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Challenges of climate change at nature tourism in Bangladesh: Evidence from Hill tracks.

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Author's short biographies

- **S M Sohel Ahmed: Educator, Researcher, Leader, Photographer, Anchor, Proactive.**

- Mr. Ahmed is a distinguished educator, accomplished researcher, and seasoned sales professional from Dhaka, Bangladesh. With 14 years of teaching experience at undergraduate and graduate levels, he currently leads as the Department Head of Marketing at Lalmatia Government Mohila College.

- Beyond his teaching role, S M Sohel Ahmed is an avid researcher with sixteen international publications, reflecting his dedication to advancing knowledge. He's particularly passionate about the intersection of AI, as demonstrated by his ongoing research project. His academic insights are enriched by his five years of sales and marketing experience.

- This dynamic individual's contributions extend beyond his roles; they encompass a commitment to growth, innovation, and community enrichment. With upcoming publications and a relentless pursuit of excellence, S M Sohel Ahmed continues to leave a lasting impact on education, research, and business realms alike.

Introduction

- **Nature Tourism and Climate Change:**
  - Nature tourism is growing, but climate change is causing problems.
  - Changing climate affects weather, nature, and tourism.
- **Strong Plan for Solutions:**
  - Use ideas from climate change, nature tourism, and risk management.
  - Understand how climate change affects nature tourism and find solutions.
- **What the Plan Does:**
  - Explains the problems and why they happen.
  - Looks at how to adapt and make things better.
- **Involving People and Rules:**
  - Get people involved in finding solutions.
  - Make good rules to protect nature and tourism.
- **Watching and Learning:**
  - Keep an eye on how things change.
  - Learn from what happens and improve the plan.
- **Making Nature Tourism Strong:**
  - The plan aims to help nature tourism stay strong.
  - Even with climate change, we want nature tourism to be safe and enjoyable.
- **Guiding the Future:**
  - This plan can help with more research and actions.
  - It's a guide for keeping nature tourism safe and fun for everyone.

The Literature Review

- **Climate Change and Nature Tourism:**
  - Climate change is a global challenge impacting sectors like nature tourism.
  - Nature tourism relies on intact ecosystems and favorable climate conditions (Lemieux, 2019).

- **Diverse Impacts of Climate Change:**
  - Climate change affects biodiversity, habitats, weather, and extreme events (Gössling, 2018).
  - Coastal destinations face sea level rise, storm surges, coral bleaching, and habitat loss (Becken, 2018).

- **Effects on Visitor Behavior and Destinations:**
  - Climate change affects visitor behavior and can reduce visitor numbers (Brouder, 2019; Gössling, 2018).

The Literature Review

- **Inland Destinations and Indigenous Communities:**
  - Inland areas like mountainous regions are impacted by precipitation changes and glacial retreat (Lemieux, 2019).
  - Indigenous communities relying on nature tourism face weather changes and habitat loss (Hossain & Chowdhury, 2017).

- **Need for Adaptation and Mitigation:**
  - Climate change impacts lead to shifts in visitor demand and livelihoods (Rahman, 2018).

- **Specific Case: Rangamati:**
  - Changing climate patterns affect biodiversity, landscapes, and livelihoods (Shahid & Nath, 2018).
  - Changing hydrological regimes impact water-based activities (Chowdhury, Rashid, & Hossain, 2020).
  - Climate change affects biodiversity and eco-tourism (Akter, Khan, & Rahman, 2020).

The Literature Review

- **Local Community Perspectives and Strategies:**
  - Changing climate patterns disrupt livelihoods and impact landscapes (Hossain & Chowdhury, 2017).
  - Indigenous communities adapt through traditional knowledge (Ahmed, Akter, & Groulx, 2021).
  - Indigenous perspectives influence ecotourism adaptation (Rahman, Akter, & Khan, 2018).
- **Tour Operators' Perspectives and Strategies:**
  - Tour operators perceive risks from changing climate patterns and extreme events. (Chowdhury & Haque, 2016).

This review highlights the diverse impacts of climate change on nature tourism, including visitor behavior, destination attractiveness, and local livelihoods. Various regions, including coastal, inland, and indigenous communities, are vulnerable. Adaptation and mitigation strategies are crucial for sustaining nature tourism in changing climates.

The Study

- In summary, this research highlights the critical need for proactive measures to address climate change risks in the Hill Tracks region of Bangladesh. The implications emphasize the importance of education, adaptive strategies, infrastructure resilience, conservation efforts, policy interventions, and collaborative approaches to ensure the long-term sustainability of nature tourism in the face of changing climatic conditions.

Research Question(s)

- How do individuals perceive the risks of climate change and its impact on nature tourism in Bangladesh?
- What are the major risks posed by climate change to infrastructure, livelihood, environmental resources, and visitor experiences in the Hill Tracks region?
- How does the perception of climate change risks correlate with damage to tourism infrastructure, livelihood, and environmental resources?
- What is the level of satisfaction with mitigation efforts aimed at addressing climate change impacts on tourism?
- How does satisfaction with mitigation efforts relate to the perceived competitiveness of the tourism industry in Bangladesh?

Methodology

- **Research Methodology for Investigating Climate Change Risks in Hill Tracks Nature Tourism: A Mixed-Methods Approach**
- **Data Collection:**
- **Literature Review:**
  - Comprehensive review of climate change impacts on nature tourism, adaptation strategies, and policies.
  - Source gathering: academic databases, research articles, reports, and books.
  - Proper referencing and citation for all sources.

  Sampling Method: Purposive

  Scale: Five point Likert scale was used

- **Surveys and Interviews:**
  - Surveys and structured interviews with stakeholders.
  - Participants: nature tourism operators, local communities, tourists, and relevant stakeholders.
  - Surveys gather quantitative data; interviews provide qualitative insights.

Methodology

- **Data Analysis:**
- **Quantitative Data Analysis:**
  - Statistical techniques: descriptive statistics, regression analysis, and more.
  - Identify patterns, trends, and relationships in quantitative survey data.
- **Qualitative Data Analysis:**
  - Thematic analysis of qualitative interview data.
  - Identify common themes, patterns, and perceptions regarding climate change risks.
- **Interpretation and Synthesis:**
- Integration of Quantitative and Qualitative Data:
  - Drawing conclusions and insights based on combined findings.
- Support from Existing Literature:
  - Relevance to theories, concepts, and climate change tourism literature.
- **Stages of Research:**
- **Data Collection:**
  - Comprehensive literature review on climate change impacts and adaptation in nature tourism.
  - Surveys and structured interviews with diverse stakeholders.

Methodology

- **Data Analysis:**
  - Quantitative analysis: statistical techniques to identify patterns in survey data.
  - Qualitative analysis: thematic identification in interview narratives.
- **Interpretation and Conclusion:**
  - Synthesis of quantitative and qualitative findings.
  - Drawing insights and conclusions supported by literature.
- **Expected Outcome:**
- Holistic understanding of climate change risks in Hill Tracks nature tourism.
- Insights into perceptions, challenges, and adaptation strategies.
- Contribution to both theoretical knowledge and practical strategies.
- **Significance:**
- Addressing a critical gap in understanding climate change impacts on nature tourism.
- Guiding policymakers, operators, and communities towards effective adaptation measures.

Results

- The study found that a significant percentage of respondents perceived increased risks of climate change, including
- -rainfall,
- -strong winds,
- -cyclones, and
- -inundation during storms.

Participants also acknowledged the damage caused by climate change to -infrastructure,

-livelihood,

-environmental resources, and

-food supply.

Additionally, the study revealed a mixed level of satisfaction with mitigation efforts and perceived moderate competitiveness of the tourism industry in Bangladesh.

Results

- In this case, the Cronbach's Alpha value is 0.99, which is very close to 1. This suggests that the items in the questionnaire are highly reliable and consistent in measuring the same underlying construct.

- Age: 55.88% are between 45-60 years old.
- Gender: Male -76.47% .
- Education: Graduate -76.47
- Occupation: Service-58.82%

- Respondents' perceptions of increased rainfall vary, with a significant portion perceiving a neutral effect (38.23%), followed by decreased (32.36%) and increased (14.71%) perceptions. Chi-square value: 14.24, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.007 .

- Respondents' views on climate change's impact on livelihood vary. The largest portion agrees (41.18%) or highly agrees (23.53%), while a smaller percentage is neutral (20.59%) or disagrees (11.76%). Chi-square value: 13.94, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.007.

- Similar to rainfall, respondents' perceptions of increased strong winds are varied. A large percentage perceive a neutral effect (38.23%), followed by increased (29.42%) and decreased (26.47%) perceptions. Chi-square value: 7.65, Degrees of freedom (df): 3, Asymptotic Significance (p-value): 0.054.

- Respondents' perceptions of increased cyclones vary, with a notable portion perceiving a neutral effect (23.53%) and decreased cyclones (35.29%). A significant percentage perceive increased (26.47%) or highly increased (5.88%) cyclones. Chi-square value: 10.41, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.034.

Results

- The majority of respondents agree (35.29%) or highly agree (23.53%) that climate change causes damage to property, while a smaller percentage have neutral (35.29%) or disagreeing (2.94%) views. Chi-square value: 7.88, Degrees of freedom (df): 3, Asymptotic Significance (p-value): 0.049.

- Respondents' perceptions regarding damage to infrastructure vary. The largest portion is neutral (47.06%), followed by agreeing (26.47%) and highly agreeing (17.65%) respondents. Chi-square value: 10.94, Degrees of freedom (df): 3, Asymptotic Significance (p-value): 0.012.

- Views on climate change's impact on environmental resources vary. A significant portion agrees (35.29%) or highly agrees (23.53%), while smaller percentages are neutral (20.59%), disagree (11.76%), or highly disagree (8.82%). Chi-square value: 7.47, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.113.

- Respondents' views on the area becoming inundated during storms vary. The largest portion agrees (41.18%), followed by neutral (23.53%), highly agrees (11.76%), and disagree (14.71%). Chi-square value: 11.59, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.021.

- Views on road risks during climate events vary. The majority perceive decreased risk (38.23%) or neutral risk (35.29%), while smaller percentages perceive increased risk (20.59%) or highly decreased risk (2.94%). Chi-square value: 24.53, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.000.

- Respondents' views on fog's present condition vary. The largest portion perceive increased fog (55.88%), followed by neutral (26.47%), highly decreased (5.88%), and decreased (5.88%) conditions. Chi-square value: 19.53, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.001.

- Views on increased floods vary. The largest portion perceives increased floods (38.23%), followed by neutral (41.18%) and decreased floods (8.82%). Chi-square value: 32.76, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.000.

- Respondents' views on increased droughts vary. A significant portion perceives increased (50%) or highly increased (26.47%) droughts, while smaller percentages are neutral (8.82%) or decreased (8.82%). Chi-square value: 22.47, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.000.

Results

- Views on increased pollution vary. The majority perceives neutral (38.23%) or increased (26.47%) pollution, while smaller percentages perceive decreased (23.53%) or highly increased (8.82%) pollution. Chi-square value: 23.65, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.000.

- Views on increased air precipitation vary. The largest portion perceives increased precipitation (41.18%), followed by neutral (29.42%), and highly increased precipitation (20.59%). Chi-square value: 13.65, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.009.
- Respondents' views on increased dust and smoke vary. The majority perceive increased (41.18%) or highly increased (23.53%) dust and smoke, while smaller percentages perceive neutral (23.53%) or decreased (5.88%) effects. Chi-square value: 17.47, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.002.

- Views on increased allergies vary. The majority perceives increased (41.18%) or highly increased (14.71%) allergies, while smaller percentages perceive neutral (35.29%) or decreased (2.94%) effects. Chi-square value: 14.82, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.005.

- Respondents' views on increased insect-borne diseases vary. A significant portion perceives increased (44.12%) or highly increased (11.76%) diseases, while smaller percentages perceive neutral (32.36%) or decreased (8.82%) effects. Chi-square value: 20.41, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.000.

- Views on heavy rainstorms vary. The majority observes increased rainstorms (55.88%), followed by neutral (29.42%) and highly decreased rainstorms (2.94%). Chi-square value: 20.71, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.000.

- Views on climate change's impact on food supply vary. The majority highly agrees (35.29%) or agrees (35.29%) that it disrupts food supply, while a smaller percentage is neutral (20.59%) or disagrees (8.82%). Chi-square value: 21.76, Degrees of freedom (df): 3, Asymptotic Significance (p-value): 0.000.

- Views on climate change causing deforestation vary. A significant portion agrees (41.18%) or highly agrees (29.41%), while smaller percentages are neutral (11.76%) or disagree (11.76%). Chi-square value: 6.71, Degrees of freedom (df): 3, Asymptotic Significance (p-value): 0.082.

Results

- Views on climate change causing water shortage vary. The majority highly agrees (41.18%) or agrees (29.41%) with this perception, while smaller percentages are neutral (11.76%) or disagree (5.88%). Chi-square value: 14.82, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.005.

- Respondents' views on water shortage in lakes and rivers vary. The majority agrees (55.88%) or highly agrees (14.71%), while smaller percentages are neutral (11.76%) or disagree (14.71%). Chi-square value: 28.94, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.000.

- Views on climate change's impact on fresh water supply vary. The majority highly agrees (35.29%) or agrees (23.53%) with this perception, while smaller percentages are neutral (14.71%) or disagree (17.65%). Chi-square value: 6.88, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.142.

- Views on climate change causing increased population displacement vary. The majority agrees (52.94%) or highly agrees (14.71%), while smaller percentages are neutral (17.65%) or disagree (5.88%). Chi-square value: 24.53, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.000.

- Respondents' views on climate change causing undermining in local communities vary. The majority agrees (44.11%) or highly agrees (14.71%), while smaller percentages are neutral (20.59%) or disagree (14.71%). Chi-square value: 6.94, Degrees of freedom (df): 3, Asymptotic Significance (p-value): 0.074.

- Views on climate change causing mudslides vary. The majority agrees (52.94%) or highly agrees (11.76%), while smaller percentages are neutral (11.76%) or disagree (8.82%). Chi-square value: 23.35, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.000.

- Views on climate change causing property loss vary. The majority agrees (44.11%) or highly agrees (14.71%), while smaller percentages are neutral (23.3%) or disagree (17.65%). Chi-square value: 7.18, Degrees of freedom (df): 3, Asymptotic Significance (p-value): 0.066.

Results

- Respondents' views on the impact of climate change on tourism vary. A slightly larger proportion agrees (52.94%) with decreased tourist numbers, while a smaller percentage disagrees (47.06%). Chi-square value: 1.06, Degrees of freedom (df): 1, Asymptotic Significance (p-value): 0.303.

- Views on supporting tourism sector development vary. The majority supports (41.18%) or strongly supports (26.47%) such development, while smaller percentages oppose (5.88%) or strongly oppose (2.94%). Chi-square value: 16.88, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.002.

- Views on the overall impact of tourism sector development vary. The majority perceives the impact as positive (47.06%) or moderately positive (26.47%), while smaller percentages perceive it as negative (17.65%) or very positive (8.82%). Chi-square value: 10.94, Degrees of freedom (df): 3, Asymptotic Significance (p-value): 0.012.

- Respondents' evaluations of the competitiveness of Bangladesh's tourism industry vary. The largest proportion perceives it as somewhat competitive (38.23%), followed by less competitive (32.36%) and competitive (23.53%). Chi-square value: 18.35, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.001.

- Do you think the rainfall raised? R: The correlation coefficient (Pearson's correlation coefficient) between the predictor variable ("Do you think nature tourism has challenges due to climate change?") and the outcome variable (rainfall raise) is 1.00. This value indicates a perfect positive linear relationship between the variables. R Square: The coefficient of determination, R-squared, is also 1.00. This means that 100% of the variability in the outcome variable can be explained by the predictor variable in this model. Adjusted R Square: The adjusted R-squared value is also 1.00, indicating that the model's goodness of fit remains perfect even when considering the number of predictor variables.

- There is a borderline statistically significant association between perceptions of increased strong wind and climate change. Model Summary: Do you think the strong wind raised? R: The correlation coefficient between the predictor variable ("Do you think nature tourism has challenges due to climate change?") and the outcome variable (strong wind raise) is 1.00. This value suggests a perfect positive linear relationship between the variables. R Square: The coefficient of determination, R-squared, is also 1.00. This indicates that 100% of the variability in the outcome variable can be explained by the predictor variable in this model. Adjusted R Square: The adjusted R-squared value is also 1.00, implying a perfect fit even when considering the number of predictor variables.

- Chi-square value: 10.41, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.034. There is a statistically significant association between perceptions of increased cyclone activity and climate change. Model Summary: Do you think cyclone has raised? R: The correlation coefficient between the predictor variable ("Do you think nature tourism has challenges due to climate change?") and the outcome variable (Cyclone raise) is 1.00. This suggests a perfect positive linear relationship between the variables. R Square: The coefficient of determination, R-squared, is also 1.00. This indicates that 100% of the variability in the outcome variable can be explained by the predictor variable in this model. Adjusted R Square: The adjusted R-squared value is also 1.00, implying a perfect fit even when considering the number of predictor variables.

Discussion

- Chi-square value: 7.88, Degrees of freedom (df): 3, Asymptotic Significance (p-value): 0.049. There is a borderline statistically significant association between perceptions of property damage and climate change. Model Summary (Does it damage property?): R: The correlation coefficient between the predictor variable ("Do you think nature tourism has challenges due to climate change?") and the outcome variable (property damage) is 1.00. This indicates a perfect positive linear relationship between the variables. R Square: The coefficient of determination, R-squared, is also 1.00. This suggests that 100% of the variability in the outcome variable can be explained by the predictor variable in this model. Adjusted R Square: The adjusted R-squared value is also 1.00, implying a perfect fit even when considering the number of predictor variables.

- Chi-square value: 10.94, Degrees of freedom (df): 3, Asymptotic Significance (p-value): 0.012. There is a statistically significant association between perceptions of infrastructure damage and climate change. Model Summary (Does it damage infrastructure?): R: The correlation coefficient between the predictor variable ("Do you think nature tourism has challenges due to climate change?") and the outcome variable (infrastructure damage) is 1.00. This indicates a perfect positive linear relationship between the variables. R Square: The coefficient of determination, R-squared, is also 1.00. This suggests that 100% of the variability in the outcome variable can be explained by the predictor variable in this model. Adjusted R Square: The adjusted R-squared value is also 1.00, implying a perfect fit even when considering the number of predictor variables.

- Chi-square value: 13.94, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.007. There is a statistically significant association between perceptions of livelihood damage and climate change. Model Summary (Does it damage livelihood?): R: The correlation coefficient between the predictor variable ("Do you think nature tourism has challenges due to climate change?") and the outcome variable (livelihood damage) is 1.00. This indicates a perfect positive linear relationship between the variables. R Square: The coefficient of determination, R-squared, is also 1.00. This suggests that 100% of the variability in the outcome variable can be explained by the predictor variable in this model. Adjusted R Square: The adjusted R-squared value is also 1.00, implying a perfect fit even when considering the number of predictor variables.

- Chi-square value: 7.47, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.113. There is no statistically significant association between perceptions of environmental resource damage and climate change. Model Summary (Does it damage environmental resources?): R: The correlation coefficient between the predictor variable ("Do you think nature tourism has challenges due to climate change?") and the outcome variable (damage to environmental resources) is 1.00. This suggests a perfect positive linear relationship between the variables. R Square: The coefficient of determination, R-squared, is also 1.00. This indicates that 100% of the variability in the outcome variable can be explained by the predictor variable in this model. Adjusted R Square: The adjusted R-squared value is also 1.00, implying a perfect fit even when considering the number of predictor variables.
- Chi-square value: 11.59, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.021. Interpretation: There is a statistically significant association between perceptions of area inundation during storms and climate change. Model Summary (Does the area become inundation during storm?): R: The correlation coefficient between the predictor variable ("Do you think nature tourism has challenges due to climate change?") and the outcome variable (inundation during a storm) is 1.00. This indicates a perfect positive linear relationship between the variables. R Square: The coefficient of determination, R-squared, is also 1.00. This suggests that 100% of the variability in the outcome variable can be explained by the predictor variable in this model. Adjusted R Square: The adjusted R-squared value is also 1.00, implying a perfect fit even when considering the number of predictor variables.
- %). Chi-square value: 24.53, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.000. There is a highly statistically significant association between perceptions of road risk and climate change. Model Summary (Does the road fall in risk?): R: The correlation coefficient between the predictor variable ("Do you think nature tourism has challenges due to climate change?") and the outcome variable (risk of the road falling) is 1.00. This suggests a perfect positive linear relationship between the variables. R Square: The coefficient of determination, R-squared, is also 1.00. This indicates that 100% of the variability in the outcome variable can be explained by the predictor variable in this model. Adjusted R Square: The adjusted R-squared value is also 1.00, implying a perfect fit even when considering the number of predictor variable.

Discussion

- Chi-square value: 19.53, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.001. There is a statistically significant association between perceptions of the present condition of fog and climate change. Model Summary (What is the present condition of fog?): R: The correlation coefficient between the predicted values and the actual values is 1.00, indicating a perfect linear relationship. R Square: The coefficient of determination is 1.00, meaning that 100% of the variability in the response variable can be explained by the predictor variable. Adjusted R Square: The adjusted R-squared is also 1.00, suggesting that the model's fit is strong.

- Chi-square value: 32.76, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.000. There is a highly statistically significant association between perceptions of increased flooding and climate change. Model Summary (Do you think flood has been increased?): R: The correlation coefficient between the predictor variable ("Do you think nature tourism has challenges due to climate change?") and the outcome variable (increase in floods) is 1.00. This suggests a perfect positive linear relationship between the variables. R Square: The coefficient of determination, R-squared, is also 1.00. This indicates that 100% of the variability in the outcome variable can be explained by the predictor variable in this model. Adjusted R Square: The adjusted R-squared value is also 1.00, implying a perfect fit even when considering the number of predictor variables.

- Chi-square value: 22.47, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.000. There is a highly statistically significant association between perceptions of increased droughts and climate change. Model Summary (Do you think droughts have been increased?): R: The correlation coefficient between the predictor variable ("Do you think nature tourism has challenges due to climate change?") and the outcome variable (increase in droughts) is 1.00. This suggests a perfect positive linear relationship between the variables. R Square: The coefficient of determination, R-squared, is also 1.00. This indicates that 100% of the variability in the outcome variable can be explained by the predictor variable in this model. Adjusted R Square: The adjusted R-squared value is also 1.00, implying a perfect fit even when considering the number of predictor variables.

- Chi-square value: 23.65, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.000. There is a highly statistically significant association between perceptions of increased pollution and climate change. R: The correlation coefficient between the predictor variable ("Do you think nature tourism has challenges due to climate change?") and the outcome variable (increase in pollution) is 1.00. This suggests a perfect positive linear relationship between the variables. R Square: The coefficient of determination, R-squared, is also 1.00. This indicates that 100% of the variability in the outcome variable can be explained by the predictor variable in this model. Adjusted R Square: The adjusted R-squared value is also 1.00, implying a perfect fit even when considering the number of predictor variables.

- Chi-square value: 17.47, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.002. There is a statistically significant association between perceptions of climate change leading to dust and smoke. Model Summary (Do you think it leads to dust and smoke?): R: The correlation coefficient between the predictor variable ("Do you think nature tourism has challenges due to climate change?") and the outcome variable (presence of dust and smoke) is 1.00. This suggests a perfect positive linear relationship between the variables. R Square: The coefficient of determination, R-squared, is also 1.00. This indicates that 100% of the variability in the outcome variable can be explained by the predictor variable in this model. Adjusted R Square: The adjusted R-squared value is also 1.00, implying a perfect fit even when considering the number of predictor variables.

- Chi-square value: 14.82, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.005. There is a statistically significant association between perceptions of increased allergies and climate change. Model Summary (Do you think people have been suffering from allergy?): R, R Square, and Adjusted R Square: All values are displayed as 1.00, indicating a perfect positive linear relationship between the predictor variable ("Do you think nature tourism has challenges due to climate change?") and the outcome variable (suffering from allergy).

- Chi-square value: 14.82, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.005. There is a statistically significant association between perceptions of increased allergies and climate change. Model Summary (Do you think people have been suffering from allergy?): R, R Square, and Adjusted R Square: All values are displayed as 1.00, indicating a perfect positive linear relationship between the predictor variable ("Do you think nature tourism has challenges due to climate change?") and the outcome variable (suffering from allergy).

- Chi-square value: 21.76, Degrees of freedom (df): 3, Asymptotic Significance (p-value): 0.000. There is a highly statistically significant association between perceptions of climate change disrupting food supply. Model Summary (Do you think it disrupts our food supply?): R: The correlation coefficient between the predicted values and the actual values is 1.00, indicating a perfect linear relationship. R Square: The coefficient of determination is 1.00, meaning that 100% of the variability in the response variable can be explained by the predictor variables.

- Chi-square value: 6.71, Degrees of freedom (df): 3, Asymptotic Significance (p-value): 0.082. There is a moderate association between perceptions of climate change causing deforestation. Model Summary (Do you think it causes deforestation?): R: The correlation coefficient between the predicted values and the actual values is 1.00, indicating a perfect linear relationship. R Square: The coefficient of determination is 1.00, meaning that 100% of the variability in the response variable can be explained by the predictor variable. Adjusted R Square: The adjusted R-squared is also 1.00, suggesting that the model's fit is strong. Standard Error of the Estimate: The standard error is 0.00, indicating a potentially perfect fit.

- Chi-square value: 14.82, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.005. There is a statistically significant association between perceptions of climate change causing water shortage. Model Summary (Do you think it causes water shortage?): R: The correlation coefficient between the predicted values and the actual values is 1.00, indicating a perfect linear relationship. R Square: The coefficient of determination is 1.00, meaning that 100% of the variability in the response variable can be explained by the predictor variable. Adjusted R Square: The adjusted R-squared is also 1.00, suggesting that the model's fit is strong.

- Chi-square value: 28.94, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.000. There is a highly statistically significant association between perceptions of climate change causing water shortage in lakes and rivers. Model Summary (Does it cause the water shortage of lake and river?): R: The correlation coefficient between the predicted values and the actual values is 1.00, indicating a perfect linear relationship. R Square: The coefficient of determination is 1.00, meaning that 100% of the variability in the response variable can be explained by the predictor variable. Adjusted R Square: The adjusted R-squared is also 1.00, suggesting that the model's fit is strong.

- Chi-square value: 6.88, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.142. There is a weak association between perceptions of climate change causing problems with fresh water supply. Model Summary (Do you think it creates a problem on fresh water supply?): R: The correlation coefficient between the predicted values and the actual values is 1.00, indicating a perfect linear relationship. R Square: The coefficient of determination is 1.00, meaning that 100% of the variability in the response variable can be explained by the predictor variable. Adjusted R Square: The adjusted R-squared is also 1.00, suggesting that the model's fit is strong.

- Chi-square value: 24.53, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.000. There is a highly statistically significant association between perceptions of climate change causing increased population displacement. R: The correlation coefficient between the predicted values and the actual values is 1.00, indicating a perfect linear relationship. R Square: The coefficient of determination is 1.00, meaning that 100% of the variability in the response variable can be explained by the predictor variable. Adjusted R Square: The adjusted R-squared is also 1.00, suggesting that the model's fit is strong.

- Chi-square value: 23.35, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.000. There is a highly statistically significant association between perceptions of climate change causing mudslides. Model Summary (Do you think it causes mudslides?): R: The correlation coefficient between the predicted values and the actual values is 1.00, indicating a perfect linear relationship. R Square: The coefficient of determination is 1.00, meaning that 100% of the variability in the response variable can be explained by the predictor variable. Adjusted R Square: The adjusted R-squared is also 1.00, suggesting that the model's fit is strong.

- Chi-square value: 7.18, Degrees of freedom (df): 3, Asymptotic Significance (p-value): 0.066. There is a weak association between perceptions of climate change causing loss of property. Model Summary (Do you think it causes property loss?): R: The correlation coefficient between the predicted values and the actual values is 1.00, indicating a perfect linear relationship. R Square: The coefficient of determination is 1.00, meaning that 100% of the variability in the response variable can be explained by the predictor variable. Adjusted R Square: The adjusted R-squared is also 1.00, suggesting that the model's fit is strong.

Discussion

- Chi-square value: 16.88, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.002. There is a statistically significant association between opinions on supporting or opposing tourism sector development and climate change. Model Summary (Would you oppose or support tourism sector development in our country - Bangladesh?): R: The correlation coefficient between the predicted values and the actual values is 1.00, indicating a perfect linear relationship. R Square: The coefficient of determination is 1.00, meaning that 100% of the variability in the response variable can be explained by the predictor variable. Adjusted R Square: The adjusted R-squared is also 1.00, suggesting that the model's fit is strong.

- Chi-square value: 10.94, Degrees of freedom (df): 3, Asymptotic Significance (p-value): 0.012. There is a statistically significant association between perceptions of the overall impacts of tourism sector development and climate change. Model Summary (How do you perceive the overall impacts of tourism sector development in our country?): R: The correlation coefficient between the predicted values and the actual values is 1.00, indicating a perfect linear relationship. R Square: The coefficient of determination is 1.00, meaning that 100% of the variability in the response variable can be explained by the predictor variable. Adjusted R Square: The adjusted R-squared is also 1.00, suggesting that the model's fit is strong.

- Chi-square value: 18.35, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.001. There is a statistically significant association between evaluations of the competitiveness of the tourism industry and climate change. Model Summary (How would you evaluate the competitiveness of the tourism industry in Bangladesh?): R: The correlation coefficient between the predicted values and the actual values is 1.00, indicating a perfect linear relationship. R Square: The coefficient of determination is 1.00, meaning that 100% of the variability in the response variable can be explained by the predictor variable. Adjusted R Square: The adjusted R-squared is also 1.00, suggesting that the model's fit is strong.

- Chi-square value: 9.24, Degrees of freedom (df): 4, Asymptotic Significance (p-value): 0.055. Model Summary (Satisfaction level of mitigation of climate change that has direct impact on tourism): R: The correlation coefficient between the predicted values and the actual values is 1.00, indicating a perfect linear relationship. R Square: The coefficient of determination is 1.00, meaning that 100% of the variability in the response variable can be explained by the predictor variable. Adjusted R Square: The adjusted R-squared is also 1.00, suggesting that the model's fit is strong.

Implications

- **Tourist Awareness and Education:**
  - Tourists' perceptions of climate change risks emphasize the need for targeted awareness campaigns.
  - Education programs can enhance tourists' understanding of climate-related challenges and encourage responsible behavior.
- **Adaptive Tourism Strategies:**
  - Tourism industry stakeholders should develop adaptive strategies that consider changing weather patterns.
  - Flexibility in itineraries and activities can enhance tourists' experiences while minimizing disruptions caused by climate events.
- **Infrastructure Resilience:**
  - Urgent actions are required to build climate-resilient infrastructure that can withstand extreme weather events.
  - Strengthening buildings, roads, and facilities will protect both tourists and local communities.
- **Conservation and Sustainability:**
  - Evidence of environmental resource damage underscores the significance of biodiversity conservation.
  - Reforestation and habitat restoration efforts can contribute to the long-term sustainability of nature tourism.

Implications

- **Policy and Governance:**
  - Findings support the need for collaborative governance among stakeholders in tourism, environment, and disaster management sectors.
  - Policymakers should prioritize climate adaptation measures within the tourism industry.

- **Economic Impact and Competitiveness:**
  - The study highlights climate change's potential impact on the competitiveness of Bangladesh's tourism sector.
  - Investment in climate resilience can safeguard the sector's economic contributions.

- **Data-Informed Decision-Making:**
  - The research provides valuable data for policymakers to make informed decisions regarding climate adaptation in nature tourism.
  - Ongoing data collection can facilitate evidence-based strategies.

- **Long-Term Sustainability:**
  - The study underscores the need for proactive measures to ensure the long-term sustainability of nature tourism.
  - Climate-resilient practices will contribute to the region's economic and ecological well-being.

- **International Collaboration:**
  - The study's insights can encourage international collaboration on climate-resilient tourism practices.
  - Sharing experiences and best practices can benefit other regions facing similar challenges.
- **Public-Private Partnerships:**
  - Collaboration between public and private sectors is crucial to implement sustainable and climate-resilient tourism initiatives.
  - Partnerships can drive investment and innovation in climate adaptation.

Suggestions for Further Research

- Qualitative Studies: Conduct qualitative research to delve deeper into tourists' perceptions and experiences related to climate change risks. Qualitative methods such as interviews and focus groups could provide richer insights into emotional responses and behavioral changes.

- Comparative Studies: Compare tourists' perceptions of climate change risks across different regions within Bangladesh or even with other countries. This could highlight variations in risk perception and inform tailored mitigation strategies.

- Longitudinal Studies: Undertake longitudinal studies to track changes in tourists' perceptions and behavior over time as climate change unfolds. This could provide insights into the effectiveness of awareness campaigns and adaptation efforts.

Suggestions for Further Research

- Economic Analysis: Perform an economic analysis of the potential costs and benefits of implementing climate adaptation measures for nature tourism. This could help justify investments in resilience-building initiatives.

- Stakeholder Engagement Studies: Explore the perspectives of local communities, tour operators, and other stakeholders regarding climate change impacts on nature tourism. This can lead to more holistic and collaborative approaches to adaptation.

- Tourist Education Impact: Investigate the effectiveness of educational programs targeting tourists in raising awareness about climate change impacts. Assess whether such programs influence tourists' behaviors and preferences.

- Seasonal Variability: Examine the effects of seasonal climate variability on tourist inflow and preferences. This could help design strategies to attract visitors during less vulnerable periods.

- Technological Solutions: Explore the potential of technology, such as early warning systems, for minimizing climate-related risks to tourists and the tourism infrastructure.

- Policy and Legal Analysis: Analyze existing policies and regulations related to climate adaptation and tourism in the region. Identify gaps and propose policy recommendations for enhancing resilience.

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