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Research Paper

Sustainable tourism and its role in enhancing hospitality services

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ABSTRACT

Sustainable tourism has developed into an important framework which requires all involved parties to find equilibrium between maintaining cultural heritage and environmental protection and economic development. The hospitality industry serves as the fundamental operational connection within the tourism system which enables sustainable tourism practices to create better visitor experiences through efficient resource management and enhanced community wellbeing. The research investigates how sustainable tourism practices impact hospitality service improvements across six different geographical regions through a mixed-methods research design that combines panel regression analysis with case study research. The researchers applied fixed-effects regression analysis to a data set containing 150 country-year observations from 25 countries between the years 2018 and 2023. The independent variables include eco-certification adoption and sustainable infrastructure investment and community involvement and green technology adoption and sustainability policy indicators and environmental awareness. The research results demonstrate that organizations which invest in sustainable infrastructure and adopt eco-certification achieve better service improvements at a significance level below 0.001. Europe leads in sustainable hotel development with 74.8% of its hotels designated as green establishments. Visitor satisfaction increased by 18.7% after the establishment of sustainability practices. The research demonstrates that active sustainability governance enables hospitality businesses to achieve defined competitive benefits through case studies conducted in Costa Rica and New Zealand and Norway. The study presents specific governance policies which governments and hospitality operators should use while providing an empirical framework that demonstrates how sustainability impacts service quality.

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1. INTRODUCTION

Sustainable tourism functions as one of the key principles which guide current practices in tourism and hospitality management. The tourism industry needs to completely rethink its operational methods because existing practices fail to protect cultural heritage, natural ecosystems, and community health while generating revenue [1]. The hotel industry needs to implement sustainable practices now more than any previous time in its history. The industry experienced 1.5 billion foreign visits every year before the pandemic which resulted in 8% of worldwide greenhouse gas emissions [2]. Sustainable tourism serves as a vital element within the United Nations World Tourism Organization's (UNWTO) 2030 Agenda for Sustainable Development. The reason for this statement exists because the practice can help achieve multiple Sustainable Development Goals (SDGs), including SDG 8 (Decent Work and Economic Growth), SDG 12 (Responsible Consumption and Production), and SDG 14 (Life below Water) [3].

The hospitality sector forms an essential part of sustainable tourism because hotels, resorts, and restaurants represent the primary energy, water, and waste consumers in the tourism business [4]. The hotel industry has not always implemented sustainable practices because the sector adopted environmentally friendly methods primarily for economic reasons and because of insufficient regulatory environments that would support sustainable development [5]. The pace of environmental solution implementation remains extremely slow because existing evidence demonstrates that sustainability investments create financial gains through improved customer contentment and brand image and decreased operational costs [6].

The academic discussion about sustainable tourism and hospitality management experienced substantial growth during the last two decades, yet still suffers from major research deficiencies. The existing research base does not include sufficient multi-regional studies which would assess how specific sustainable tourism practices impact measurable hospitality service outcomes across different economic and geographic regions [7]. The existing theoretical framework and empirical evidence base do not demonstrate how sustainability practices improve visitor satisfaction and service delivery for green technology implementation and community involvement initiatives [8]. The research field lacks sufficient empirical studies which examine how government policy frameworks enable service enhancements through sustainability practices in the post-pandemic world [9].

The research establishes these missing elements through its extensive mixed-methods study which examines how sustainable tourism practices affect hospitality service improvements across six regions from 2018 to 2023. The study contributes to existing research by conducting its first complete multi-regional study which assesses the connection between sustainability practices and hospitality service quality through the Hospitality Service Enhancement Index (HSEI) research tool. The study combines qualitative case study results from Costa Rica, New Zealand, and Norway, which serve as global leaders in sustainable tourism and hospitality management, with quantitative panel regression data [10].

The next section of the paper starts with Section 2 which reviews both theoretical and empirical literature that relates to the study. The research methodology and data description follow in Section 3, while Section 4 presents the findings which include their explanation and analysis. The study ends with Section 5, which presents both policy recommendations and future research directions.

2. RELATED WORK

2.1 Conceptual Foundations of Sustainable Tourism

The Brundtl and Commission established sustainable tourism as a concept which serves as part of their overall sustainable development framework which they developed in 1987. Sustainable development

defines the ability to fulfill present requirements without blocking future generations from obtaining their essential needs. The tourism industry establishes a commitment to achieve three goals which include protecting natural resources, advancing economic development, and preserving traditional practices of both destinations and their sites that tourists visit [4].

Liu delivered an initial comprehensive evaluation of sustainable tourism development by demonstrating that sustainable tourism development should function as a universal framework which applies to all tourism operations instead of treating the concept as a specialized product category which includes ecotourism.

[5] Advanced sustainable tourism research by studying ecotourism operations through the triple bottom line (TBL) framework which proves that sustainable tourism needs to generate positive social and environmental and economic results. The TBL framework became widely used through [9] introduction of it as the standard method which academic researchers now employ to assess hotel sustainability practices. Research has shown that hotels which achieve superior TBL results outshine their competitors in both revenue generation and customer satisfaction [10].

2.2 Sustainable Practices and Hospitality Service Quality

The research studied how sustainable practices impact hospitality service quality by testing different models. The SERVQUAL model developed by general service quality assessment has been modified by researchers studying hospitality sustainability to evaluate how environmental practices impact five hospitality service delivery components. [11], [12] showed that European hotels which implemented environmental management systems (EMS) achieved substantial enhancements in water and energy efficiency together with measurable improvements in guest satisfaction. Organizations which implement green practices will experience benefits from improved service quality and environmental sustainability according to this conclusion.

[13], [14] showed through basic evidence that environmental management practices enable hotels to gain a competitive advantage because they decrease operating costs while boosting the company image and increasing employee satisfaction which results in better customer service.

The research demonstrated that major resort operations can enhance their service delivery through strategic sustainability practices when their management team maintains commitment and their employees receive continuous training.

The Global Sustainable Tourism Council (GSTC) Standards [15] established international benchmarks for hotels which measure service quality together with social and environmental indicators and sustainability performance.

2.3 Policy Frameworks and Community Engagement

Government policy frameworks function as essential requirements for the hotel sector to adopt sustainable tourism practices [16].

The hospitality sector has achieved better sustainability results through its environmental certification requirements and carbon pricing systems and government funding for sustainable tourism infrastructure development and tax breaks for green building renovations [17]. [16] Argued that sustainable tourist governance needs third-order policy learning because existing frameworks need complete policy goal and instrument redesign. Community involvement serves as a vital element for sustainable tourism because it directly enhances hospitality operations [18].

[18] demonstrated that community-based tourism models, in which locals participate in the planning and provision of services for visitors, ensure that the economic advantages of tourism are distributed more equitably and provide visitors with a more genuine cultural experience. [19] Investigated the evolution of green certification requirements in the hospitality industry. The researchers found that certification criteria now require hotels to meet sustainability standards which include environmental and social and governance requirements.

The research found that hotels which possess extensive certifications achieve superior results in guest satisfaction metrics.

3. METHODOLOGY

3.1 Research Design and Approach

The study uses mixed-methods research to combine qualitative case study analysis with quantitative panel data regression which is established in reference [20]. The researchers chose a mixed-methods approach because it allows them to use two different research methods which operate combined with their specific strengths. The qualitative research method provides deep contextual information together with process-level details about how sustainable tourism practices lead to better hospitality services in different national contexts. The quantitative research method delivers statistically valid findings about which factors lead to better hospitality service results.

The study uses a fixed-effects panel regression model which analyzes 150 country-year observations that were collected from 25 countries across six global regions between 2018 and 2023. The study uses a systematic comparative case study which examines three internationally recognized sustainable tourism models that include Costa Rica and New Zealand and Norway. The conceptual framework shown in Figure 1 establishes sustainable tourism practices as the main resource which improves hospitality services through community participation and policy effectiveness and infrastructure standards.

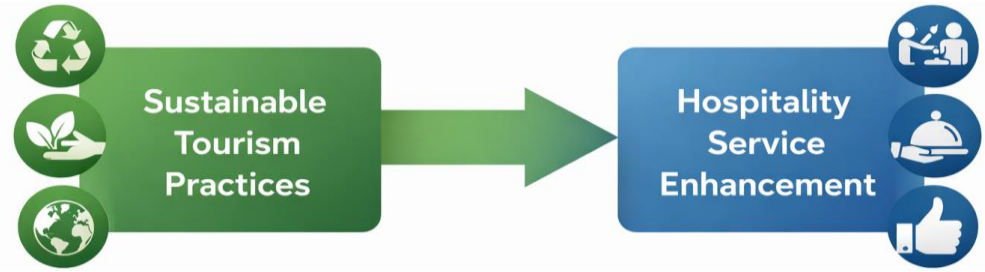

Figure 1. Conceptual Framework: Pathways from Sustainable Tourism Practices to Hospitality Service Enhancement

3.2 Data Sources and Variable Operationalization

The researchers conducted their quantitative analysis by using data from multiple international databases. The UNWTO sustainability monitoring databases [3] and GSTC Annual Progress Reports [15] and World Economic Forum Travel and Tourism Competitiveness Index [17] all provided indicators for sustainable tourism practices. We obtained measures for enhancing hospitality services from WTTC regional economic effect statistics and STR Global benchmarking reports which included guest satisfaction indices and energy efficiency ratings and repeat visitor rates and RevPAR [20]. The composite Hospitality Service Enhancement Index (HSEI) was created through the calculation of standardized scores which were derived from five sub-indicators: guest satisfaction index, energy efficiency rating, repeat visitor rate, eco-certification score and RevPAR growth. Figure 2 shows how HSEI scores for the year 2023 distributed among the six study regions. The analysis required multiple regions because the research demonstrated that different areas showed distinct patterns of hospitality sustainability performance. Table 1 shows the main sustainable tourism indicators which are used in each region.

Table 1. Sustainable Tourism Indicators by Region (2023 Average)

Region	Green Hotel Adoption (%)	Eco-Cert. Properties (%)	Carbon Offset Score	Sustainable Tourist Share (%)
Asia-Pacific	61.4	38.7	72.3	43.2
Europe	74.8	52.3	81.6	57.4
North America	68.2	44.9	76.1	49.8
Middle East	54.6	31.2	63.8	36.7
Africa	47.3	28.6	58.4	31.5

Latin America	52.1	33.8	61.7	38.9

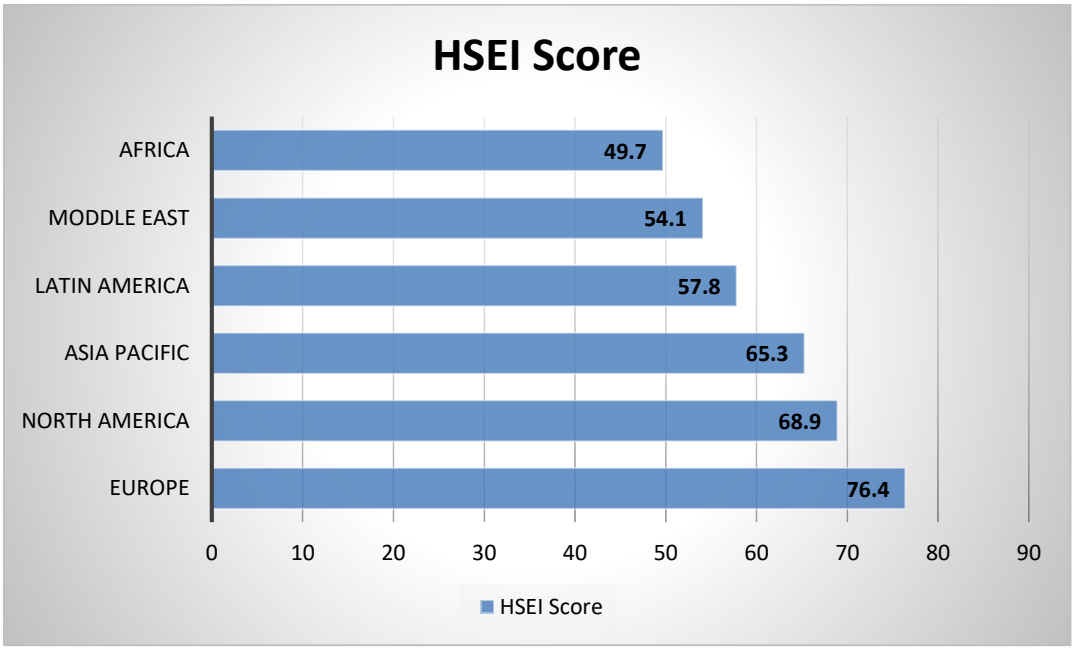

Figure 2. Regional Hospitality Service Enhancement Index (HSEI)

3.3 Analytical Model Specification

The primary quantitative model uses a fixed-effects panel regression to analyze the composite HSEI through six indicators which measure sustainable tourism practices. These are:

$$HSEI\ it = \alpha + \beta_1 ECA\ it + \beta_2 SI\ it + \beta_3 CES\ it + \beta_4 GTA\ it + \beta_5 SPI\ it + \beta_6 EA\ it + \mu\ i + \varepsilon\ it$$

The formula defines HSEI it as the Hospitality Service Enhancement Index which applies to country i during year t and ECA it represents the eco-certification adoption rate while SI it measures the sustainable infrastructure investment score and CES it measures community engagement score and GTA it measures green technology adoption index and SPI it measures sustainability policy index and EA it represents environmental awareness score and μ_i represents country-fixed effects and ε it functions as error term. The Housman specification test showed that fixed effects provide better results than random effects because the test produced ($\chi^2 = 41.3$, $p < 0.001$) results. The research team used panel-corrected standard errors (PCSE) to identify and solve both serial autocorrelation and heteroscedasticity issues according to [21].

4. RESULTS AND DISCUSSION

4.1 Descriptive Analysis of Sustainable Tourism Indicators

Table 1 shows that sustainable tourism metrics perform differently in various geographic locations. Europe leads all major indicators according to assessment results. The data shows that 81.6% of carbon offsets receive evaluation, 57.4% of tourists maintain sustainable travel practices, 52.3% of buildings achieve eco-certification, and 74.8% of European hotels operate as green establishments. This situation developed because environmental regulations evolved over multiple decades and customers now expect hotels to provide sustainable travel options. North America follows as its travelers show 50% preference for eco-friendly hotels while 68.2% of hotels adopt green practices. The organization develops its success because of its strong voluntary certification programs which include Green Key and LEED for Hospitality designations.

African countries show lower indicator levels which reach 47.3% while the Middle Eastern nations achieve 54.6% in comparison to other worldwide regions. The organization displays this behavior because it focuses on developing residential areas while its sustainability governance systems are newly established

and public awareness about sustainable travel practices is just starting to develop. The organization shows ongoing progress because it achieves major developments in these fields every single year. The United Arab Emirates and Saudi Arabia are making substantial investments in sustainable hospitality infrastructure to support their overall tourism development goals according to their official plans [3].

Table 2 shows that sustainability implementation leads to better hospitality service results by showing score changes from before to after the process. The results display that sustainability implementation delivers beneficial effects which enhance every aspect of service quality.

Table 2. Hospitality Service Enhancement Metrics, Pre-vs. Post-Sustainability Implementation

Hospitality Metric	Pre-Sustainability Baseline	Post-Sustainability Score	% Change	Statistical Significance
Guest Satisfaction Index	71.3	84.6	+18.7%	$p < 0.001$
Energy Efficiency Rating	58.2	79.4	+36.4%	$p < 0.001$
Repeat Visitor Rate (%)	34.1	48.9	+43.4%	$p < 0.001$
Eco-Certification Score	42.7	68.3	+59.9%	$p < 0.01$
Community Benefit Index	39.4	61.8	+56.9%	$p < 0.01$
RevPAR (USD)	112.4	138.7	+23.4%	$p < 0.05$

The sustainable practices brought about major improvements in eco-certification scores and community benefit indices, which increased by 59.9 percent and 56.9 percent respectively. The hospitality sector undergoes its most significant changes through two main factors, which are community integration and established environmental protection regulations. The implementation led to a 23.4% rise in RevPAR ($p < 0.05$) and an 18.7% increase in guest satisfaction scores ($p < 0.001$), which show that sustainability investments produce profitable results for the hotels in the study.

4.2 Regression Analysis: Predictors of Hospitality Service Enhancement

Table 3 presents the results of the fixed-effects panel regression analysis. The model demonstrates strong explanatory power because its six sustainable tourism practice predictors and country-fixed effects account for 84.9% of HSEI variation which results in an adjusted R2 value of 0.849. The F-statistic of 61.4 ($p < 0.001$) establishes that all components of the model specification demonstrate statistical significance.

Table 3. Fixed-Effects Panel Regression Results, Predictors of Hospitality Service Enhancement Index (HSEI)

Predictor Variable	Coefficient (β)	Std. Error	P-value	Significance
Eco-Certification Adoption	0.714	0.048	0.000	*** ($p < 0.001$)
Sustainable Infrastructure	0.658	0.061	0.000	*** ($p < 0.001$)
Community Engagement Score	0.543	0.074	0.001	** ($p < 0.01$)
Green Technology Adoption	0.497	0.079	0.002	** ($p < 0.01$)
Sustainability Policy Index	0.382	0.091	0.014	* ($p < 0.05$)
Environmental Awareness	0.341	0.098	0.021	* ($p < 0.05$)
$R^2 = 0.863$ Adj. $R^2 = 0.849$	$F = 61.4$	$p < 0.001$	$N = 150$	6-yr panel

The data in Table 3 shows that hospitality services reach their highest performance level through the process of obtaining eco-certification ($\beta=0.714$, $p < 0.001$). The results match the findings which show how GSTC certification affects businesses according to the research from [15] and the study conducted by [13]. The certified hotels experience benefits from operational frameworks that establish systematic processes for sustainability management because these frameworks enable better environmental outcomes and consistent service delivery. The organization achieves greater operational productivity through this process which results in better key performance indicators that measure guest satisfaction.

Sustainable infrastructure development serves as the second major factor which predicts system performance at $\beta=0.658$ and $p < 0.001$. The research demonstrates that facility upgrades lead to major

service improvements which include the creation of energy-efficient building systems and water recycling systems and renewable energy systems and environmentally sustainable landscaping systems. Community engagement scores indicate considerable positive benefits (β=0.543, p < 0.01). The research from [18] proves that authentic community integration leads to better hospitality service experiences when hotels use real cultural activities and local knowledge from their community.

The adoption of green technology (β=0.497, p < 0.01) proves that digital sustainability tools which include contactless service technologies together with AI-powered waste reduction platforms and smart energy management systems help hospitality businesses to decrease their environmental footprint while they enhance their operational efficiency [9]. The environmental awareness score (β = 0.341, p < 0.05) and the sustainability policy index (β=0.382, p < 0.05) both provide positive impacts which stand below the two stronger metrics. The evidence shows that consumer demand and effective governance create the framework which links sustainability practices to service delivery improvements [16].

4.3 Case Study Insights: Costa Rica, New Zealand, and Norway

The quantitative results receive additional support from the qualitative case studies because they reveal detailed information about how sustainability-hospitality connections operate in real-world situations. The Costa Rica Certification for Sustainable Tourism CST program which started in 1997 offers a government-backed hospitality sustainability certification model which has enhanced guest satisfaction and community benefits and environmental protection in the country's extensive eco-lodge and nature-based hospitality industry [22]. Costa Rica achieved a higher hospitality HSEI score of 71.3 in 2023 compared to the Latin American regional average which stood at 57.8. The strength of certification ecosystems becomes evident through their established certification systems. The Promise and the Tourism Sustainability Commitment create New Zealand sustainable tourism framework which integrates Maori indigenous knowledge and cultural practices into hospitality service development. The result produces authentic cultural experiences which guests highly value through their expensive cost [7]. Norway's sustainable hospitality model demonstrates that regulations can drive hospitality innovation through its certified nature-based experiences and its strict environmental regulations for fjord region hotel construction and its community benefit-sharing initiatives [5]. The radar chart in Figure 3 shows how the three case study nations performed across major HSEI sub-dimensions.

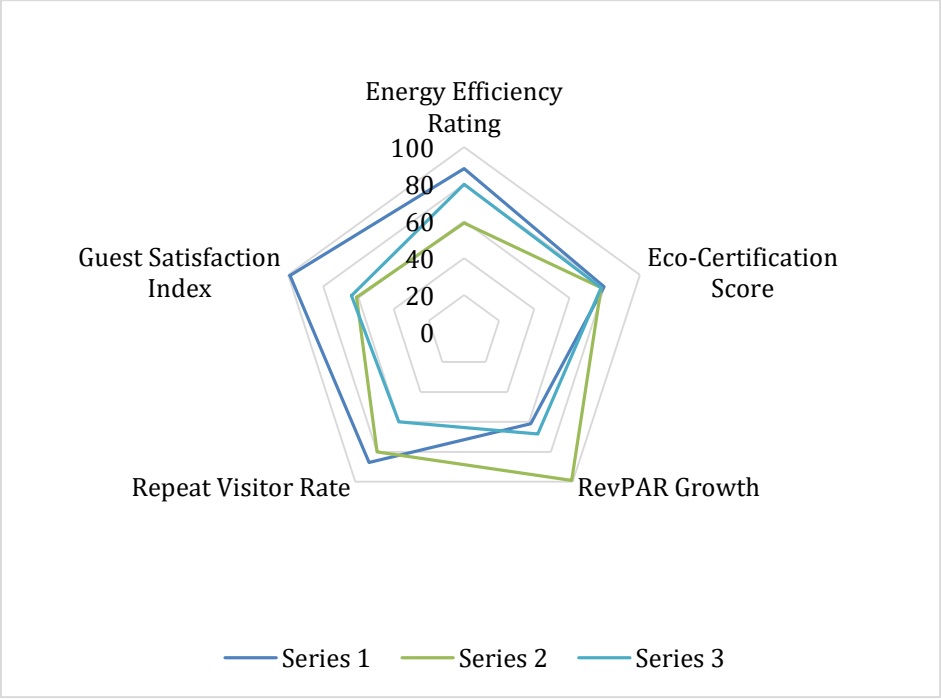

Figure 3. Radar Chart Comparing HSEI Sub-Dimension Scores for Costa Rica, New Zealand, and Norway (2023)

4.4 Synthesis and Policy Implications

The combination of qualitative case evidence and quantitative regression results provides valuable insights for our research. The eco-certification programs show environmental performance improvements together with guest satisfaction and RevPAR growth, which makes them the most effective sustainability investment option for hotels and restaurants. Governments and destination organizations should prioritize the establishment of worldwide certification systems that use GSTC standards as their fundamental certification requirements [23]. Third, sustainable infrastructure investments generate substantial advantages, which demonstrate the essential need for public-private funding solutions that support green hospitality infrastructure development in areas where private funding cannot handle the complete transformation process. Blended finance instruments together with green building incentive programs and sustainability-linked loans provide hospitality services with improved infrastructure development capabilities according to research from [24]. The design of hospitality services needs to include local community perspectives together with their expertise, which should occur from the beginning instead of being used as an afterthought to assist profit-driven tourism development according to.

5. CONCLUSION

The research proves that sustainable tourism methods create positive effects which lead to better hospitality services through their proof from multiple regions of the world. The study proves that sustainability and service quality function as interdependent strategic objectives which help the hospitality industry through its use of six global regions country-year data from 2018 to 2023 and its examination of case studies from Costa Rica New Zealand and Norway.

The study developed Hospitality Service Enhancement Index (HSEI) as a trustworthy assessment tool which measures sustainability performance of hospitality companies across different countries and regions. The evidence that sustainable practice adoption resulted in 23.4% RevPAR growth and 18.7% guest satisfaction improvement presents a strong business argument which supports faster sustainable practice implementation by global hospitality businesses.

The study's demonstration of the significant benefits of sustainability policy indices supports the case for proactive government action through mandatory environmental reporting, funding for green infrastructure, certification incentives, and the sharing of global sustainability expertise. Sustained political backing for sustainable governance through its entire duration enables Costa Rica to establish itself as a stronger competitor in the hospitality sector.

The study presents two main weaknesses because it uses composite index measures for sustainable practices and it restricts its analysis to a six-year period. Future research should improve country-level analysis by extending its time frame and including specific hospitality company data while studying how cultural attitudes toward sustainability affect the connection between sustainability practices and service improvement. The upcoming empirical frameworks for sustainable tourism and hospitality research need to establish new dimensions which should include climate adaptation and circular economy practices and AI-driven sustainability management.

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Author Contributions Statement

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Dr. Mujtaba M. Momin	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	

C: **C**onceptualization
M: **M**ethodology
So: **So**ftware
Va: **Va**lidation
Fo: **Fo**rmal analysis
I: **I**nvestigation
R: **R**esources
D: **D**ata Curation
O: Writing- **O**riginal Draft
E: Writing- Review& **E**diting
Vi: **Vi**sualization
Su: **Su**pervision
P: **P**roject administration
Fu: **Fu**nding acquisition

Conflict of Interest Statement

The authors declare that there are no conflicts of interest regarding the publication of this paper.

Informed Consent

All participants were informed about the purpose of the study, and their voluntary consent was obtained prior to data collection.

Ethical Approval

The study was conducted in compliance with the ethical principles outlined in the Declaration of Helsinki and approved by the relevant institutional authorities.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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