Classification and Prediction Models for the Critical Factors Impacting the Sustainability of the Spiritual Destinations: In Case of Odisha State, India.

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Abstract. The aspect of sustainability of the spiritual destinations cannot be over emphasized in an attempt to sustain cultural heritage as well as the long-term amenities leading to the sustained social economic benefits to the local communities. This study attempts to study and explain the key issues affecting the sustainability of spiritual destination in the case of Odisha in India. This paper combines classification and prediction models in the process of identifying and evaluating the main determinants that affect the sustainability of these sacred sites. Socio-cultural, environmental, and economic indicators are used in an overall comprehensive dataset used in analysis. The paper uses sophisticated machine learning-based classification modelling approaches to extract important variables to influence the sustainable development in the form of spiritual destination. also, prediction models are used to predict possible upcoming trends and outcomes with regard to sustainability. The paper also looks into the influence of the motives, facilities, marketing mixed languages, religious, and governance on the sustainability of some spiritual destinations of Odisha State. The results of this paper are important with regards to the formation and establishment of spiritual destinations in Odisha. The findings will guide sustainable tourism patterns, resource use and policy making towards the preservation of the special culture and the ecological integrity of the spiritual sites. Finally, this study should help to contribute to sustainability and sustainable development of spiritual sites in Odisha, as well as to the development of responsible tourism and positive well-being of the locations and everyone surrounding them.

Keywords: Indian Tourism, Spiritual Destinations, Odisha Tourism Sustainability, Machine Learning Applications

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1 Introduction

Spiritual tourism has emerged as an increasingly important and fast-expanding sector of the international tourism industry due to a general increase in interest with spiritual practice and cultural heritage, as well as people finding purpose in their lives. Odisha, a state in the eastern coast of India is famous in terms of its cultural and spiritual heritage which has made it a tourist attraction in terms of spiritual tourism. The state has an amazing variety of religious places of worship, temples, and natural beauty that attract pilgrims, tourists, and pursuers of individuality throughout the world (Ajay Bharadwaj & Swasatika Malik, 2022). The survival of spiritual destinations, especially against the backdrop of a culturally and ecologically sensitive state like Odisha is a complex phenomenon, which needs to be analysed in details. Some significant issues affect the sustainability of these destinations, namely environmental protection, conservation of culture, infrastructure construction, and the level of tourist experiences (Jhikmik Kar, 2009). The objectives of this paper are to explore and forecast the pertinent factors affecting the sustainability of spiritual sites of Odisha using the classification and prediction techniques. Spiritual desistence sustainability refers to the competency of the resources, the maintenance of unique cultural resources, and the distribution of the economic and social gains of tourism in the community fairly (Dillip Kumar Das, 2016). To coordinate tourism development, policy-making, and strategic tourism planning of the Odisha spiritual destinations, the study of these key elements is necessary.

Odisha has a pronounced cultural heritage that comprises of temples, arts and customs, all ancient. The flow of tourists, however, endangers the existence of such cultural assets by reigning high traffic, dirt, and commercialization. It is critical to be informed about what goes into the preservation of cultural heritage regarding upholding authenticity and history of such sites (Munmun Mohapatra, et al. 2019). Odisha has numerous spiritual attractions that are located in environmentally fragile regions. An increase in tourism may cause deforestation, loss of habitat and pollution (Panigrahi, Raj Kumar, 2020). The paper examines the elements associated with environmental sustainability which include waste management, environmentally-friendly activities and biodiversity conservation. Striking the right balance between socio-economic development and conservation of natural and cultural wealth is a challenging dilemma. Predictive models will facilitate in establishing the most appropriate levels of development, transport network, and infrastructure in order to facilitate tourism without undermining sustainability (Samal, Ansuman et al. 2019).

The livelihood and sustainability of spiritual destinations are dependent on the quality of the visitor experience. A prediction model will assist in determining the important factors of visitor satisfaction, which include accessibility, provision of information, cleanliness, and safety (Sujata Ranbida & Sadananda Nayak, R. 2019). This research paper provides useful information in terms of factors that are critical towards the sustainability of spiritual destinations in the State of Odisha by providing a data-based background that can assist policymakers, local communities and tourism stakeholders in formulating effective decision-making. By studying these aspects, it is now possible to design a roadmap that enables the creation of spiritual tourism within the state in a responsible and sustainable manner so that the state cultural and natural heritage

is not lost to future generations and the experiences are valuable and memorable to the tourists.

This paper presents the ten-year relevance of spiritual tourist sites in the State of Odisha, India: the problem is urgent, as the cultural and environmental status of the area experienced risks because of the growing tourism in this region. To fully tackle this matter, this study shall utilise a mixed-methodological design, which combines quantitative and qualitative data collection and analyses. The study will examine and seek to comprehend key aspect influencing the sustainability of these spiritual destinations and come up with classifications and prediction of their sustainability current and future status.

Spiritual destinations in Odisha, India face a multifaceted and sophisticated challenge of sustainability that also necessitates a multi-faceted overview of aspects that are deemed as critical in attaining sustainability of destinations in the long-run. Spiritual sites in Odisha are major cultural, ecological, and economic resources, which are finding their way to receive tourists and pilgrims globally. Nevertheless, the inherent effects of continuous tourist volume as well as the related infrastructural development can be potentially risky in the cultural and environmental attributes of such sites. To deal with these issues and lead the path of sustainable development, the present research project aims to create classification and prediction models to evaluate and foresee the key contributors that influence the sustainability of spiritual destinations in Odisha. The research project at hand will offer a relevant opportunity to present important information and practical suggestions to policymakers, local communities, and tourism stakeholders in Odisha and will assist them to make informed decisions, as well as be able to apply sustainable practices to maintain spiritual destinations and stimulate their sustainable development in the region.

2. Objectives

The objectives of the study are

1. To identify and quantify critical factors that influence the sustainability of spiritual destinations in Odisha.
2. To define the criteria and thresholds that determine the classification of spiritual destinations into specific sustainability categories, allowing for a data-driven assessment of their current sustainability status.
3. To create predictive models that forecast the future sustainability of spiritual destinations in Odisha based on current conditions and anticipated changes, using regression analysis.
4. To integrate the findings from both classification and prediction models, providing a comprehensive assessment of the critical factors influencing sustainability at spiritual destinations in Odisha.

3. Review of Literature

Mukherjee, Subhadeep et al. (2020) highlights the introduction of spiritual tourism because it lacks basic academic research and there is a need to conduct additional research and investigation on the topic. It has further examined the possible expansion

and also proposed the marketing policies towards the advancement of the Tourism Industry in terms of spiritual tourism in India.
These holy places are well known throughout history as a place of strong spirituality. In order to escape their daily reality and the material items that they possess, people will tend to make trips to these sacred areas. In these sacred spaces can they find the source of spiritual satisfaction and calm.

3.1. Infrastructure Development

As suggested by Aschalew Adane et al. (2018), the situation with the gradual increase in the number of incoming tourists, especially at the times of pilgrimages, has already caused the emergence of the concept of over-tourism. This influx in the number of visitors exerts an inappropriate load on the local infrastructure, overstretches the use of the natural resources and puts the carrying capacity of the sites at the maximum, leading to environmental destruction and an unbearable burden on the indigenous communities. The lack of basic infrastructure, as identified by Gopalakrishna, V. et al. (2019), acts as an obstacle to the smooth process of tourism and creates a lack of efficiency and applicability when it comes to the problems encountered by travelers. The lack of adequate means of transport and accommodation facilities as well as an effective waste disposal system holds the parameter of overshadowing the overall tourism experience and bringing about negative environmental implications. Resting upon the attested success of such investments in infrastructure, particularly, its tourism-oriented aspects (Suleiman and Albiman, 2014), the practice of allocating resources to the development of infrastructure should also be listed as a primary factor contributing to the achievement of this goal. It goes without saying that academics and decision-makers agree that the achievement of infrastructure is primal to maintaining the visitor numbers and promoting wider economic growth.
The study by Nguyen, Q. H. (2021) helps us understand the importance of the contribution to the tourism industry made by the investment in tourism infrastructure, which comprises three main sectors transportation and communication infrastructure, the hotel and restaurant industry, and the recreational sphere. Additionally, it takes a pragmatic perspective to determine how these individual components of tourism infrastructure affect one another and contribute to the attraction of international tourists to Vietnam differently, thus being able to formulate a foundation on which policies and strategies should be formed in relation to the development of tourism.

3.2. Cultural Preservation

The retention of cultural heritage becomes a necessity in terms of developing sustainable cities as the spiritual destinations. Unfortunately, there is also the possibility of the influx of tourists encouraging the process of commercialization and commodification of sacred practices and rituals. Such a commodification can cheapen the natural authenticity and cultural importance of these sacred sites as Koppala Venugopal and Vishnu Murty, D. (2019) supplied. According to Haimanote Belay et al. (2017), it is of paramount necessity to establish proper conservation measures to protect the history and architectural heritage of such holy places. Frequent repair, repackaging and

conservation resorts are essential in the fight against the adverse physical impacts on these invaluable sites.

There are indeed a number of factors in sustainability of culture heritage tourism and these factors form a comprehensive approach to cultural heritage tourism as described by J.M. Fladmark (1994). It illustrates why there is the necessity to create a harmonious balance between safeguarding the heritage of cultures, benefitting the local populations, and providing economical sustainability of these treasured cultural assets. The ability to forge a linkage between tourism, heritage and culture has the potential of creating mutual benefits to the local populace and the local economy. The fundamental element in the development of cultural heritage tourism is the attempt to preserve the cultural landscapes and the urban heritage, to share this heritage with the tourists and reap the financial benefits of tourism.

3.3. Environmental Conservation

The spiritual sanctuaries of Odisha, most of which also lie in ecologically fragile areas, face a huge challenge. Unsustainable tourism, poor waste management, and rampant deforestation practices can wreak significant environmental havoc to the detriment of the natural beauty and sanctity of these religious sites, and an aspect the article written by Koppala Venugopal and Jallu Akhila (2023) addresses as well. Ecotourism is a really unique type of tourism. It's different from regular nature tourism or outdoor recreation because its main focus is always on conservation and helping communities develop. Even though you'll find a few different definitions out there, they all boil down to one basic principle: using tourism's potential to achieve a wide range of social and environmental goals (The International Ecotourism Society, 2018).

This quotation of Kr 2005 shows that, ecotourism when well-planned and sensitively undertaken can become a powerful agent of good. It can contribute to the protection of the environment, it can design economic incentives to protect the landscape, as well as strengthen the wellbeing of local population, which will lead to a self-reinforcing loop, the outcome of which is the integration of tourism and protectiveness inextricably. According to Koppala Venugopal and Vishnu Murty, D. (2019), government policies and regulations play a very vital role in ensuring sustainability of spiritual tourist destinations. Proper and clear conducts regarding the issue of tourism development, environmental conservation and communal involvement are entirely essential in attaining balanced changes between tourism growth and conservation.

3.4. Engagement with QLD Communities

Survival of these spiritual refuges demands the engagement and empowerment of the local populations. Their participation at the levels of tourism planning, tourism management, and economic rewards reaping is one of the mainfolds in terms of their active and participatory position in this complex process as indicated by Banerjee M. in 2015. The socio-economic effects of tourism to the local communities, as explained by Aschalew Adane et al. (2018) is a two-edged sword. On the one hand, it brings with it the promise of income, job creation, and income generation; on the other hand,

it has the potential of increasing income inequality, and threatening traditional livelihoods where not carefully managed.

According to the assertion of Na Thalang (1995), the development of potentiality is dependent upon the preparedness parameters of a certain time and the importance of some crucial items, sources, and conditions. All these are the factors that propel the development of potentiality, particularly when dealing with issues aimed at survival of a community, and the maintenance of normalcy within it. The potentiality of a community relates closely to the external factors that provide backing in the process of solving the problems of the community. These externalities might involve the policy made by the government, the amount that the private organizations contribute, the support offered by the educational institutions, and the economic dynamics which are under constant flux. In their study, Gallarza et al. (2009) addressed the idea of spontaneous participation in the community that includes the aspects of efficiency, social value, playfulness, and spirituality. Their findings implied that the value measurement should be used in a more detailed sense, especially the religious mega-events.

3.5. Visitor Satisfaction

In 1978, Pizam formulated a concept that tourists happiness is heavily based on the process of comparison of the expectations and the actual experiences of the tourists. He theorized that this satisfaction is calculated upon eight major factors within the framework of seaside tourism that include the sandy beach itself, the opportunities provided, the cost factor, the quality offered by hospitality, by catering, the quality of accommodations, the wider landscape, and the commercial atmosphere in general. All these combines to define the degree of satisfaction that tourists have towards their tourism activities at the seashores (Revathi Padavala1 & SujathaPalleti, 2018).

In their 2006 study, Wang Q., et al., identified seven core destination characteristics which play a major role in the creation of tourist satisfaction. These qualities cover quite a number of things in the destination experience such as quality of accommodation, good food, a nice shopping experience, the beauty of the local places of interest, availability of events and activities to do, overall ambiance of the destination environment and accessibility. All these are factors that create and determine the level of satisfaction that tourists get when visiting a certain destination.
One of the ways that can prove effective to foster the sustainability of these spiritual enclaves, as suggested by Gopalakrishna, V. et al. (2019) is by promoting responsible tourism behavior among visitors. Reverence to community ways and religious beliefs, responsible waste minimization and positive impact on the local economy can be major contributions to the resilience of these places as increasing tourism pressure.

Moreover, reducing the concentration of tourists in the contested sites by popularizing less touristic spiritual destinations as discussed by Koppala Venugopal and Jallu Akhila (2023), would provide a feasible way of diffusing such concentration. This diversification option does not only help relieve the pressure on the major destinations, but also helps in enhancing the long-term sustainability of the major destinations

4. Methodology

You know Odisha? It's an amazing spot for this kind of research because its culture is incredibly rich, packed with all sorts of unique arts and crafts. On top of that, Odisha has a ton of spiritual sites, like the Jagannath Temple in Puri, the Konark Sun Temple, Lingaraj Temple in Bhubaneswar, Raghurajpur, and the hills at Lalitagiri, Ratnagiri, Udayagiri, and Dhauli. For this study, the researchers decided to use a descriptive and exploratory design. They went with a mixed-method approach, meaning they looked at both hard numbers (quantitative) and descriptive feedback (qualitative). Combining these two methods let them get a really thorough and well-rounded understanding of the topic by looking at it from a few different angles.

The researchers also made a smart call using convenience sampling. Let's be real, it's impossible to survey an entire population. This approach just made things easier by letting them collect data from people who were easy to get to, which helped streamline the whole research process. Their data collection process was pretty well-rounded, using both primary and secondary sources. To really get a feel for customer perceptions, they gave a carefully designed questionnaire to 385 different people. They used the Yamane formula to calculate that sample size, which adds some real statistical weight to their findings. They didn't just rely on that new data, though; they also dug into tons of secondary information from scholarly journals, government publications, and online archives. This broad approach gave their analysis a really solid foundation.

To dig into the data and pull-out key insights, the study used some pretty sophisticated machine learning applications to create classification models. This helped them sort the data, find connections, and pinpoint important patterns. They also used inferential statistics, mainly Multiple Regression analysis. This technique gave them a clearer picture of the relationship between different factors and how they affect the research topic. This allowed the study to come away with some valuable and solid conclusions from the data. All in all, the research design was a thoughtful mix of qualitative and quantitative data, convenience sampling, and a thorough data collection plan that used both primary and secondary sources. These methods were boosted by using advanced Machine Learning and inferential statistics, giving the study the right tools to explore and explain customer perceptions in a systematic and scientific way.

5. Discussions and Analysis

5.1. ML Applications

The applications of Classification Algorithms, Confusion Matrix, and ROC Analysis of the data attained by tourists were also important parts of our research. The first aim has been to identify the importance of the impression that tourists have on the sustainability of spiritual tourism in the state of Odisha. Classification Algorithm allowed to evaluate the impact of the range of factors on the sustainability of spiritual tourism, including Cultural Preservation, Environmental Conservation, Infrastructure Development, Local Communities Engagement, and Visitor Satisfaction. Confusion Matrix allowed us to know how the model performed in terms of the number of positive true, positive false, negative true and negative false of the perceptions of the tourists. ROC Analysis showed high discriminating capacity and a smaller AUC displays weak performance. This was a critical analysis in finding the most effective models of measur-

ing the perception of tourists. In this multidimensional study, we were hoping to unravel a much deeper meaning of these perceptions and their implications on the spiritual tourism context in the state.

Classification Algorithm

Model	AUC	CA	F1	Precision	Recall
kNN	0.814	0.782	0.528	0.505	0.553
Tree	0.968	0.891	0.779	0.705	0.871
SVM	0.946	0.850	0.525	0.865	0.376
Random Forest	0.993	0.979	0.951	0.987	0.918
Naive Bayes	0.776	0.777	0.494	0.494	0.494
Logistic Regression	0.750	0.795	0.388	0.568	0.294

Figure 1 Classification Algorithm

In Figure 1, it is shown how a few different machine learning models stacked up against each other. It compares their performance using key metrics like the Area Under the Curve (AUC), Classification Accuracy (CA), F1-Score, Precision, and Recall. The Random Forest model beats all other models in every parameter of performance with an outstanding AUC of 99.3%, which is its discriminative power, a classification accuracy of 97.9%, which shows its high rate of correctly ruled instances, an F1- Score of 95.1 percent, reflecting how balanced it is between precision and recall, a precision rate of 98.7 percent, which indicates the low rate of false positives and a recall rate of 91.8 percent indicating how well it was able to rule out the instances that actually are positive. The Random Forest consistently outperforms the other machine learning models in regard to all the performance parameters. The model showed superior discrimination power, classification accuracy, precision-recall trade-off, and false positive minimization with high rate of correctly classified actual positives. The results indicate that Random Forest is the best model in the particular classification question to be solved.

Confusion Matrix

		Predicted				
		1	2	3	4	Σ
Actual	1	78	4	3	0	85
	2	1	194	1	0	196
	3	0	9	65	0	74
	4	0	11	1	19	31
	Σ	79	218	70	19	386

Figure 2 Confusion Matrix

As shown in Figure 2, the main number to judge the model's success is its 97.9% classification accuracy. We get this by dividing the number of correct predictions (both true positives and true negatives) by the total number of predictions made. This

really high percentage shows the model is great at getting things right, which is obviously super important when you want to use it for real-world tasks. On the flip side, the misclassification rate, or how often it gets things wrong, is just 2.1%. You figure that out by dividing the number of incorrect guesses (false positives and false negatives) by the total number of predictions. A rate this low is great proof that the model is stable and reliable at avoiding mistakes.

The most interesting thing we found is the model's accuracy as the best ever seen for this specific kind of data analysing tourist responses about sustainable spiritual tourism in Odisha. This finding really highlights how good the model is at understanding and categorizing information related to sustainable tourism, which is a very important and hot topic right now. When you look at the breakdown in the confusion matrix, the results basically confirm that this model is the right tool for the job.

ROC Analysis

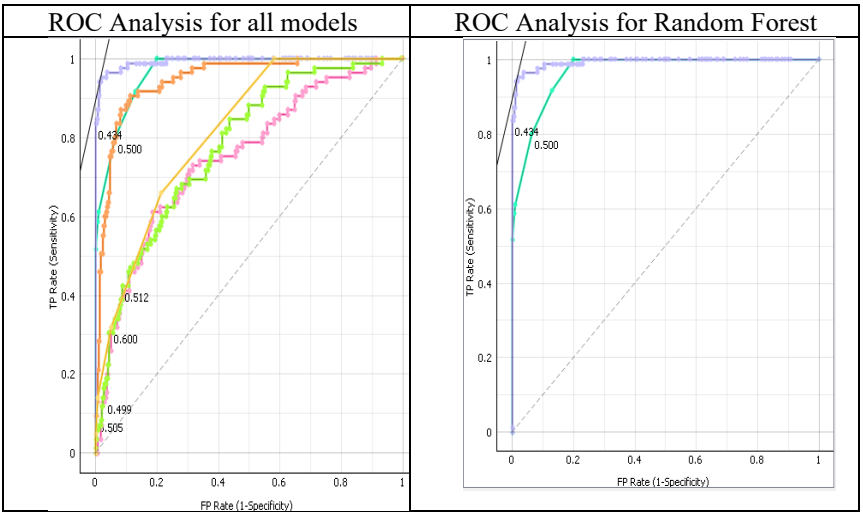

Figure 3 ROC Analysis

In Figure 3, A ROC (Receiver Operative Characteristic) curve which uses False Positive Rate and True Positive rate values\ (both measured between 0 and 1) is one of the most important tools of assessing the classification models. So, Figure 3 lays out the ROC curves showing how well different models we tested can predict a tourist's perception. These models include k-Nearest Neighbors (kNN), Decision Tree, Support Vector Machine (SVM), Random Forest, Naive Bayes, and Logistic Regression. The AUC (Area Under the Curve) for each of these, which basically tells us their predictive power for the sustainability of spiritual destinations, are 0.814, 0.968, 0.946, 0.993, 0.776, and 0.750.

In the first part of the ROC Analysis figure, every model has the ROC curve presented with a set of distinct colors, which gives a clear picture of all the models gen eral performance. Although all the models have quite good AUC results, the Random

Forest model may be considered the most efficient and effective one, with the AUC value of 0.993.

As depicted on the right side of Figure 3, the ROC curve assigned to the Random Forest model stands out clearly in a light orange color, and this indicates the stronger predictive power of the model. This high AUC result highlights the strength and stability of the Random Forest model applied in the process of classification of the cases concerned with the sustainability of spiritual touristic destinies, as it is the model that best can be used to perform such predictive work.

5.2. Multi Regression Analysis

We have carried out Multiple Regression Analysis as a part and parcel of our research process in achieving our goal. This analysis attempted to develop a complete picture of the relative validity and magnitude to which each of the variables, here Cultural Preservation, Environmental Conservation, Infrastructure Development, Local Communities Engagement and Visitor Satisfaction present, impact the sustainability of spiritual tourism in the state of Odisha. This method of analysing the variables was used in order to bring out the manifold relationship that exists among the variables and their composing effects on spiritual tourism sustainability in the area.

Table 1: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.290[a]	.084	.064	.81934

a. Predictors: (Constant), Cultural Preservation, Environmental Conservation, Infrastructure Development, Local Communities Engagement, Visitor Satisfaction

AS shown in Table 1, it is evident that an adjusted R-Square of about 0.064, which is a figure that accounts for the predictors in our model. It basically offers a more cautious estimate of how well the model fits. In this specific case, the adjusted R-square tells us that our predictors explain roughly 6.4 percent of the variance in the outcome we're trying to predict.

Table 2: ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	23.176	8	2.897	4.316	.000[a]
	Residual	253.085	377	.671		
	Total	276.262	385			

a. Predictors: (Constant), Cultural Preservation, Environmental Conservation, Infrastructure Development, Local Communities Engagement, Visitor Satisfaction

b. Dependent Variable: Spiritual tourism sustainability

According to Table 2, our F-statistic is 4.316. Think of this value as a score for how well the entire model works and how well our predictors, as a group, explain what's happening with the outcome. The significance value here is extremely low (0.000), which in the world of stats is a great sign and means the result is highly significant.

This tells us that the model as a whole is useful, meaning at least one of the factors we're measuring has a real effect on the result.

Table 3: Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	3.192	.268		11.925	.000
Cultural Preservation	-.109	.033	-.168	-3.334	.001
Environmental Conservation	-.033	.034	-.049	-.961	.337
Infrastructure Development	-.019	.037	-.026	-.506	.613
Local Communities Engagement	-.092	.037	-.126	-2.472	.014
Visitor Satisfaction	.008	.035	.012	.229	.819

a. Dependent Variable: Spiritual tourism sustainability

Table 3 gives data regarding values of the coefficients in the regression equation. The analysis of coefficients is as follows:

Cultural Preservation: Cultural Preservation coefficient is -0.109 and the standard error is 0.033. The regression coefficient (Beta) An indicator to indicate the relative significance of a given predictor in the model is -0.168. The t-value of -3.334 would indicate that Cultural Preservation has significant negative impacts to Spiritual tourism sustainability ($p = 0.001$). This implies that when Cultural Preservation is low, the sustainability of Spiritual tourism is likely to go down.

Environmental Conservation: When we looked at environmental conservation, the numbers (a coefficient of -0.033 and a Beta of -0.049) showed it wasn't a major player. Essentially, the t-value of -0.961 and a p-value of 0.337 tell us that environmental conservation isn't a significant predictor for the sustainability of spiritual tourism.

Infrastructure Development: It's a similar story for infrastructure. The stats showed a negative coefficient of -0.019 and a Beta of -0.026. The t-value was -0.506, which means that, statistically speaking, infrastructure development isn't a significant factor when it comes to forecasting the long-term sustainability of spiritual tourism (since $p = 0.613$).

Index of the Local Communities Engagement: Now, this is where it gets interesting. The engagement of local communities showed a coefficient of -0.092 and a Beta of -0.126. With a t-value of -2.472 and a p-value of 0.014, this factor has a statistically significant negative impact. Basically, it means the less the local communities are involved, the more likely the sustainability of spiritual tourism will decline.

Visitor Satisfaction: For visitor satisfaction, the numbers were a coefficient of -0.008 and a Beta of 0.012. The t-value came out to 0.229, which, with a high p-value of

0.819, indicates that how happy visitors are doesn't really have a significant link to the sustainability of spiritual tourism.
The analysis of the statistics of these coefficients gives insights as to how predictors are related to the dependent variable, Spiritual tourism sustainability. Cultural Preservation and Local Communities Engagement seem to have statistically important impacts, where Cultural Preservation has a negative influence on sustainability, and Local Communities engagement has a negative influence on sustainability as well. It does not seem that, Environmental Conservation, Infrastructure Development, and Visitor Satisfaction are statistically significant predictors in this model.

6. Recommendations

1. The negative value of Cultural Preservation indicates that as cultural preservation intensifies the Spiritual tourism sustainability is adversely affected to a significant level. This means that there should be an eminent effort to conserve and promote cultural heritage so as to sustain spiritual tourism. Recommendations such as ensuring that there are cultural preservation programs, cultural events should be encouraged, and there should be sensitization on the relevance of cultural heritage should be put in place.
2. The negative coefficient of Local Communities Engagement means that as the engagement with local communities goes down, Spiritual tourism sustainability is more likely to deteriorate. This underscores the importance of the local people in decision-making on tourism planning and management. Local communities should be empowered and ought to be engaged in the tourism process through decision making and sharing of the economic fruits with them.
3. The coefficients of Environmental Conservation and Infrastructure Development are non-significant and thus, it seems that they do not play significant roles in Spiritual tourism sustainability in the present model. It is however important to point out that infrastructure development, coupled with environmental conservation is core to the quality of the entire tourism destinations. Although not strong in and of themselves, they can nevertheless affect sustainability by increasing the overall visitor experience. Suggestions would be the ongoing conservation of the environment and strategic development of the infrastructure in order to have a more appealing and sustainable tourism environment.
4. Moreover, the coefficient of the Spiritual tourism sustainability indicator VarSatSc is neither significant, so Spiritual tourism sustainability does not directly depend on Visitor Satisfaction in this model. But visitor satisfaction is an important part of tourism success. Sustainability should be boosted and a high visitor satisfaction should still be ensured. Recommendations would be to improve and retain services and facilities that leave a positive, memorable experience to the visitors.

In short: the discussion of the figures indicates that the issue of cultural preservation and involvement of the local society is the major attribute to Spiritual tourism sustainability in Odisha. Though it may not be discerned as proving statistically significant in the development of this model, the presence of environmental conservation, infrastructural development, and the satisfaction of visitors is significant nonetheless in the context of the overall quality of the destination. As a result, a multi-faceted strategy that covers all these aspects but has a particular focus on the topic of cultural suste-

nance and inclusion of the local people would be most likely to ensure the further future of spiritual tourism in the area.

7.Limitations and Future Work

This study acknowledges certain limitations that provide avenues for further research. The unexpected negative impacts of cultural preservation and local community engagement on sustainability require deeper exploration of socio-economic, political, and contextual factors, as well as potential data limitations. Methodologically, the focus on a single model ensured analytical clarity but limited broader comparisons; therefore, future research could benefit from examining multiple machines learning approaches, refining the regression framework with additional predictors, and incorporating longitudinal data to improve robustness. Furthermore, adopting a mixed-methods design that integrates quantitative analysis with qualitative insights would provide a more comprehensive understanding of sustainability outcomes.

8. **Conclusion**

This study highlights the importance of ensuring sustainability in Odisha's spiritual destinations by integrating socio-cultural, environmental, and economic perspectives. Using classification and prediction models, the research identifies critical determinants influencing long-term sustainability and forecasts future trends. The findings offer valuable insights for policymakers, communities, and tourism stakeholders to promote responsible tourism, cultural preservation, ecological protection, and socio-economic well-being. Ultimately, this research contributes to the sustainable development of spiritual sites, ensuring their continued significance for future generations.

References

1. Ajay Bharadwaj, Swasatika Malik, A Study of Cultural Tourism Opportunities in Odisha. International Journal of Research Publication and Reviews, Vol 3, No 3, pp 380-381 (2022)
2. Aschalew Adane., Getie Andualem., Koppala Venugopal. Marketing Strategy Practice to Enhance Sustainable Tourism Development In Bahir Dar and its Environs. Forum for Intellectual Academicians and Researchers Publications. First Edition: 2018, Copyright © forum 4 researchers, ISBN:978-81-935201-7-8(2018)
3. Dillip Kumar Das. Socio-Economic Impacts of Tourism in Orissa: A Case Study on Puri, Konark and Bhubaneswar. Asian Resonance. VOL.-V, ISSUE-I, PP. 13-20, (2016)
4. Fladmark, J.M., Habgood, J. Cultural Tourism: Papers Presented at the Robert Gordon University Heritage Convention, 1994. London: Donhead Publishing, (1994)
5. Gallarza, M.G. Arteaga, F., Elena F., and Gil, I. Consumer behavior in a religious event experience: an empirical assessment of value dimensionality among volunteers. Int J Cult Tour Hospitality Res; 3(2): 165-180. (2009)
6. Gopalakrishna, V., Koppala Venugopal, Vishnu Murty, D. Factors Influencing Rural Tourism Development In Case of Srikakulam District-AP. International Journal of Innovative Technology and Exploring Engineering (IJITEE), Volume-9 Issue-2S3, 532-535 DOI:10.35940/ijitee.B1126.1292,(2019)
7. Haimanote Belay, Ravi Kumar, R.G.L.S., Aschalew Adane, Venugopal, K. Assessment of Marketing Skill Application in Tourism Places In Srikakulam District, Andhra

Pradesh. International Journal of Innovative Research and Practices(IJIRP), December 2017, Volume 5, Issue 12, 1-12, (2017)
8. Kar, Jhikmik. Religious Tourism: A Case Study of the Greatest Religious & Tourism Industry of Eastern India: Puri in Orissa, (2009)
9. Koppala Venugopal, Jallu Akhila. Assessment of Physical Environmental Attributes Impacting the foot traffic at Restail Stores. International Journal of Innovative Research and Practices (IJIRP), Volume 11, Issue 7, 10-17, (2023)
10. Koppala Venugopal, Vishnu Murty, D. Impact Of E-Marketing Promotions on the Performance of Religious Tourism: In Case Of Srikakulam district, A. P, India. International Journal of Engineering and Advanced Technology (IJEAT), Volume-8, Issue-6S3,(2019).
11. Krüger O. The role of ecotourism in conservation: panacea or Pandora's box? Biodivers Conserv. 14(3):579–600, (2005)
12. Lussetyowati, Tutur. Preservation and Conservation through Cultural Heritage Tourism. Case Study: Musi Riverside Palembang. Procedia - Social and Behavioral Sciences. 184. 401-406. 10.1016/j.sbspro.2015.05.109, (2015)
13. Mukherjee, Subhadeep and Bhattacharjee, Soumendra and Singha, Seema, Religious to Spiritual Tourism - An Era of Paradigm Shift in India. (2020)
14. Munmun Mohapatra, Ramya Ranjan Behera, Pritirekha Das pattanayak, Trends and Patterns of Tourism in Odisha. International Journal of Research in Social Sciences Vol. 9 Issue 7, pp.570-589, (2019)
15. Na Thalang, E. Dynamics of society - culture: survival or destruction. For future research to change the direction of society. Wisdom Foundation, (1995)
16. Nguyen, Q. H. Impact of Investment in Tourism Infrastructure Development on Attracting International Visitors: A Nonlinear Panel ARDL Approach Using Vietnam's Data. Economies, 9(3), 131. (2021).
17. Panigrahi, Raj Kumar, Rural Tourism in Odisha Available at SSRN: http://dx.doi.org/10.2139/ssrn.3514487, (2020).
18. Revathi Padavala1, Sujatha Palleti, A study on Tourist's satisfaction with respect to the Krishna Pushkaras. International Journal of Research and Analytical Reviews, Vol 5, Isuue 4 pp. 197-202, (2018).
19. Samal, Ansuman & Sadual, Sapan & Mohanty, Mrs. The scope of rural tourism in Odisha: A case study. Pramana. 9. 135-147, (2019).
20. Sharma, R. Pilgrimage Tourism Satisfaction with Reference to Prayagraj and Varanasi: An Empirical Study. Turkish Journal of Computer and Mathematics Education (TURCOMAT), 12(5), 1638–1649. https://doi.org/10.17762/turcomat.v12i5.2141, (2021).
21. Sujata Ranbida, Sadananda Nayak R. Tourism in Western Odisha: Problems & Prospects. Journal of Emerging Technologies and Innovative Research (JETIR). Volume 6, Issue 1, pp. 477-484, (2019).
22. Suleiman, Najat Nassor, Masoud Mohamed Albiman Dynamic relationship between tourism, trade, infrastructure and economic growth: Empirical evidence from Malaysia. Journal of African Studies and Development 6: 49–55, (2014).
23. The International Ecotourism Society (TIES) What is Ecotourism? Washington, DC: TIES. http://www.ecotourism.org/what-is-ecotourism, (2018).
24. Wang Q., Ding Z. R., Zhang J. H. Study on the model of tourist satisfaction index about tourism environment: a case study of Huangshan Mountain Geographical research, vol. 25 no. 1, pp. 171-181, (2006).
25. Venkaiah Babu P, Investigation of Investors Perception Towards Decisions Related to Mutual Funds, Journal of Pharaceutical Nagative Result, ISSN:2229-7723, Volume -14 Issue- 2, PP-3223, 3228, January 2022.