exports, and WIND Information data on inventory changes. The calculations utilize default emissions factors provided by the IPCC and annual emissions factors per ton of cement production until 2019. The monthly statistics are adjusted to match the yearly fuel consumption data in the Statistical Communiques and the National Bureau of Statistics' annual Yearbooks. Chart created by Carbon Brief [87].

D. Green Performance under a Scenario of Carbon Neutrality

The term green performance refers to the impact on an entity's, such as a business, community, or country environment and future sustainability. Green performance is essential in reaching carbon neutrality, and tries to balance the removal of GHG and their emission from the atmosphere [95]. Numerous aspects of green performance have the potential to contribute towards achieving carbon neutrality, such as energy efficiency, renewable energy utilization, circular economy adaptation, Sustainable Transportation, and carbon offset and removal. Improving energy efficiency is a critical component of lowering carbon emissions. Energy-efficient technologies and practices can help businesses reduce their energy use and, as a result, their carbon footprint. For example, research has shown that energy-efficient buildings can dramatically reduce GHG emissions [96]. Green performance can be improved by implementing energy management systems, renewable energy sources, and energy-saving techniques [97, 98]. To become carbon neutral, we must switch to renewable energy sources. Renewable energy sources like solar, wind, and hydropower do not increase GHG emissions when producing energy. A circular economy encourages material reduction, reuse,

recycling, and recovery to lessen the demand for raw materials and the accompanying emissions from extraction and production. Circular manufacturing, waste management, and consumption practices can improve EP and contribute to carbon neutrality [99]. The transportation sector is also an essential contributor to carbon emissions.

The adoption of Electric Vehicles (EVs) and the enhancement of public transportation infrastructure have the potential to facilitate the attainment of carbon neutrality. EVs exhibit a notable reduction in emissions compared to vehicles powered by internal combustion engines. Research has demonstrated that promoting EVs and enhancing public transportation systems can significantly reduce GHG emissions [100]. Achieving 100% carbon neutrality may not always be possible in the short term. As a result, carbon offset techniques are frequently employed. Carbon offset allows businesses to invest in projects that reduce or eliminate GHG emissions, effectively offsetting their total emissions. For example, investing in forestry initiatives or carbon capture and storage can help achieve carbon neutrality [101].

To summarize, in a carbon-neutral situation, green performance is important. Energy efficiency, renewable energy, circular economy, sustainable transportation, and carbon offsetting and removal are all critical components in reaching carbon neutrality and lowering GHG emissions.

VII. PRACTICAL IMPLICATIONS

The findings of this research will enable public and private firms in China to understand how to handle their ethical responsibility to the environment. According to these results, it can be assumed that GHRM practices, GI, and carbon neutrality positively impact EP and promote an environmental management-based philosophy. Environmental friendly practices of GHRM, GI, and sustainable performance would improve community wellness and enhance company reputation. They would also save money and promote company social responsibility. Although the outcomes from the present research show a positive relationship with EP, it is essential to examine the various interactions between carbon neutrality, GHRM, GI, and EP. Therefore, the former involve important practical implications for various stakeholders, including organizations, governments, and researchers committed to promoting sustainable initiatives, mitigating carbon emissions, and fostering a more environmentally friendly and sustainable future. The primary and most immediate advantage of implementing green practices and attaining carbon neutrality is to reduce the environmental impact, such as the rapidly increasing rate of global warming. Similarly, achieving carbon neutrality would reduce the risk of natural disasters. The immediate effect would be to maintain the current social structure, while an indirect effect would be to encourage the development of society. Carbon neutrality will promote a transition in economic growth towards environmentally friendly, low-carbon, and sustainable development. It will also substantially influence emerging technology trends, including decarbonization, energy efficiency, recycling, new power systems, energy storage, and reduced emission technologies. In addition, new approaches will likely replace particular industries or enterprises. For instance, the current coal industry and its associated infrastructure, manufacturing, and service sectors are expected to experience more job losses. Carbon neutrality can lead to job growth in clean energy, carbon-free energy, and renewable energy sectors.

VIII. CONCLUSIONS AND FUTURE RESEARCH DIRECTIONS

Green practices and carbon neutrality are essential for the future ecological development. GHRM and GI assist low-carbon growth, shifting the emissions graph, and may lead to low-carbon neutrality to improve EP. China tries to become carbon neutral by 2060. However, there are many problems to solve along this journey. China is continuously trying to advance scientific research and developments to solve the challenges faced by businesses and people due to carbon emissions. For this purpose, China has been striving either by itself or by internationally collaborating with different countries and world organizations to bring carbon neutrality through a low-carbon strategy, efforts to save energy, use renewable energy, etc. As a result of the large-scale deployment of renewable power generation, mainly hydro, wind, and solar, the share of fossil fuel has reached an all-time low, and coal usage has plateaued. Similarly, several mitigation initiatives have been implemented to acknowledge how crucial China is in stabilizing the planet's climate. To meet these objectives, in December 2020, President Xi improved China's Intended Nationally Determined Contributions (INDC) targets to a >65% decrease in carbon intensity by 2030 from 2005 levels. In September 2020, the long-term mitigation goal of carbon neutrality by 2060 was proposed. Nevertheless, it is still challenging to understand the trends and trajectories of carbon emissions, given the lack of uncertainty around the global economy and technological advancements.

Achieving net-zero carbon emissions in China before 2060 will facilitate the promotion of sustainable and high-quality growth. Integrating carbon neutrality into national social and economic strategies would speed up the efficiency and greening of industrial and energy frameworks while fostering the advancement of new technologies within low-carbon industries. China is globally the top producer of green technologies since it has the highest installation capacity in the world for wind, solar, and hydro power. Each of these qualities has the potential to facilitate China's ability to transform and enhance its various businesses, hence fostering the creation of additional employment opportunities within green industries.

This article concludes by offering an in-depth review of the relationships among GHRM, GI, and EP within the framework of China's efforts toward achieving carbon neutrality. The study highlighted several reasons in favor of adopting GHRM practices and promoting GIs, stressing their potential to significantly enhance a firm's environmental performance and ultimately help achieve the carbon neutrality goals. The study's findings emphasize the importance of fostering a culture of sustainability within organizations through the strategic integration of HRM practices that embrace environmental values, such as green recruitment and selection, green training and development, green compensation, and green employee engagement. These sustainable approaches to HRM help employees gain environmental awareness, knowledge, skills,

and attitudes, promoting GI, technology developments, and environmentally friendly corporate strategies. Additionally, the research emphasizes the significance of fostering an encouraging corporate environment and integrating GI frameworks to assist the successful adoption of GHRM practices. It is pointed out that organizations should embrace a proactive and participatory stance in promoting eco-innovation. This involves fostering green creativity and facilitating the exchange of ideas and knowledge across various organizational levels and departments. Enhancing environmental performance requires the construction of collaborative networks, the formation of green teams, and the allocation of resources for innovation.

The study also provides information on China's distinct background and commitment to carbon neutrality. China's significant economic growth and enormous environmental issues make it a critical case study for understanding the dynamics of GHRM, GIs, and EP. The country's efforts to a transition from a carbon-intensive economy to a low-carbon and sustainable future are underlined and the necessity for the Chinese government, organizations, and policymakers to prioritize GHRM practices and promote GIs is accentuated. This study makes a valuable contribution to the current literature by illustrating the significant impact of GHRM and GI on the EP, aiding China's efforts toward achieving carbon neutrality.

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