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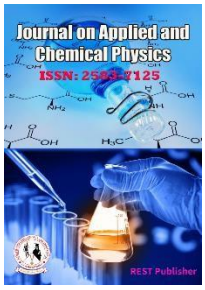

Evaluating Low Carbon Development Strategies Using the DEMATEL Technique: A Multi-Criteria Approach to Climate Change Mitigation

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Abstract: *Low carbon development refers to an approach that aims to address climate change and support sustainable economic growth by reducing greenhouse gas emissions. It involves the implementation of strategies and policies that prioritize renewable energy sources, energy efficiency, and sustainable practices in various sectors such as energy, transportation, agriculture, and construction. This summary provides an overview of the fundamental principles and advantages of low carbon development, highlighting its potential to tackle climate change, enhance energy security, foster innovation, and create environmentally friendly job opportunities. It also examines the importance of international cooperation and policy frameworks in enabling the shift towards a low-carbon economy cannot be overstated. These mechanisms play a crucial role in facilitating the transition and emphasize the necessity of collective efforts to attain global climate objectives. International cooperation forms the basis for tackling climate change worldwide. It establishes a platform for countries to work together, allowing them to exchange knowledge, share best practices, and transfer technologies necessary for effectively transitioning to a low-carbon economy. Collaborative efforts enable nations to combine their resources and expertise, making it easier to develop and adopt sustainable solutions. In essence, embracing low-carbon development provides a roadmap towards a future that is both sustainable and resilient, striking a harmonious equilibrium between economic growth, social welfare, and environmental conservation. Effective policies and governance frameworks are essential for facilitating the transition to a low carbon economy. Research in this field provides insights into the design, implementation, and evaluation of policies and regulatory measures. It helps identify barriers and opportunities for policy implementation, assesses the effectiveness of existing policies, and offers recommendations for policy improvements. Research also contributes to international cooperation and the development of global agreements and mechanisms to address climate change. research in low carbon development is of significant importance as it contributes to climate change mitigation, sustainable economic growth, energy security, technological innovation, and effective policy and governance. It provides evidence-based solutions and recommendations to guide policymakers, businesses, and society towards a more sustainable and resilient future. In this research we will be using DEMATEL technique. We have taken alternative parameters and evaluation parameters are* ***Absolutely*** *more important, strongly more important, obviously more important, slightly more important, equally important. out of all the 5 alternatives, absolutely more important, gets first rank and obviously more important is last rank. With the demote technique we are able to find the best project Inlow carbon development has been evaluated with various parameters and methodology.*

Keywords*: low-carbon development, low-carbon economy, low-carbon society.*

1. INTRODUCTION

The growing global concern regarding the impact of carbon dioxide emissions from energy sources on climate change has spurred countries to explore different approaches in addressing this issue. One such approach, known as low-carbon development, has garnered significant support. Low-carbon development aims to reduce carbon dioxide

emissions while promoting sustainable economic growth. However, the specific definition of low-carbon development can vary among nations and organizations. The literature introduces various terms associated with low-carbon development, including low-carbon energy, low-carbon lifestyle, low-carbon society, low-carbon city, low-carbon community, low-carbon tourism, and low-carbon global initiatives. possess distinct differences that should not be confused. This research study seeks to systematically analyze these concepts and establish a theoretical framework for investigating low-carbon development. Given the urgent need to address climate change and work towards a sustainable future, the concept of low-carbon development a focal point in global discussions. As the world grapples with the increasing challenges posed by greenhouse gas emissions, resource depletion, and environmental degradation, low-carbon development offers a comprehensive solution. Framework to address these pressing issues. This research paper thoroughly examines the various dimensions of low carbon development, investigating its importance, fundamental principles, and potential for bringing about significant change. The concept of low carbon development encompasses a wide array of approaches, governmental policies, and practical implementations that prioritize the mitigation of carbon dioxide and other greenhouse gas emissions. Concurrently, it aims to foster economic progress, ensure energy stability, and promote environmental sustainability. The central idea behind low carbon development advocates for a fundamental transformation in societal and economic operations, with a particular emphasis on transitioning away from fossil fuel-reliant systems to low carbon alternatives. By embracing renewable energy sources, energy efficiency measures, sustainable land use, and innovative technologies, low carbon development presents a viable pathway towards a more sustainable and resilient future. its implications across different sectors. It seeks to explore the effectiveness different policy interventions, technological advancements, and socio-economic considerations in facilitating the transition to a low carbon economy. By analyzing case studies, empirical data, and theoretical frameworks, this research aims to provide valuable insights and recommendations for policymakers, businesses, and stakeholders involved in shaping low carbon development strategies. Moreover, this research paper acknowledges the importance of international cooperation and collaborative efforts in addressing global climate challenges. It explores the role of policy frameworks, multilateral agreements, and the sharing of best practices in advancing low carbon development on a global scale. Additionally, it examines the potential socio-economic benefits, including job creation, improved public health, and enhanced energy security, that can be derived from embracing low carbon practices. To summarize, its fundamental principles, and its potential to bring about significant change. The paper also examines successful approaches, policy measures, and technological advancements to provide valuable insights to decision-makers and stakeholders. By doing so, it aims to equip them with information regarding the opportunities and challenges associated with transitioning to a low carbon economy. Ultimately, the research aims to promote sustainable development by achieving a synergistic relationship between economic growth, social welfare, and environmental preservation.

2. MATERIALS AND METHOD

The article discusses the methodology used to establish criteria for CO2 capture and iron-making technology. The process of evaluating these criteria and applying the 2-tuple DEMATEL technique. The results and analysis of the collected data are presented in Section 4. Section 5 focuses on investigating the causes and effects of the identified criteria. Finally, the conclusion section provides a summary of the study's findings and suggests directions for future research. The research primarily concentrates on identifying key metrics for information systems and supply chain sustainability. It explores the impact of information systems on supply chain sustainability through an exploratory study conducted at Mobarakeh Steel Complexes, the largest steel company in Iran. The study utilizes the DEMATEL method, which is a multi-criteria decision-making approach, to assess the relative importance of the identified factors and understand their interrelationships. The DEMATEL method enables the quantification of subjective judgments in a measurable and evaluative manner. It is employed alongside the Analytic Hierarchy Process (AHP), another method used to gather input data through pair-wise comparisons. Together, these methods facilitate the understanding of connections between factors and the determination of their relative significance.is a valuable tool extensively used in research for analyzing intricate cause-and-effect relationships and comprehending the interdependencies among various factors. It offers a systematic approach to assess the mutual influences and significance of different factors within a research context. This section of the research paper presents a summary of the DEMATEL method, its application, and its importance in facilitating decision-making and problem-solving processes. The DEMATEL method, rooted in graph theory, finds widespread use in disciplines such as management, engineering, economics, and social sciences. Its main objective is to investigate set of factors and determine their relative importance. By employing a combination of qualitative and quantitative techniques, DEMATEL enables

researchers to grasp the complex interactions and feedback loops inherent in a system. The process of implementing the DEMATEL method encompasses several crucial steps. In the beginning, researchers begin by identifying and defining the factors or variables that are relevant to a particular problem or decision-making process. These factors can be either tangible or intangible and are often represented in a cause-and-effect matrix. Following this, experts or stakeholders are consulted to obtain their opinions or assessments on the relationships between these factors. The gathered data is then used to construct an influence matrix, which evaluates events or phenomena where one event, known as the cause, leads to another event, known as the effect connections among the different factors. After the establishment of the influence matrix, the DEMATEL method utilizes a set of calculations to ascertain the direct and indirect impacts of each factor. This enables the classification of factors into cause factors (those with high driving power) and effect factors (those significantly influenced by other factors). Furthermore, the method generates measurements such as total effect and total causalities for each factor, providing a comprehensive understanding of the overall relationships within the system. The importance of the DEMATEL method lies in its ability to provide valuable insights for decision-making and problem-solving endeavors. It helps researchers identify critical factors that have a significant impact on the system by visually representing and quantifying application of the DEMATEL method, it becomes possible to prioritize tasks, allocate resources efficiently, and develop effective strategies. It also aids in identifying feedback loops and potential bottlenecks within a system, enabling researchers to address the underlying causes of issues and make well-informed decisions. Ultimately, the DEMATEL method serves as a valuable research tool for understanding complex cause-and-effect relationships among factors. Its systematic approach offers insights into the mutual influences and importance of these factors, thus supporting decision-making, problem-solving, and system analysis. Through the use of the DEMATEL method, researchers can gain a deeper understanding of interdependencies within a system and develop effective strategies to overcome challenges and take advantage of opportunities in their respective research domains.

3. RESULT AND DISCUSSION

TABLE 1. Low Carbon Development

	Absolutely more important	Strongly more important	Obviously more important	Slightly more important	Equally important	SUM
Absolutely more important	0	3	2	4	2	11
Strongly more important	3	0	2	3	2	10
Obviously more important	2	2	0	4	1	9
Slightly more important	2	2	2	0	2	8
Equally important	2	2	2	1	0	7

Table 1 showing Low carbon development using the analysis method in DEMATEL method, alternative preference and evaluation preference: absolutely more important, strongly important, obviously more important, slightly more important, equally important.

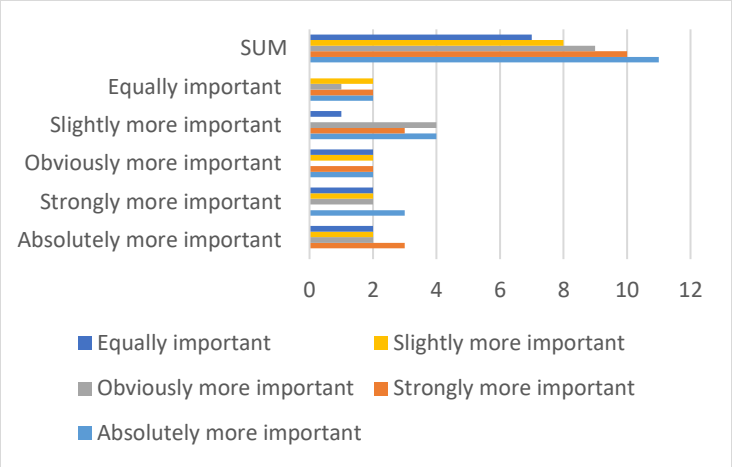

FIGURE 1. Low Carbon Development

FIGURE 1 showing Low carbon development using the analysis method in DEMATEL method, alternative preference and evaluation preference: absolutely more important, strongly important, obviously more important, slightly more important, and equally important.

TABLE 2. Normalization of direct relation matrix

	Absolutely more important	Strongly more important	Obviously more important	Slightly more important	Equally important
Absolutely more important	0	0.272727273	0.181818182	0.363636364	0.181818182
Strongly more important	0.272727273	0	0.181818182	0.272727273	0.181818182
Obviously more important	0.181818182	0.181818182	0	0.363636364	0.090909091
Slightly more important	0.181818182	0.181818182	0.181818182	0	0.181818182
Equally important	0.181818182	0.181818182	0.181818182	0.090909091	0

Table 2 showing Low carbon development using the analysis method in DEMATEL method, Normalization of alternative preference and evaluation preference: absolutely more important, strongly important, obviously more important, slightly more important, equally important.

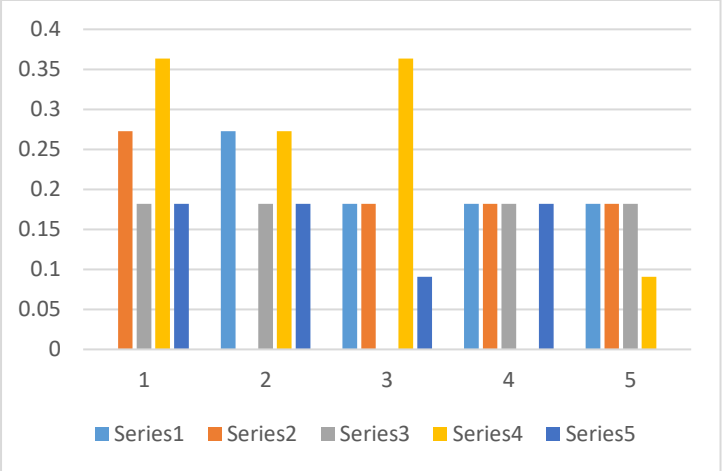

FIGURE 2. Normalization of direct relation matrix

Figure 2 showing Low carbon development using the analysis method in DEMATEL method, Normalization of direct relation matrix of alternative preference and evaluation preference: absolutely more important, strongly important, obviously more important, slightly more important, equally important.

TABLE 3. Deviation sequence

	Ri	Ci
Absolutely more important	5.208797	4.5304716
Strongly more important	4.6216216	4.8214096
Obviously more important	3.5463699	4.5136902
Slightly more important	4.0063593	4.4165342
Equally important	4.9517753	4.0528175

Table 3 showing Low carbon development using the analysis method in DEMATEL method, Deviation sequence of alternative preference and evaluation preference: absolutely more important, strongly important, obviously more important, slightly more important, equally important

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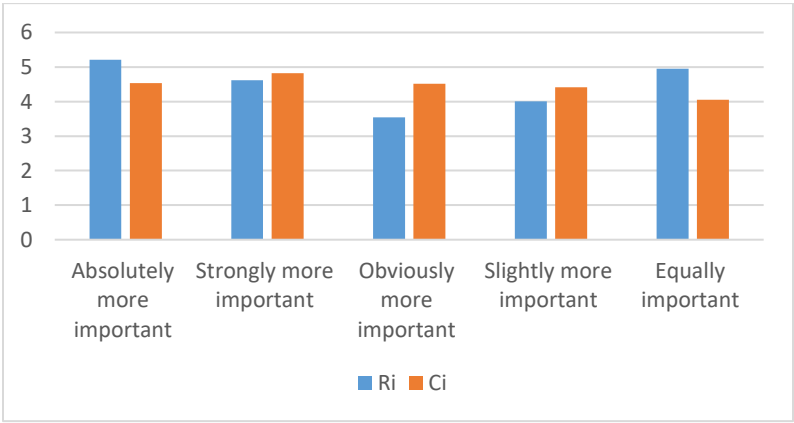

FIGURE 3. Deviation sequence

Figure 3 showing Low carbon development using the analysis method in DEMATEL method, Deviation sequence of alternative preference and evaluation preference: absolutely more important, strongly important, obviously more important, slightly more important, equally important

TABLE 4. Grey relation coefficient

	T matrix				
Absolutely more important	0.890832	1.100689	1.168345	1.038156	1.010775
Strongly more important	1.081081	0.8378378	0.963964	0.8648649	0.8738739
Obviously more important	0.7498675	0.7355591	0.6122593	0.81558	0.6331037
Slightly more important	0.7885533	0.952305	0.8325384	0.6661367	0.7668256
Equally important	1.020138	1.195019	0.936584	1.031797	0.7682388

Table 4 showing Low carbon development using the analysis method in DEMATEL method, grey relation coefficient alternative preference and evaluation preference: absolutely more important, strongly important, obviously more important, slightly more important, equally important.

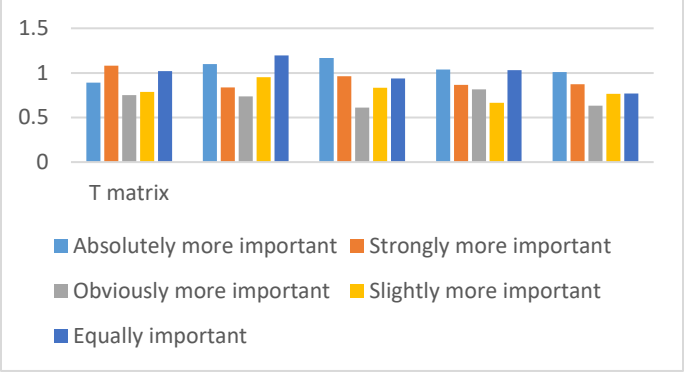

FIGURE 4. Grey relation coefficient

Figure 4 showing Low carbon development using the analysis method in DEMATEL method, grey relation coefficient alternative preference and evaluation preference: absolutely more important, strongly important, obviously more important, slightly more important, equally important.

TABLE 5. GRG and RANK

GRG	Rank
Absolutely more important	1
Strongly more important	2
Obviously more important	5
Slightly more important	4
Equally important	3

Table 5 showing in GRG DEMATEL method, alternative preference and evaluation preference: absolutely more important, strongly important, obviously more important, slightly more important, equally important.

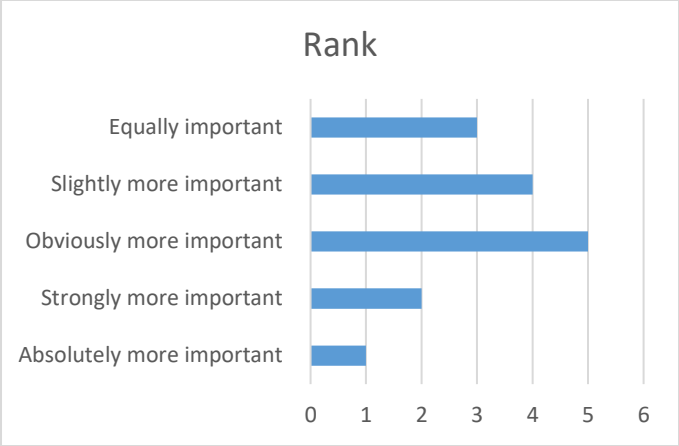

FIGURE 5. GRG and RANK

Figure 5 showing in GRG DEMATEL method, alternative preference and evaluation preference: absolutely more important, strongly important, obviously more important, slightly more important, equally important.

4. CONCLUSION

To summarize, this research paper has examined the concept of low carbon development as a comprehensive framework for addressing climate change challenges. It emphasizes the importance of this approach in achieving sustainable economic growth, ensuring energy security, driving technological innovation, and guiding effective policy and governance. The analysis highlights the potential of low carbon development to bring about transformative changes in societies and economies, fostering sustainability and resilience. Low carbon development provides a viable solution to tackle climate change by incorporating renewable energy sources, energy efficiency measures, sustainable land use practices, and innovative technologies. This approach not only reduces greenhouse gas emissions but also presents opportunities for sustainable economic growth through clean industries, green jobs, and improved resource efficiency. Moreover, low carbon development enhances energy security by reducing reliance on fossil fuels, diversifying energy sources, and strengthening resilience. Technological innovation is crucial in driving the transition to a low carbon economy, particularly in sectors like energy, transportation, agriculture, and manufacturing. Effective policies and governance frameworks are also essential, creating favorable conditions, promoting international collaboration, and fostering teamwork to address climate change and achieve global sustainable development goals. Additionally, this research has emphasized the various advantages linked to low carbon development. These benefits encompass better public health results, diminished environmental harm, increased energy accessibility, and the advancement of social fairness. By embracing low carbon approaches, communities can establish healthier and more conducive surroundings while addressing the difficulties posed by climate change However, it's important to recognize the obstacles and difficulties that could impede the implementation of strategies aimed at achieving low carbon development. These obstacles include limitations in technology, financial constraints, political and institutional challenges, as well as resistance to change. Overcoming these barriers requires promoting effective collaboration and knowledge sharing among stakeholders, along with targeted policy interventions. In summary, this research paper offers valuable insights into the significance and potential of low carbon development for achieving sustainable development. By examining the interconnections between economic, environmental, and social factors, it emphasizes. The study's findings contribute to the existing knowledge on low carbon development, providing a basis for informed decision-making, policy formulation, and further research in this critical field. Ultimately, embracing low carbon development is crucial for establishing a sustainable and resilient future for present and future generations.

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