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Article

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Suggested Citation: Abhishek N. et al. (2024) : Renewable energy initiatives by corporates and sustainable development – a mediation analysis, Cogent Economics & Finance, ISSN 2332-2039, Taylor & Francis, Abingdon, Vol. 12, Iss. 1, pp. 1-29,
<https://doi.org/10.1080/23322039.2024.2344122>

This Version is available at:

<https://hdl.handle.net/10419/321474>

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To cite this article: Abhishek N, Habeeb Ur Rahiman, Neethu Suraj, Abhinandan Kulal, Ashoka M L, M. S. Divyashree & Swapna Raghupathi (2024) Renewable energy initiatives by corporates and sustainable development – a mediation analysis, Cogent Economics & Finance, 12:1, 2344122, DOI: [10.1080/23322039.2024.2344122](https://doi.org/10.1080/23322039.2024.2344122)

To link to this article: <https://doi.org/10.1080/23322039.2024.2344122>



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Published online: 27 Apr 2024.



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Renewable energy initiatives by corporates and sustainable development – a mediation analysis

Abhishek N^a , Habeeb Ur Rahiman^b , Neethu Suraj^a , Abhinandan Kulal^c, Ashoka M L^d, M. S. Divyashree^e  and Swapna Raghupathi^f

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ABSTRACT

Corporate efforts in eradicating environmental negativities are a significant aspect that is playing a vital role to contribute sustainable development. Renewable energy initiatives by corporations are also a trending effort through which they can promote the generation and consumption process of clean energy that helps to conserve non-renewable natural resources and contributes to the same for future generations. Therefore, the study followed both quantitative and qualitative approaches to achieve the objectives. The qualitative approach consists of content analysis of earlier literature and theories and focus group discussions for finalizing the research instrument. The research instrument was distributed to managers and academicians through e-forms, 271 responses were received and 253 completed responses were considered for further analysis. The study employed descriptive statistics, structural equation modelling, and mediation analysis techniques to draw conclusions based on the objectives. The results of the one-sample t-test revealed that the respondents positively opined that renewable energy initiatives by corporations influence sustainable development. Further, the results of structural equation modelling and mediation analysis confirmed the influence of such initiatives have an indirect influence on sustainable development, mediated by the environmental, social, and economic aspects. The outcomes of this study help industries to know the importance of such initiatives and provide inputs to design their business models based on such initiatives and also guides to frame the policies to align their operations with sustainability. Further, the outcome also helps to correlate complex relationships between corporations' actions and sustainable development goals. Lastly, the study contributes to the existing body of knowledge on the intersection of corporations' initiatives, renewable energy, and sustainable development. Advancing the research in this field paves the way for future research and to frame policies for fostering sustainable business practices and addressing environmental issues.

IMPACT STATEMENT

The study focuses on stakeholders' perceptions on Renewable Energy Initiatives (REIs) by corporate entities and their impact on sustainable development. Many statistical experiments have been done and evidentially found that there is a positive perception among respondents on the influence of REIs by corporates on sustainable development. This influence is statistically mediated by environmental, social, and economic aspects. However, the study acknowledges limitations such as subjective perceptions, lack of assessment of long-term effects, and did not focus the actual practices of business entities. The outcome of the study offers insights for policy-makers to frame guidelines and frameworks for REIs, including company disclosure requirements, aligning national strategies with sustainability goals, and providing subsidies and incentives for such initiatives. This can lead to better monitoring, transparency, and coordinated efforts towards sustainability. The corporates can use this outcome as evidence while making decision on engaging in REIs, contributing to environmental, social and economic sustainability. The study also highlights the significance of disclosing such information in their reports to

ARTICLE HISTORY

Received 7 November 2023
Revised 28 March 2024
Accepted 12 April 2024

KEYWORDS



Renewable energy;
corporate initiatives; clean
energy; clean environment;
sustainable development;
UNSDG-7

REVIEWING EDITOR

Goodness Aye, University of
Agriculture, Makurdi Benue
State, Nigeria

SUBJECTS

Finance; Business,
Management and
Accounting; Environmental
Economics

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This article has been corrected with minor changes. These changes do not impact the academic content of the article.

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enhance accountability and transparency. And also helps in building corporate image and leadership in the market.

From the outcome of the current study, future studies can build upon existing theories like stakeholder theory and institutional theory. This can lead to a better understanding of how stakeholder interests and institutional pressures influence corporate decision-making regarding REIs.

The study also has significance in offering suggestions in developing sustainability frameworks to incorporate various factors beyond REIs alone, such as water usage, waste management, and supply chain sustainability. This would provide more comprehensive insights into corporate sustainability practices and their impacts.

1. Introduction

Due to rapid industrialization, natural resource exploitation is increasing daily (Usman & Balsalobre-Lorente, 2022). Natural disasters like earthquakes, landslides, tsunamis, and hurricanes are also frequently occurring (Barbier, 2010). Further, man-made disasters such as anthropogenic acts such as various pollution disturb the environment and create uncertainty for future generations (Naidu et al., 2021; Li et al., 2022). As a corporate citizen, it is the duty and responsibility of the company to undertake activities and initiatives that certainly minimize such negative externality on the environment and future generations (Reinhardt et al., 2008). Therefore, the promoting environmental-friendly business activities by inculcating various initiatives, for instance, Renewable Energy Initiatives (REI) such as the production, consumption, and distribution of renewable sources of energy, use of electric vehicles, production and distribution of RE products for instance solar panels, solar roofs and electric vehicles are necessary (Majid et al., 2020). There are many rules and regulations governing to protection of the environment that have emerged in recent times which have taken an initiation through ties with corporate bodies, NGOs, and Government initiatives that slowly eradicate environmental pollution, which in turn will protect the resources for future generations (Doh & Guay, 2006). Further, by undertaking such environmentally friendly initiatives companies can discharge their corporate responsibilities as per prevailing corporate legislation and they can also be involved in contributing to sustainable development and enjoy sustainable leadership at large (Székely & Knirsch, 2005; Charles et al., 2017).

Today corporates are running under a triple-bottom-line line business model which includes profit, people, and planet. By undertaking REI corporates can lower the overall business costs which in turn enhances profitability (Deason, 2018). On the other hand, they also lower toxic emissions/carbon footprint which in turn promotes a pollution-free environment that leads to the good health of people (Masondo, 2020). Further, such initiatives also reduce greenhouse gas emissions, improve air quality promote the conservation of non-renewable resources, and mitigate environmental degradation in turn promotes a green and clean sustainable environment that safeguards the planet at large (Khan et al., 2022).

REIs by corporates ensure energy security and reduce the dependency on external energy suppliers. This aspect particularly matters a lot during energy supply disruptions.

In other words, REI by corporations has a socio-economic and environmental impact that positively influences sustainable development (Michalek, 2008). In addition, they also provide access to green markets where companies can sell their excess renewable energy or get renewable energy certificates, this paves the way for additional revenue streams and promotes sustainability (Pineda & Bock, 2016).

The motivation behind this study emerged from the increasing recognition of the pivotal role that companies play in managing climate risks and promoting sustainable development. With the emergence of corporate renewable energy initiatives, there is a need to gain insights into specific means through which these initiatives contribute to attaining sustainable development goals. By considering the mediating factors involved, the present study aims to provide an in-depth understanding of corporate renewable energy efforts on social, environmental and economic outcomes.

Further, the current topic is of paramount importance in the context of global efforts to combat climate change and attain sustainable development goals. Understanding the manner through which corporate efforts on renewable energy initiatives lead to the creation of positive sustainability outcomes which are crucial for making policy decisions, framing corporate strategies, and promoting greater collaboration between the public and private sectors.

In this paper, an attempt has been made to evaluate the impact of REI by corporations on sustainable development through the mediation effect of environmental, social, and economic aspects.

The outcome of this study contributes to the existing literature by applying mediation analysis to explore the underlying manner through which corporate renewable energy initiatives impact sustainable development. This innovative approach followed in the current study not only advances the theoretical base but also offers practical insights that can support in designing and implementation of effective policies and strategies to promote corporate engagement in renewable energy practices to attain sustainable goals.

The succeeding part of the paper is organized as a literature review, conceptual model, methods, results, discussions, and conclusion.

2. Literature review

2.1. Green business practices

Pang et al. (2022) observed that many corporates including financial institutions started to promote e-business operations to minimize the negativities on the environment that occurred through carbon footprints. This aspect is also noted by Salman and Ismael (2023). In addition to this, Liu & Wu (2023) highlighted that a firm's green practices are positively correlated with improved financial performance.

Babon-Ayeng et al. (2022) noted that the prior experience in green projects plays a vital role in implementing green business practices. In support of this, Mishra et al. (2021) highlighted that undertaking green business practices supports following circular economy principles such as repair, reduce, reuse, and recycling in a business model that creates value for the business itself in the long run. This argument is also in consensus with the argument of Arena et al. (2022). Further, many researchers in their study for instance, Pujiati et al. (2022); Stocco et al. (2022), highlighted that the inculcation of a model that promotes the re-use of industry waste is a trend among many green business practices. Further, Di Vaio et al. (2022) as part of green business initiatives inducing artificial knowledge and digitization of supply chain management enhance the accountability, transparency, and sustainable performance of the organization at the core. In support of this, Wang et al. (2023) argued that by employing different technologies in business practices negativities such as carbon footprint and climate change can be minimized to a notable extent. This argument is also supported by Sovacool et al. (2020). On the other hand, Herth and Blok (2022) highlighted that the involvement of corporates along with governments in minimizing carbon emissions is essential to promote a sustainable socio-economic and natural environment.

2.2. Social responsibility practices

Social initiatives such as giving donations, charity, health initiatives, and scholarships enable business organizations to enjoy a social competitive advantage in the long run and that in turn helps organizations to get a customer base (Bidari & Djajadikerta, 2020).

Sovacool et al. (2020) in their study it is revealed that social values are strongly connected with sustainable development. They also highlighted that there is a lack of a common terminology and understanding of the relation between social values, sustainable development, and community-based projects. Interestingly, Gulema and Roba (2021) in their study it is pointed out that the firms' cooperative attitude toward foreign governments has a positive relation in undertaking more and more CSR activities. On the other hand, Parsa et al. (2018) noted that CSR practices undertaken by companies are more concentrated on labour welfare practices and it is less practised in society, human rights, and other aspects.

The companies need to be involved in undertaking initiatives that minimize supply chain costs and contribute to social sustainability to promote energy-related measures for creating a sustainable social environment (Ehsan et al., 2023). In support of this, Gabriel et al. (2022) argued that corporate responsibility initiatives play a vital role in conserving natural resources and materials that are heavily endangered sustainability by avoiding the use of plastics and carbon to protect the health of society.

2.3. Renewable energy initiatives

A study by Jia et al. (2021) recommended that the corporation's effort to promote renewable energy initiatives is essential specifically in underdeveloped and developing countries.

The environmental, economic, and social environmental development in an industrial world directly depends on the level of involvement of government and corporations in promoting renewable energy production and consumption (Magazzino et al., 2022; Lahrech et al., 2023; Ghosh, 2022; Slacik & Greiling, 2020). The national policy on energy consumption certainly influences the nature of energy production and consumption in the particular environment (Wei et al., 2020).

Kaartemo et al. (2020) argued that as renewable energy market is very complex and focuses on the environmental and economic aspects, and that negatively impacts SDGs as they least bother on social aspects. On the contrary, Frumhoff et al. (2015) climate risks that emerged out of industrial practices disturb socio-economic development, but the inducement of technology-based renewable energy initiatives helps in alleviating their effects. In support of this Obrecht and Denac (2013) and Ndzibah et al. (2022) recommended that the corporates needed to be involved in undertaking photovoltaic solar power plants and use of electric vehicles for promoting sustainability performance.

Interestingly, Westerman et al. (2020) highlighted that the corporates that are involved in renewable energy projects have more profitability than conventional firms. Further, the firms can also enjoy sustainability by undertaking hydroelectric projects but the infrastructure and supply of factors of production are in question (Nascimento et al., 2021).

Xinjun (2022) in a study argued the prominence of involvement in renewable energy generation and consumption by companies specifically, transportation organizations like railways to promote socio-economic sustainable development. Yousuf et al. (2014) & Lin et al., (2023) noted that by installing renewable energy projects corporate carbon emission footprint due to coal thermal power generation can be minimized. Further, Chang et al. (2015) pointed out that by undertaking renewable energy initiatives companies can discharge social responsibility as laid down in the relevant laws.

From the literature review, it is observed that the majority of studies have focused on exploring the significance of green energy practices, CSR practices, and renewable energy initiatives by corporates but no studies have attempted to evaluate the role renewable energy initiatives on sustainable development through the mediating effect of environment, social and economic aspects. Therefore, the present study intends to address the following research questions:

RQ1- What is the perception of various stakeholders on renewable energy initiatives by corporates?

RQ2- What is the impact of renewable energy initiatives by corporates on sustainable development?

RQ3- Are there any mediating factors affecting sustainable development through renewable energy initiatives by corporates?

3. Conceptual model and hypotheses development

3.1. REI and sustainable development

There are many environmentally friendly business practices but in recent days renewable energy initiatives by corporations getting more prominence day by day. This is due to its uncountable positive effects on sustainable development (Bekun et al., 2021). Specifically, such initiatives promote a cleaner and healthier environment and make provisions for future generations (Rangan et al., 2015). On the other hand, companies involved in developing and promoting renewable energy initiatives certainly enjoy a reputation (Issa and Hanaysha, 2023). Further, they also help ensure energy security and minimize overall business costs (Stram, 2016; Valentine 2011).

Such initiatives by corporations not only promote the sustainability of corporates themselves but also contribute to sustainable development through minimized climate-related risks, low carbon footprints, and long-term environmental stability (Adebayo, 2022; S.Y et al., 2022). Hence, the following hypothesis has been framed:

H₁ = Renewable energy initiatives by corporates have a significant effect on Sustainable Development.

3.2. Mediating effects the renewable energy initiatives – sustainable development link

Some studies argue that there is a direct influence of renewable energy initiatives by corporations on sustainable development (Dominish et al., 2019; Ritu et al., 2018). On the contrary, many authors argued that environmental, social, and economic aspects are more significantly influenced by such initiatives by corporations (Ilhan, 2013; Shannon et al., 2016). Therefore, the following hypotheses have been developed.

H₂ = Renewable energy initiatives by corporations have a significant effect on a) the environment, b) Society, and c) the Economy.

Environmental aspects such as global warming and climate change can be efficiently minimized by promoting REIs by both government and companies (Omer, 2008). Such initiatives also improve air quality, conserve water resources, and preserve natural ecosystems (Ali et al., 2019; Gasparatos et al., 2017; Ouyang et al., 2023).

REIs by corporations also help promote a better quality of life by creating a significant number of jobs, minimizing percapita energy consumption costs, and the per maximize per capita income of the people (Hartwig & Sturm, 2014; Ross et al., 2022; Stanef-Puică et al., 2022).

Further, such initiatives also influence economic aspects to promote productive investment, save costs for both to public and government and promote increased energy efficiency (Farrell and Grieg, 2018; Ilhan, 2013; Osman et al., 2023; Sikandar et al., 2021). Here it is clear that REIs by corporations influence sustainable development through environmental, social, and economic aspects. Hence, H₃ to H₆ have been framed:

H₃ = a) Environment, b) Societal and c) Economic aspects have significant effects on Sustainable Development.

H₄ = The environmental aspect has a significant effect on the Societal aspect.

H₅ = The societal aspect has a significant effect on the Economic aspect.

H₆ = The link between Renewable Energy initiatives by corporates and Sustainable Development is mediated by a) Environmental, b) Societal, and c) Economic aspects.

All these hypotheses about the conceptual model are indicated in Figure 1.

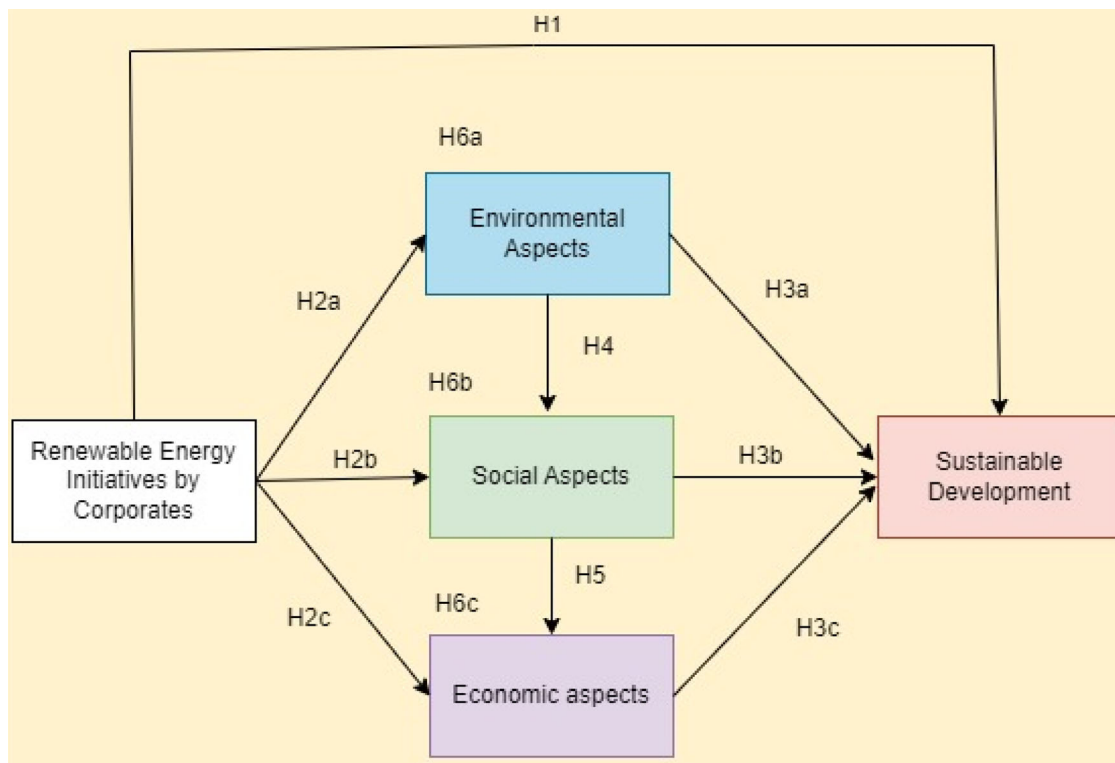


Figure 1. Conceptual model.

4. Methodology

4.1. Research design

Since it is an opinion-based study, both quantitative and qualitative research is employed as recommended by (Cooper et al., 2006; Patton, 1999; Tashakkori & Creswell, 2007). A qualitative approach is followed for the development conceptual model, and research instrument through a focus group discussion (see Figure 2). A quantitative approach is followed for the collection of data through a structured questionnaire and analysis and interpretation of the same.

4.2. Instrument development

Since there is no standard measurement tool in the published literature to evaluate the impact of REIs on sustainable development with the mediating effect of environmental, social, and economic aspects, the researcher developed a questionnaire through a systematic and scientific procedure and also tested the same as per well-accepted reliability and validity procedure (Robert & Priest, 2006).

4.3. Item generations

With the help of previous literature and focus group studies the researcher constructed items to measure pre-determined constructs such as REIs, ENVT, SOC, ECO, and SD from the Managers, Administrators, and Academicians' perception

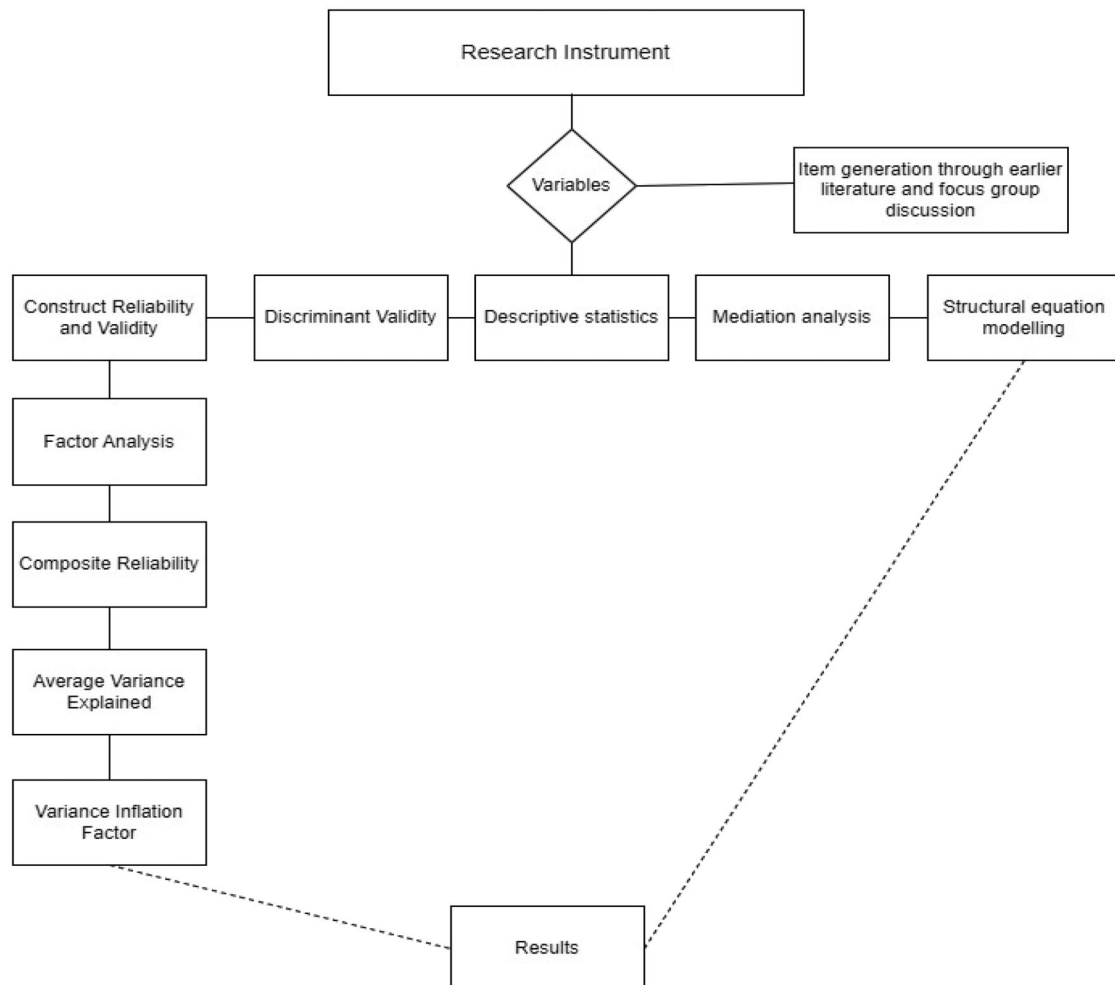


Figure 2. Conceptual model on research methodology.

Source: Authors compiled.

A focused group discussion was conducted among managers, administrators, and academicians each group consisted of 6 experts. Open-ended questions were raised which are 'Do you think REIs by corporates are necessary?' 'Does the REI by corporates influence environmentally, socially and economically?' and 'Are REI by corporates influences on sustainable development?'

The opinions of experts from the focus group study were recorded and later content analysis was performed to generate specific items for constructs. In the first stage, the researcher identified 16 items for REIs, 11 items for ENVT, 9 items for SOC, 12 items for ECO, and 13 items for SD.

In the second stage after considering the opinion of experts 12 items for the REI construct and 8 items each for all other constructs viz., ENVT, SOC, ECO, and SD. [Table 1](#) shows item generation and sources.

4.3. Response format

The questionnaire is divided into 6 parts, the first part concerns to demographic profile of the respondents through the closed-ended questions. From second part to the sixth part is related to REIs by corporates and their influence on SD through mediating factors viz., ENVT, SOC, and ECO, and questions were asked on the five-point Likert scale where 5 (Strongly Agree) and 1 (Strongly Disagree).

4.4. Sources of data and their collection procedures

The present study relied both on primary and secondary sources of data, Primary data was collected. Many authors (Connaway et al., 2017; Hider and Pymm, 2008) Recommended the perception survey method in stakeholder studies therefore, the present research gathered primary data through an online survey between June and September 2023. The questionnaires were distributed with the help of Google Forms through a mailing to production managers, service managers, and administrators. These stakeholders are the most suitable population for the current research as they are working in a real-world scenario of renewable energy initiatives (Ilias et al., 2020). A total of 271 responses were received at a response rate of 271 (45.17%). Out of the collected responses, 253 are completed responses and all are considered for further analysis. The participant's profile is indicated in [Table 2](#).

[Table 2](#) depicts the demographic profile of the target respondents, which shows the gender distribution, age groups, positions, and years of experience of the surveyed respondents. It indicates that the majority 193(76.28%) of the respondents are Male. 60(23.72%) of the respondents are Female. The majority of respondents 117 (46.25%) are Below 25 years old. 72(28.46%) are between 25 and 35 years old. 32 (12.65%) belong to 35 – 45 years, 23 (9.09%) belong to 45–55 years and 9 (3.56%) belong to 55 years and above age groups. The largest group of respondents 114 (45.06%) are Academicians, Other Administrative Positions include 88 (34.87%), Production Managers respondents around 33(13.04%), and service managers around 18 (7.11%) also make up significant portions of the group. The majority of respondents 117(68.77%) have less than 10 years of experience 50(19.76%) have 10–20 years of experience 22 (8.70%) respondents have 20–30 years of experience and 7 (2.77%) respondents who are 30 years and above. In the case of knowledge of REI, 94(37.15%) of respondents are aware of solar energy initiatives, 58 (22.92%) are aware of wind energy initiatives 5(1.98%) are aware of both solar and wind power initiatives. 68(26.88%) of the respondents are aware of hydroelectric power initiatives. 14(5.53%) of respondents are aware of biological sources of renewable energy. 6 (2.37%) of respondents are aware of nuclear energy and 8(3.17%) of the respondents are aware of municipal solid waste energy initiatives.

4.5. Construct validity

Within the context of a research paper, the construct validity test constitutes a pivotal methodology aimed at evaluating the extent to which a measurement instrument effectively aligns with the underlying theoretical construct it is designed to assess (Sireci, 1998; Strauss & Smith, 2009). This validation process plays an instrumental role in corroborating the congruence between the data gathered and the stipulated research objectives, thereby bolstering the research's overall veracity and dependability

Table 1. Item generation and sources.

Concept	Dimensions	Items	Criteria/Description	Source
Impact Renewable Energy Initiatives of Corporates on Sustainable Development	Need for Renewable energy initiatives by Corporates	NREI1	Renewable energy initiative is needed to have a cleaner and healthier environment.	Bekun et al. (2021)
		NREI2	The renewable energy initiative aligns with the company's CSR goals.	Rangan et al. (2015)
		NREI3	It enhances the company's reputation	Issa and Hanaysha (2023)
		NREI4	It is required to reduce and maintain the cost	Stram (2016)
		NREI5	Renewable energy initiatives ensure energy security	Valentine (2011)
		NREI6	It improves innovation	He et al. (2021)
		NREI7	It leads to a competitive advantage	Amran and Muhtazaruddin (2019)
		NREI8	Embracing renewable energy initiatives can help companies comply with the regulations and avoid potential penalties.	Punitha and Rasdi (2013)
		NREI9	It is needed to have long-term stability	Adebayo (2022)
		NREI10	Renewable energy initiatives are required to improve employee morale and attract and retain top talent.	Davidescu et al. (2020)
		NREI11	By investing in renewable energy measures, companies can build resilience against climate-related risks	S.Y et al. (2022)
		NREI12	Renewable energy initiatives provide opportunities for companies to collaborate with governments, NGOs, and other organizations to work towards a shared goal of sustainable development.	Palit (2013)
	Environmental aspects of Renewable energy initiatives by Corporates	ENIREI1	Renewable energy reduces the overall contribution to global warming and climate change.	Omer (2008)
		ENIREI2	Renewables improve air quality and reduce smog, leading to better respiratory health.	Ali et al. (2019)
		ENIREI3	It helps conserve water resources, particularly in water-stressed regions.	Farrar et al. (2022)
		ENIREI4	It will minimize habitat destruction and land degradation, preserving natural ecosystems.	Gill (2005)
		ENIREI5	Renewable energy initiatives support biodiversity conservation and protect vulnerable species and ecosystems.	Gasparatos et al. (2017)
		ENIREI6	Investing in renewable energy initiatives helps build resilience to climate change by reducing vulnerability to extreme weather events	Ouyang et al. (2023); Magazzino (2018)
		ENIREI7	Renewable energy technologies produce little noise pollution, minimizing disruptions to local communities and wildlife.	Shannon et al. (2016); Pratiwi et al. (2020)
		ENIREI8	Renewable energy initiatives can bring energy access to remote and underserved regions and thus promote global energy justice and provide sustainable solutions.	Hsiang et al. (2017); Maxim, et al. (2022)
	Social aspects of Renewable energy initiatives by Corporates	SIREI1	Improved public health, lower healthcare costs, and an overall better quality of life for communities.	Hartwig & Sturm (2014); Cooper (2009)
		SIREI2	Renewable energy initiatives create a significant number of jobs across various sectors help revitalize local economies and reduce unemployment rates.	Stanef-Puică et al. (2022); Ross et al. (2022)
		SIREI3	It empowers communities, provides additional revenue streams, and funds local development projects, thereby leading to community development	Zahnd (2014); Nordberg et al., (2020); Ashiq et al. (2023)
		SIREI4	It can help lower energy costs for consumers, making energy more affordable and reducing energy poverty since it is more cost-effective.	Stephane et al. ; Adom et al. 2021)

(continued)

Table 1. Continued.

Concept	Dimensions	Items	Criteria/Description	Source
		SIREI5	It becomes an inspiration and leads to behaviour change	Kumar and Majid (2020)
		SIREI6	Renewable energy initiatives create opportunities for educational programs and skill development in related fields.	Hugo et al.; Seetharaman et al. (2016)
		SIREI7	It helps reduce environmental degradation	Cosimo et al. (2022); Zhaohua et al. (2023)
		SIREI8	Investing in renewable energy reduces a nation's reliance on imported fossil fuels	Khan et al. (2023); Romain and Flavio
	Economic aspects of Renewable energy initiatives by Corporates	ECIREI1	The renewable energy sector generates a considerable number of jobs across various sectors and stimulates economic growth.	McCollum et al. (2017); McCollum et al. (2018)
		ECIREI2	Renewable energy initiatives attract investments from both public and private sectors.	Vakulchuk et al. (2023)
		ECIREI3	Shifting to renewable energy can decrease the need for subsidies provided.	Sikandar et al. (2021); Abdmouleh et al. (2015)
		ECIREI4	Companies that excel in renewable energy technologies can export their expertise and products to other nations, creating a new source of export revenue.	Anna (2002)
		ECIREI5	Investing in renewable energy helps mitigate climate change and reduces the costs associated with more severe climate impacts in the future.	Osman et al. (2023)
		ECIREI6	The healthcare system will experience cost savings due to decreased medical treatment requirements.	Farrell and Grieg (2018)
		ECIREI7	Renewable energy prices tend to be more stable and predictable over the long term.	Ellabban et al. (2014)
		ECIREI8	It leads to increased energy efficiency	Ilhan (2013)
	The overall impact of Renewable energy initiatives by corporations on Sustainable development	IREI1	It creates jobs and can lead to shifts in the labour market and attract a diverse workforce.	Dominish et al. (2019)
		IREI2	Renewable energy projects influence population distribution by leading to increased urbanization in areas with suitable resources for renewable energy generation.	Tomasz et al. ; Ritu et al. (2018)
		IREI3	Investment in renewable energy leads to growth in per capita income as people move to these areas for better economic prospects.	IEA and IRENA (2017)
		IREI4	The transition to renewable energy can lead to shifts in population due to changes in job opportunities.	Babaremu et al. (2022)
		IREI5	Cleaner environments can attract and retain residents, leading to demographic changes over time.	Baloch et al. (2023)
		IREI6	Renewable energy projects provide new income streams for rural communities resulting in Rural Revitalization	Prados et al. (2021); Laura et al. (2020)
		IREI7	It leads to increased investment in education and research, attracting students and professionals and potentially affecting demographics.	Wang et al. (2022); Prados et al. (2021)
		IREI8	It helps to have good International Relations	Xiying et al. (2022)

Source: Authors compiled.

(Segars & Grover, 1998; Roberts & Priest, 2006). Specifically, within the domain of construct validity, two distinct facets are commonly examined: convergent validity and discriminant validity.

The reliability of the variables was assessed using Cronbach's Alpha and Composite Reliability. Initially, the factor loading for all the factors was calculated and items having factor loading less than 0.600 were removed. The results of reliability and validity for the rest of the items are depicted in Table 3. Alpha and CR values for all the variables were greater than the recommended value of 0.700 by

Table 2. Profile of participants.

Profile	Classification	No. of respondents	Percentage
Gender	Male	193	76.28
	Female	60	23.72
	Total	253	100.00
Age	Below 25 years	117	46.25
	25–35	72	28.46
	35–45	32	12.65
	45–55	23	9.09
	55 years and above	9	3.56
	Total	253	100.00
Position	Production manager	33	13.04
	Service manager	18	7.11
	Other administrative position	88	34.78
	Academicians	114	45.06
	Total	253	100.00
Experience	Less than 10 years	174	68.77
	10–20	50	19.76
	20–30	22	8.70
	30 years and above	7	2.77
	Total	253	100.00
Experience/Knowledge of renewable energy initiatives	Solar energy	94	37.15
	Wind energy initiatives	58	22.92
	Solar and wind power	5	1.98
	Hydro	68	26.88
	Biopower	14	5.53
	Nuclear	6	2.37
	Municipal solid waste energy initiative	8	3.17
	Total	253	100.00

Source: Survey Data.

Wadkar et al. (2016). The Average Variance Extracted (AVE) values and CR values were higher or close to 0.500 and 0.700, respectively, which confirms convergent validity (Carlson et al., 2012; Shrestha, 2021). Multi-collinearity was also assessed with Variance Inflation Factor (VIF) for each indicator the value of which was less than 5 therefore, there is no problem with discriminant validity (Kock & Lynn, 2012).

4.6. Discriminant validity

Discriminant validity is a critical aspect of construct validity, ensuring that a measurement instrument can effectively differentiate between different constructs (Henseler et al., 2015). Two widely accepted methods for assessing discriminant validity are the Fornell and Larcker criterion, which examines the relationships between constructs and their average variance extracted, and the Heterotrait-Monotrait Method (HTMT), which compares the correlations between items measuring different constructs to those measuring the same construct (Fornell & Larcker, 1981). Table 4 shows that Discriminant values which are bold and italic are greater than the correlation between the constructs, discriminant validity is not an issue.

4.7. Tools

To achieve the objectives of the study, the researchers employed descriptive statistics, and one sample t-test for evaluating the perception of various stakeholders on renewable energy initiatives by corporates and their influence on sustainable development. To analyze the mediation effect of economic, social, and environmental aspects of renewable energy initiatives and sustainable development, structural equation modelling is used. Further, SEM is also used to evaluate the validity and reliability of measurement tools and to evaluate the goodness of fit of a proposed conceptual model (Barrett, 2007). This tool is a popular statistical method employed in various domains such as psychology, education, marketing, human resources, finance, and business in the present paper this tool is used to test the conceptual model developed to attain the objective of the study with the help of IBM SPSS AMOS version 2022. In this study, SEM helped in examining complex and structured relationships between REI, mediating aspects, and sustainable development.

Table 3. Reliability and validity.

Dimensions	Items	λ	Alpha	CR	AVE	VIF
Need for Renewable energy initiatives by Corporates	NREI1	.698	0.853	0.913	0.585	2.439
	NREI2	.819				
	NREI3	.762				
	NREI4	.709				
	NREI5	.758				
	NREI6	.780				
	NREI7	.757				
	NREI8	.675				
	NREI9	.650				
	NREI10	.612				
	NREI11	.660				
	NREI12	.750				
Environmental aspects of Renewable energy initiatives by Corporates	ENIREI1	.755	0.816	0.854	0.569	2.333
	ENIREI2	.772				
	ENIREI3	.657				
	ENIREI4	.665				
	ENIREI5	.694				
	ENIREI6	.678				
	ENIREI7	.602				
	ENIREI8	.718				
Social aspects of Renewable energy initiatives by Corporates	SIREI1	.720	0.873	0.875	0.631	1.415
	SIREI2	.674				
	SIREI3	.718				
	SIREI4	.655				
	SIREI5	.700				
	SIREI6	.711				
	SIREI7	.599				
	SIREI8	.763				
Economic aspects of Renewable energy initiatives by Corporates	ECIREI1	.665	761	723	0.4950	1.9802
	ECIREI2	.754				
	ECIREI3	.644				
	ECIREI4	.688				
	ECIREI5	.741				
	ECIREI6	.709				
	ECIREI7	.763				
	ECIREI8	.620				
The overall impact of Renewable energy initiatives by corporations on Sustainable development	IREI1	.758	812	788	0.622	1.632
	IREI2	.728				
	IREI3	.652				
	IREI4	.757				
	IREI5	.651				
	IREI6	.738				
	IREI7	.756				
	IREI8	.792				

Source: Authors compiled.

Table 4. Discriminant validity using the criterion by Fornell & Larcker and the Heterotrait-Monotrait Method (HTMT).

	NREI	ENIRE	SIRE	ECIRE	IREI
NREI	0.816				
ENIRE	0.418	0.753			
SIRE	0.367	0.558	0.744		
ECIRE	0.751	0.456	0.547	0.678	
IREI	0.647	0.621	0.652	0.519	0.847

Source: Authors compiled.

Values which are bold and italic are discriminant values

The study also employed mediation analysis for testing the conceptual model. The prime purpose of mediation analysis is to evaluate the system where the independent variable affects the dependent variable through the mediating effect of one or more intermediate variables such as environmental, social, and economic aspects.

4.8. Ethical consideration

Obtaining ethical clearance from the Institutional Review Board (IRB) in Mysore represents a primary aspect of ensuring the ethical standards of this research. The study is firmly conducted by considering

ethical principles and by giving priority to safeguarding the participant's rights and well-being. The study followed the principles of the Declaration of Helsinki (World Medical Association, 2013), informed & written consent is obtained from all participants. Rigorous efforts have been made to minimize potential risks. The collection and handling of data was carried out with the utmost confidentiality, and the responsible and non-exploitative communication of findings ensures the dignity and privacy of participants. The ethical approval from the IRB in Mysore signifies an unwavering commitment to ethical research practices, prioritizing the welfare and rights of all individuals involved.

Further, the participants are also informed that the results of the study would be published in academic journals and presented at professional conferences but their identity would not be linked with their responses.

5. Results

This section is divided into two parts the first section reveals descriptive results on the perception of various stakeholders on REIs by corporates. In the section results of the mediation analysis are provided.

5.1. Descriptive statistics

Table 5 shows the results of one sample t-statistics on the opinion of managers and academicians on renewable energy initiatives by corporations.

The respondents strongly agreed that ($M = 4.00$, $SD = 1.266$) renewable energy initiatives by corporations are needed for a cleaner and healthier environment. The reduction in GHG emissions due to REIs improves air quality, reduces dependency on finite resources, helps in mitigation of environmental degradation, and promotion of sustainable energy consumption. This observation reinforces the findings of Bekun et al. (2021).

The respondents agreed that by undertaking renewable energy initiatives corporates can match with their CSR goals ($M = 3.81$, $SD = 1.149$). REIs help to ensure the firms' stewardship by reducing carbon footprints which in turn leads to mitigating climate-related risks and contributing to a sustainable future through community engagement and social responsibility. In addition, it also indirectly helps to promote corporate pledges on climate change and global warming issues. This is consistent with the outcomes of Rangan et al. (2015).

From the opinion of managers and academicians, it is noted that the involvement in promoting renewable energy production and consumption by corporations favours gaining a reputation in the market ($M = 3.82$, $SD = 1.161$). Few companies are involved in sustainable activities and the companies involved in such initiatives will gain sustainable leadership in the market. This observation confirms the arguments of Issa and Hanaysha (2023).

The respondents agreed that renewable energy initiatives are needed to maintain and reduce the overall cost of energy consumption ($M = 3.79$, $SD = 1.171$). It is observed that renewable energy initiatives support recycling and re-using waste material in energy production. It also helps in reducing or eliminating energy outsourcing costs. This observation confirms the findings of Stram (2016).

Table 5. Need for renewable energy initiatives by corporates (NREI).

Statements	N	Df	Mean	Std. deviation	t-Value	p-Value
NREI1	253	252	4.00	1.266	12.562	.001
NREI2	253	252	3.81	1.149	11.214	.001
NREI3	253	252	3.82	1.161	11.210	.001
NREI4	253	252	3.79	1.171	10.795	.001
NREI5	253	252	3.78	1.170	10.638	.001
NREI6	253	252	3.92	1.110	13.198	.001
NREI7	253	252	3.87	1.133	12.153	.001
NREI8	253	252	3.78	1.019	12.156	.001
NREI9	253	252	3.87	1.115	12.346	.001
NREI10	253	252	3.70	1.118	10.013	.001
NREI11	253	252	3.85	1.106	12.221	.001
NREI12	253	252	3.83	1.209	10.868	.001

Source: Authors compiled.

Respondents agreed that these initiatives by corporations help ensure energy security in society ($M = 3.78$, $SD = 1.170$). REIs reduce the exploitation of natural resources; low pollution accommodate energy sources for future generations and it also promotes national energy independence. This finding is in line with the arguments of Valentine (2011).

The majority of respondents also agreed that by inducing renewable energy initiatives corporates can promote innovation in the energy consumption process ($M = 3.92$, $SD = 1.110$). Such initiatives promote business organizations to adopt green technologies in the production and consumption of energy which in turn promotes environmentally friendly business operations. Further, it also promotes developing and using solar roof tiles, carbon nanotube electricity, 3D printed solar energy trees, liquid sunlight, and so on. These findings confirm the observations of the study (He et al., 2021).

From the opinions of the respondents, it is found that such initiatives help companies gain a competitive advantage in the market ($M = 3.87$, $SD = 1.133$). The use of renewable energy initiatives leads to minimised overhead costs and to offer goods and services at affordable prices than competitors which in turn helps to gain a competitive advantage in the market. This observation is inconsistent with the findings (Amran and Muhtazaruddin, 2019).

The respondents also agreed that by adopting such initiatives companies may comply with regulatory requirements and minimize penalties ($M = 3.78$, $SD = 1.019$). This observation is in confirmation of the findings of Punitha and Rasdi (2013).

From the perception of various respondents, it was found that renewable energy initiatives promote the long-term sustainability of the organizations ($M = 3.85$, $SD = 1.115$). Such initiatives help to adopt zero-emission methods to generate energy which in turn minimizes costs and other negative aspects and from which a firm can survive in the long run. This outcome reinforces the findings of Adebayo (2022).

The respondents also agreed that renewable energy initiatives are required to improve employee morale and attract and retain top talent ($M = 3.70$, $SD = 1.118$). This is due to the increased ethical commitment, public image, and social from such initiatives, which enhances confidence in the minds of employees on the longer existence of the firm. This in turn contributes to retaining talent in the workplace. This observation is aligned with the outcomes of the study by Davidescu et al. (2020).

From the opinion of respondents, it is observed that such initiatives by corporates can build resilience against climate-related risks ($M = 3.85$, $SD = 1.106$). This is because such initiatives lower carbon emissions promote zero waste, promote the usage of alternative fuel vehicles, and also help to lower the impact on the ozone layer. This outcome reinforces the argument of S.Y et al. (2022).

Lastly, respondents also agreed that renewable energy initiatives provide opportunities for companies to collaborate with governments, NGOs, and other organizations to work towards a shared goal of sustainable development ($M = 3.83$, $SD = 1.209$). This finding supports the observations made in the studies for instance (Palit, 2013).

Table 6 shows the perception of various respondents on environmental aspects of renewable energy initiatives by corporates with the help of descriptive statistics and a one-sample t-test.

The perception of respondents revealed that renewable energy initiatives by corporations play a positive role in global warming and climate change ($M = 3.85$, $SD = 1.157$) this is because it promotes zero waste, no carbon emission, and minimized dependency on fossil fuel resources. These aspects are also noted by earlier studies for instance (Omer, 2008).

Table 6. Environmental aspects of renewable energy initiatives by corporates.

Statements	N	Df	Mean	Std. deviation	t-Value	p-Value
ENIREI1	253	252	3.85	1.157	11.733	.001
ENIREI2	253	252	4.00	1.100	14.515	.001
ENIREI3	253	252	3.84	1.169	11.402	.001
ENIREI4	253	252	3.81	1.164	11.017	.001
ENIREI5	253	252	3.89	1.128	12.535	.001
ENIREI6	253	252	3.84	1.126	11.890	.001
ENIREI7	253	252	3.76	1.106	10.913	.001
ENIREI8	253	252	3.84	1.077	12.374	.001

Source: Authors compiled.

The respondents agreed that such initiative helps in promoting better air quality which leads to good health of living creatures ($M = 4.00$, $SD = 1.100$). REIs help corporates to switch to solar, wind, and other sources of clean energy, which leads to improved air quality and reverses the effect of climate change on health and the respiratory system. It is also highlighted by earlier studies (Ali et al., 2019).

The opinion of various respondents confirms that REI by corporations helps to conserve water resources, particularly in water-stressed regions ($M = 3.84$, $SD = 1.169$). REIs support desalination plants and regulated treatment of wastewater to limit the depletion of freshwater resources which in turn supports mitigating climate change and meeting the needs of a growing population. This observation articulates the outcomes of previous studies for example (Farrar et al., 2022).

The perception of respondents confirms that REIs by corporations minimize habitat destruction ($M = 3.81$, $SD = 1.164$). It promotes solar energy initiatives protection of fossil fuels, and redesigning environmental harmer technology for instance changing the colour of wind turbine blades. This observation is also noted by earlier studies for example (Gill, 2005).

Respondents also agreed that REIs support the conservation of biodiversity ($M = 3.89$, $SD = 1.128$). RE creations do not harm the ecosystem and some RE sources like wind turbines occupy less space and allow for more open land. This observation reinforces the findings of Gasparatos et al. (2017).

The majority of the respondents agreed that REIs help to reduce vulnerability to extreme weather events ($M = 3.84$, $SD = 1.126$) and is possible through private, public, and NGO partnerships for providing project finance and technical cooperation to build resilient foundations with rapid and inclusive development (Ouyang et al., 2023; Magazzino et al., 2018).

The majority of the respondents opined that the RE technologies produce little noise pollution, minimizing disruptions to local communities and wildlife ($M = 3.76$, $SD = 1.106$). REIs such as innovative turbine blade designs, active noise control systems, sound barrier mindfulness, wind farm planning, and other aspects help to conserve wildlife and minimize their disruptions to local communities. This observation is in line with the findings of (Shannon et al., 2016; Pratiwi & Juerges, 2020).

It is found that REIs can bring energy access to remote and underserved regions and thus promote global energy justice and provide sustainable solutions ($M = 3.84$, $SD = 1.077$). REIs provide remote and underserved regions with the opportunity to produce their energy rather than importing conventional energy from outside. This is in confirmation of the findings of (Hsiang et al., 2017; Maxim and Grubert, 2022).

Table 7 reveals the descriptive results on the perception of respondents on social aspects of renewable energy initiatives by corporates. The respondents strongly agree that there is an improvement in public health which in turn leads to lower healthcare costs and an overall better quality of life for communities ($M = 3.68$, $SD = 1.154$). Such initiatives improve environmental quality, human health, and quality of life through saving energy costs, lowering medical costs, and higher disposable income. This observation is in line with the findings of (Hartwig & Sturm, 2014; Cooper, 2009).

The majority of the respondents believe that RE initiatives create a significant number of jobs across various sectors which helps revitalize local economies and reduce unemployment rates ($M = 3.73$, $SD = 1.109$). The development, construction, and maintenance of REI by corporations requires a skilled workforce that generates employment opportunities in various sectors. This confirms the arguments made by (Stanef et al. 2022; Ross et al., 2022).

Respondents believe that RE empowers communities and also provides additional revenue streams and funds local development projects leading to community development ($M = 3.79$, $SD = 1.064$). REI

Table 7. Social aspects of renewable energy initiatives by corporates.

Statements	N	Df	Mean	Std. deviation	t-Value	p-Value
SIREI1	253	252	3.68	1.154	9.318	.001
SIREI2	253	252	3.73	1.109	10.427	.001
SIREI3	253	252	3.79	1.064	11.876	.001
SIREI4	253	252	3.76	1.057	11.475	.001
SIREI5	253	252	3.80	1.070	11.865	.001
SIREI6	253	252	3.87	1.076	12.909	.001
SIREI7	253	252	3.94	1.093	13.743	.001
SIREI8	253	252	3.93	1.040	14.202	.001

Source: Authors compiled.

Table 8. Economic aspects of renewable energy initiatives by corporates.

Statements	N	Df	Mean	Std. deviation	t-Value	p-Value
ECIREI1	253	252	3.83	1.126	11.722	.001
ECIREI2	253	252	3.72	1.094	10.403	.001
ECIREI3	253	252	3.69	1.109	9.920	.001
ECIREI4	253	252	3.78	1.101	11.247	.001
ECIREI5	253	252	3.82	1.100	11.887	.001
ECIREI6	253	252	3.76	1.134	10.641	.001
ECIREI7	253	252	3.90	1.088	13.170	.001
ECIREI8	253	252	3.93	1.054	14.079	.001

Source: Authors compiled.

enables to fuelling of property specifically in remote regions by allowing isolated communities to produce their energy and improves their revenue level and community development (Zahnd, 2014; Ashiq et al., 2023).

Respondents opined that RE can help lower energy costs for consumers by making energy more affordable and reducing energy poverty since it is more cost-effective ($M = 3.76$, $SD = 1.057$). RE helps in reducing the cost of production as compared to other energy sources (Adom et al., 2021).

The majority of the respondents state that RE is inspirational and leads to behaviour change among stakeholders ($M = 3.80$, $SD = 1.070$). REIs by corporations and their effort to create awareness of the importance of the same influences regulated energy consumption in communities (Kumar and Majid, 2020).

The respondents confirm that the REI creates opportunities for educational programs and skill development in related fields ($M = 3.87$, $SD = 1.076$). This is due to the requirement of a highly skilled workforce which necessitates the development of completely new programmes of education and skill development (Hugo et al., 2018; Seetharaman et al., 2016).

The majority of the respondents agree that RE helps in reducing environmental degradation and protecting the community residing in specific areas ($M = 3.94$, $SD = 1.093$). through promoting afforestation that avoids disruptions for living creatures (Cosimo et al., 2022; Zhaohua et al., 2023).

The majority of the respondents believe that investing in RE reduces a nation's reliance on imported fossil fuels ($M = 3.93$, $SD = 1.040$). This avoids international dependency on energy sources which promotes domestic independence in this aspect (Moe, 2016; Khan et al., 2023).

From Table 8, it is revealed that the majority of the respondents believe that the RE sector generates a considerable number of jobs across various sectors and stimulates economic growth. ($M = 3.83$, $SD = 1.126$). REI offers many opportunities to set up various RE projects which creates new jobs and increases the per capita income of the nation (McCollum et al., 2017; McCollum et al., 2018).

The majority of the respondents opined that REIs attract investments from both the public and private sectors ($M = 3.72$, $SD = 1.094$). REIs is not only a govt concern it is a concern of all environmentally conscious organisations which may lead to promoting investment from both the public and private sectors to ensure energy security and competitive advantage. (Vakulchuk et al., 2023).

The majority of the respondents believe that shifting to RE can decrease the need for subsidies provided ($M = 3.69$, $SD = 1.109$). REIs promote energy security which leads to minimized initiative of government that requires fewer subsidy burdens (Abdmouleh et al., 2015).

Respondents believe that companies that excel in RE technologies can export their expertise and products to other nations, creating a new source of export revenue ($M = 3.78$, $SD = 1.101$). Successful REI sets a benchmark of energy efficiency which may attract international stakeholders who intend to undertake such projects (Anna, 2002).

Respondents opined that Investing in RE helps mitigate climate change and reduces the costs associated with more severe climate impacts in the future. ($M = 3.82$, $SD = 1.100$). This is because of the development of promotion of a greener and pollution-free environment that leads to the minimization of climate-related risks which in turn eliminates the costs associated with more climate impacts in the future (Osman et al., 2023).

Respondents believe that the healthcare system will experience cost savings due to decreased medical treatment requirements ($M = 3.76$, $SD = 1.134$). This is due to improved climatic conditions will lead to minimized health-related risks that reduce overall costs to be borne for medical treatment (Farrell and Grieg, 2018).

Table 9. The overall impact of renewable energy initiatives by corporates on sustainable development.

Statements	N	Df	Mean	Std. deviation	t-Value	p-Value
IREI1	253	252	3.65	1.171	8.803	.001
IREI2	253	252	3.68	1.146	9.494	.001
IREI3	253	252	3.67	1.140	9.371	.001
IREI4	253	252	3.70	1.082	10.347	.001
IREI5	253	252	3.74	1.204	9.713	.001
IREI6	253	252	3.81	1.178	10.890	.001
IREI7	253	252	3.72	1.159	9.925	.001
IREI8	253	252	3.82	1.052	12.428	.001

Source: Authors compiled.

The majority of the respondents believe RE prices tend to be more stable and predictable over the long term. ($M = 3.90$, $SD = 1.088$). This is due to less exploitation of natural resources and relying upon RE leads to minimization of the overall cost of energy generation and also makes provision for energy to future generations (Ellabban et al., 2014).

Respondents opined that REI leads to increased energy efficiency. ($M = 3.93$, $SD = 1.054$). This is because REI by corporations promotes innovation in energy production in an advanced way and this energy consumes fewer natural resources and enhances overall energy efficiency (Ilhan, 2013).

Table 9 reveals the perception of respondents confirms that RE creates jobs and can lead to shifts in the labour market and it will also attract a diverse workforce ($M = 3.93$, $SD = 1.040$). This shift is due to the role of REI in avoiding and eliminating some hazardous working conditions such as coal mining involved in extraction from earth. This attracts a shift in the labour market and attracts a diverse workforce (Dominish et al., 2019).

The majority of the respondents state that RE projects will influence population distribution by leading to increased urbanization in areas with suitable resources for renewable energy generation ($M = 3.93$, $SD = 1.040$). This is due to the positive impact of REI on urbanization and energy cost-cutting which will lead to the attraction of the population from high-cost energy areas (Ritu et al., 2018).

The majority of the respondents believe that investing in renewable RE will lead to growth in per capita income as people move to these areas for better economic prospects ($M = 3.93$, $SD = 1.040$). This is due to lower energy costs, and govt subsidies which can be utilized by employing RE sources for domestic purposes (IRENA, 2017).

The majority of the respondents state that the transition to RE can lead to shifts in population due to which changes in job opportunities are possible ($M = 3.93$, $SD = 1.040$). This is due to REI creating wind farms, solar installations, and bioenergy facilities which creates employment opportunities and stimulates economic growth (Babaremu et al., 2022).

The respondents opined that cleaner environments can attract and retain residents which will in turn lead to demographic changes over time ($M = 3.93$, $SD = 1.040$). It is due to improvement in a Healthy and safe environment that allows people to access basic needs (quality of life, health benefits, education and culture, economic opportunities) at a lower cost which improves their demographic status (Baloch et al., 2023).

The majority of the respondents agreed that RE projects provide new income streams for rural communities resulting in Rural Revitalization ($M = 3.93$, $SD = 1.040$). This could be due to the generation of steady income for landowners, Increased revenue due to tax exemption, diversification of the rural economy, improved infrastructure, and improved healthier environment (Laura et al., 2020; Prados et al., 2021).

The majority of the respondents find that RE will lead to increased investment in education and research thereby it will attract students and professionals by potentially affecting demographics ($M = 3.93$, $SD = 1.040$). This is due to the attraction of start-ups and businesses focused on RE solutions and that changes the demography of people (Phebe et al., 2016; Wang et al., 2022).

The majority of the respondents state that RE helps to have good International Relations ($M = 3.93$, $SD = 1.040$). This is due to the creation of economic partnerships between countries where one country may provide technology and expertise while another offers green and clean resources. This partnership strengthens economic and diplomatic relations (Griffiths 2019; Lei et al., 2022).

5.2. Structural equation model

The next phase of our analysis involved evaluating the proposed connections. Table 10 reveals the direct relationship between the variables used in the conceptual model.

About H1 it is found that there is a positive relationship between REI and SD, with a beta coefficient of 0.144 which is statistically significant with a *t*-value of 2.595 and a *p*-value of 0.009.

Concerning H2a, it is observed that there is a positive relationship between REI and ENVT with a beta coefficient of 0.732. This relationship is also statistically significant with a *t*-value of 19.311 and a *p*-value of 0.000.

Hypotheses H2b and H2c also bear significant results stressing the positive association among REI with SOCT and ECON respectively.

In addition, hypotheses H3a, H3b, and H3c also demonstrated positive relationships between ENVT, SOCT, ECON, and SD, which is also statistically significant.

Concerning hypotheses H4 and H5 it is observed that there is a positive relationship between ENVT and SOCT as well as SOCT and ECON which is also statistically significant.

In a nutshell, the above results emphasize the significant direct relationships among the variables employed in the conceptual model. Therefore, the study accepts all hypotheses (H1 to H5) at a 5% significant level.

5.3. Mediation analysis

This section of analysis part of the study focuses on mediation analysis which is indicated in Table 11 and Figure 3.

Table 11 depicts the results of mediation analysis about H6 which examines the relationship between REIs, and mediating variables such as ENVT, SOCT, ECON and SD. The results revealed that there is significant evidence of mediating effects in all three scenarios.

Concerning hypothesis H6a it is observed that there is a positive relationship between REI and SD mediated by ENVT with a beta coefficient of 0.100. This mediating effect is statistically significant with a *t*-value of 3.5040 and a *p*-value of 0.001.

Regarding hypothesis H6b, the mediation analysis confirmed a mediating effect of SOCT between REI and SD with a beta coefficient of 0.118. This shows a positive relationship between REI and SD through SOCT. This result is also statistically significant, with a *t*-value of 2.789 and a *p*-value of 0.001.

About hypothesis H6c, the results of mediation analysis confirmed the mediation effect of ECON between REI to SD with a beta value of 0.049. This also reveals the positive relationship between REI and SD through the mediating factor ECON. This mediating effect is also statistically significant with a *t*-value of 4.150 and a *p*-value of 0.001.

Table 10. Direct relationship (H1–H5).

Path	β	<i>t</i> -Value	<i>p</i> -Value
H1: REI > SD	.144	2.595	.001
H2a: REI > ENVT	.732	19.311	.001
H2b: REI > SOCT	.306	6.950	.001
H2c: REI > ECON	.189	5.036	.001
H3a: ENVT > SD	.137	2.170	.030
H3b: SOCT > SD	.384	4.064	.001
H3c: ECON > SD	.257	3.048	.002
H4: ENVT > SOCT	.521	11.215	.001
H5: SOCT > ECON	.756	17.683	.001

Source: Authors compiled.

Table 11. Mediation analysis (H6).

Path	β	<i>t</i> -Value	<i>p</i> -Value
H6a: REI > ENVT > SD	.100	3.504	.001
H6b: REI > SOCT > SD	.118	2.789	.001
H6c: REI > ECON > SD	.049	4.150	.001

Source: Authors compiled.

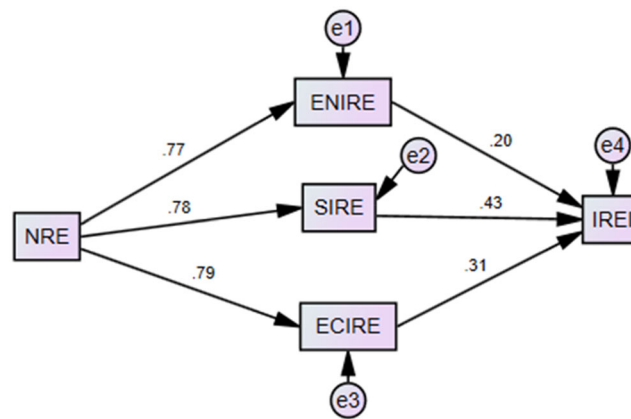


Figure 3. Tested model.
Source: SPSS AMOS 2022.

At last, our analysis strongly supports all three hypotheses (H6a, H6b, and H6c), indicating that REI's influence on SD is partially explained by the mediating variables ENVT, SOCT, and ECON. These findings underscore the complexity of these relationships and emphasize the significance of mediating factors in understanding the dynamics between these variables.

6. Discussion

The research identified the role of renewable energy initiatives in promoting sustainable development by considering environmental, social and economic aspects as mediating variables. The results were obtained by testing six hypotheses based on said objectives along with mediating variables. The structural equation model was administered to identify the relationship between independent and dependent variables.

Corporate entities play a vital role in managing climate change-related risks through their efforts by undertaking various initiatives like REIs. This highlights the significance of corporate engagement in managing climate change risks and contributing to sustainable development (Khan et al., 2023; Zhaohua et al., 2023). The outcome of the research highlighted the significance of renewable energy initiatives through six hypotheses that associate the influence of REIs on sustainable development with the mediating role of environmental, social and economic aspects. The study was conducted by administering an empirical study and a sample of 253 industry experts and academicians who have prior knowledge and expertise on the current topic.

The study indicated the significant influence of REIs by corporate entities on sustainable development. This result reinforces the outcome of previous studies for instance (Ritu et al., 2018; Babaremu et al., 2022). Which highlighted the role of corporates in managing climate-related risks through their voluntary commitments such as pollution control, conservation of natural resources, promoting environmentally friendly supply chain management and REIs at large.

The results highlighted that corporate entities by undertaking REIs significantly promote a clean environment by minimizing pollution levels, saving trees etc., which in turn promotes the health and welfare of the society at large. This result confirms the arguments made in the study (Ouyang et al., 2023; Magazzino et al., 2018; Maxim and Grubert, 2022). Therefore, it can be inferred that REIs by corporate entities are essential in the current vulnerable environment to protect the interests of future generations.

The outcome of the study confirmed that the corporate efforts in undertaking REIs significantly impact social aspects such as the promotion of public health, empowering local communities, minimizes lower energy costs, this, in turn, promotes an overall better quality of life for local communities where such initiatives have been taken place. This argument supports the outcome of previous studies for instance (Cooper, 2009; Hartwig & Sturm, 2014; Ross et al., 2022; Stanef-Puică et al., 2022).

The results of the study also confirmed that REIs of corporate entities significantly influence various economic aspects such as the creation of jobs, promotion of investments in green sectors, decreased

rate of subsidies to the public, export of technical expertise, reduces costs associated with severe climate impacts and enhances overall energy efficiency. This outcome reinforces the outcome of previous studies for instance (Vakulchuk et al., 2023).

Lastly, the findings of the study evidentially advocated that sustainable development is influenced by REIs by corporate entities with the mediating effect of environmental, social and economic aspects. Furthermore, such initiatives contribute to sustainable development at large by attracting a diverse workforce and lowering unemployability, growth in per capita income, cleaner environment, new income streams for rural communities and promoting international relations. This outcome reinforces the results of previous studies for instance (Baloch et al., 2023; Prados et al., 2021; Wang et al., 2022; Wang et al., 2023).

From the above discussion, it is clear that the findings of the study align with existing literature and the current practices of industry and offer a strong basis for generalizing the findings that by undertaking renewable energy initiatives corporate entities can promote sustainable development and for the organization in turn it creates good image at large.

7. Policy implications

The outcome of the study has many policy implications they are:

Firstly, the policymakers can gain evidential insight from the findings of the present study while framing comprehensive guidelines and frameworks for renewable energy initiatives carried by corporate entities. These policy guidelines may outline the probable environmental, social, and economic impacts along with best practices for implementation.

Secondly, the regulators by considering the outcome of the present study may implement requirements for companies to disclose information on their renewable energy projects in their business reports. This would help in better monitoring, tracking and analysis of the long-term impact of such initiatives and also ensure corporate transparency and accountability.

Lastly, by considering the findings of the study, policymakers can put effort into aligning national strategies and policies with sustainable goals to foster more coordinated efforts towards sustainability.

8. Conclusion

The present research aimed to analyze the perception of various stakeholders on REI by corporates and their impact on sustainable development. The results of descriptive statistics and one sample t-test confirmed that the stakeholders positively opined that REIs by corporations influence sustainable development through environmental, social, and economic aspects.

Further, the results of SEM and mediation analysis confirmed that REI has had an indirect influence on sustainable development which is mediated by the environment ($\beta = 0.100$, $t\text{-value} = 3.504$, $p\text{-value} \leq 0.001$), the social ($\beta = 0.118$, $t\text{-value} = 2.789$, $p\text{-value} \leq 0.001$), Economic aspects ($\beta = 0.049$, $t\text{-value} = 4.150$, $p\text{-value} \leq 0.001$). These findings suggest that, in general, REI undertaken by corporations plays a significant and vital role in improving the environment, society, economy, and sustainable development at large. Considering this, corporates that have not yet engaged in REI can move forward with confidence based on this evidence.

These results and observations add value to the rapidly expanding field of corporate initiatives on socio-economic, environmental, and sustainable development. A major limitation of the study is that it focuses only on the stakeholder's perception and does not study the company's REI by companies directly. Therefore, a further study could assess the long-term effects of REI by companies by analysing the information revealed on REI by companies in their reports. This could also help in validating the results of the present study. These findings assist policymakers in framing a guideline, and framework on REIs to be undertaken by companies. Furthermore, they support the government in providing subsidies, incentives, and tax benefits for companies undertaking REIs. Further, by the outcome of this study corporate can get input to undertake clean energy projects and technology. This in turn contributes to achieving UNSDG-7 i.e., affordable clean energy set by UNO.

9. Limitations and recommendations for future research

The present study also suffers from some limitations which may become a potential opportunity for future researchers to extend the current study. The notable limitations of the present study:

Firstly, the study mainly relied on stakeholders' perceptions of REIs of corporate entities and their impact on sustainable development. This may become subjective as stakeholders' views may not always align with objective assessments of companies' actual involvement in REIs. Further, it may be challenging to assess the actual effectiveness of REIs in driving sustainable development outcomes from the perception of stakeholders.

Secondly, the study identified the indirect influence of REI on sustainable development and does not evaluate the long-term effects of these initiatives. Therefore, future studies should consider analysing the influence of such initiatives over time to offer a more comprehensive understanding of their effectiveness.

Lastly, the study largely analysed the positive perceptions of stakeholders on REIs by corporate entities, this may create confirmation bias, where the results are reinforcing preconceived notions rather than exploring potential challenges and drawbacks of such initiatives. To overcome these limitations future studies should focus on both positive and negative aspects of such initiatives.

In addition to addressing these limitations, future research avenues may consider the following aspects to ensure relevance:

Future studies should involve investigating deeper into specific findings of the present study. For instance, the indirect influence of REIs on sustainable development through environmental, social, and economic aspects. This could involve exploring additional factors that may mediate or moderate such influence.

Furthermore, to address the flaws in the current research design such as the focus solely on stakeholders' perception rather than analysis of actual REIs of corporate entities, future studies should employ a more comprehensive design that incorporates both stakeholder view and direct survey of actual initiatives by companies. This helps to validate both the results of quantitative and qualitative design to produce a more holistic understanding of the current issue.

Further research may also focus on conducting comparative studies across industries, and locations to evaluate the variations in effectiveness of REIs and their impact on sustainable development. This enhances the generalizability of the findings to new contexts or cultures.

In addition, future studies could revisit and update existing theories such as stakeholder theory and institutional theory by considering the outcome of this study. Furthermore, stakeholder theory can be advanced by taking into consideration how stakeholders' interests and power dynamics influence the corporate decision-making process specifically in terms of REIs. On the other hand, institutional theory can also be advanced by considering the outcome of this study. Specifically, to better understand how institutional pressures and norms impact the REIs of corporate entities.

Future studies could expand existing sustainability frameworks to inculcate various factors beyond REIs alone. For instance, they can integrate other variables such as water usage, waste management, and supply chain sustainability into the integrated sustainability frameworks to provide more insights into corporate sustainability practices and their impacts.

Ethical approval

The present study involved human participants; therefore, we performed the research procedure in accordance with the principles stated in the Declaration of Helsinki. We obtained ethical approval prior to the study from the Institutional Review Board of DoS in Commerce of Mysore University. A committee conducted a meeting on 02-05-2023 and approved our research instrument. Further, respondents were informed about the purpose of the study and free consent was obtained from the respondents before the collection of data.

Acknowledgement

Swami Koragajja in his blessings the current research has been completed. The authors also pleased to acknowledge the support of Dr Parameshwara, Associate Professor, Faculty of Commerce, Mangalore University and Master Likhesh in completing the present work.

The researchers also thankful to Kingdom University for their support in our research endeavours.

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Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

The authors express their gratitude to Kingdom University, Bahrain, for their invaluable support and collaboration in our research publications and for generously funding this entire project. Their partnership has been instrumental in our endeavors. The present research is funded by Kingdom University, Bahrain for research grant [No. 2023/37].

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Data availability statement

Data will be made available upon request.

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Appendix A (Questionnaire)

Renewable Energy Initiatives by Corporates and Sustainable Development – A Mediation Analysis

Age

1. Below 25 years
2. 25–35
3. 35–45
4. 45–55
5. 55 years and above

Designation

1. Production manager
2. Service manager
3. Other administrative position
4. Academicians

Experience

1. Less than 10 years
2. 10–20
3. 20–30
4. 30 years and above

Need for renewable energy initiatives:

Statements	5	4	3	2	1
Renewable energy initiative is needed to have a cleaner and healthier environment					
Renewable energy initiative aligns with company's CSR goals					
It enhances the company's reputation					
It is required to reduce and maintain the cost					
Renewable energy initiatives ensure energy security					
It improves innovation					
It leads to competitive advantage					
Embracing renewable energy initiatives can help companies comply with the regulations and avoid potential penalties					
It is needed to have long term stability					
Renewable energy initiatives is required to improve employee morale and attract and retain top talent.					
Investing in renewable energy measures, companies can build resilience against climate related risks					
Renewable energy initiatives provide opportunities for companies to collaborate with governments, NGOs, and other organizations to work towards a shared goal of sustainable development					
Environmental Impact of Renewable energy initiatives:					
Renewable energy reduces the overall contribution to global warming and climate change.					
Renewables improves air quality and reduces smog, leading to better respiratory health.					
It helps conserve water resources, particularly in water-stressed regions.					
It will minimize habitat destruction and land degradation, preserving natural ecosystems.					
Renewable energy initiatives support biodiversity conservation and protect vulnerable species and ecosystems.					
Investing in renewable energy initiatives helps build resilience to climate change by reducing vulnerability to extreme weather events					
Renewable energy technologies produce little noise pollution, minimizing disruptions to local communities and wildlife.					
Renewable energy initiatives can bring energy access to remote and underserved regions and thus promote global energy justice and provide sustainable solutions.					
Social Impact of Renewable energy initiatives:					
Renewable energy initiatives create a significant number of jobs across various sectors, and help revitalize local economies and reduce unemployment rates.					
It empowers communities, provide additional revenue streams, and fund local development projects, thereby leads to the community development					
It can help lower energy costs for consumers, making energy more affordable and reducing energy poverty since it is more cost effective.					
It becomes an inspiration and leads to behaviour change					
Renewable energy initiatives create opportunities for educational programs and skill development in related fields.					
It helps in reduced environmental degradation					
Investing in renewable energy reduces a nation's reliance on imported fossil fuels					
Economic impact of renewable energy initiatives:					
The renewable energy sector generates a considerable number of jobs across various sectors and so stimulates economic growth.					
Renewable energy initiatives attract investments from both public and private sectors.					
Shifting to renewable energy can decrease the need for subsidies provided.					
Companies that excel in renewable energy technologies can export their expertise and products to other nations, creating a new source of export revenue.					
Investing in renewable energy helps mitigate climate change and reduces the costs associated with more severe climate impacts in the future.					
Healthcare system will experience cost savings due to decreased medical treatment requirements.					
Renewable energy prices tend to be more stable and predictable over the long term.					
It leads to increased energy efficiency					
Impact of Renewable energy initiatives:					
It creates job and can lead to shifts in the labor market and attract a diverse workforce.					
Renewable energy projects influence population distribution by leading to increased urbanization in areas with suitable resources for renewable energy generation.					

(continued)

Continued.

Need for renewable energy initiatives:

Statements	5	4	3	2	1
Investment in renewable energy leads to population growth as people move to these areas for better economic prospects.					
The transition to renewable energy can lead to shifts in population due to changes in job opportunities.					
Cleaner environments can attract and retain residents, leading to demographic changes over time.					
Renewable energy projects provide new income streams for rural communities resulting in Rural Revitalization					
It leads to increased investment in education and research and thereby attracting students and professionals and potentially affecting demographics					
It helps to have good International Relations					

Ethical statement:

Obtaining ethical clearance from the Institutional Review Board (IRB) in Mysore represents a primary aspect of ensuring the ethical standards of this research. The study is firmly conducted by considering ethical principles and by giving priority to safeguarding the participant's rights and well-being. The study followed the principles of the Declaration of Helsinki (World Medical Association, 2013), informed consent is obtained from all participants. Rigorous efforts have been made to minimize potential risks. The collection and handling of data was carried out with the utmost confidentiality, and the responsible and non-exploitative communication of findings ensures the dignity and privacy of participants. The ethical approval from the IRB in Mysore signifies an unwavering commitment to ethical research practices, prioritizing the welfare and rights of all individuals involved.