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Original scientific paper

Research on the "Agricultural and Tourism Dual Chain" Model of Leisure Agriculture from the Perspective of Circular Economy

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Abstract: Leisure agriculture is a growing trend in the agricultural tourism industry. Human activities negatively affect ecosystem and agricultural output, and these effects worsen as the economy grows. Therefore, most conventional agricultural firms rely on external sources for technological advancement to outsource development or only engage in a limited number of innovation chains. A novel model named the Agricultural and Tourism Dual Chain Model of Leisure Agriculture (ATDCM-LA), is proposed after a thorough examination of the circular economy and presented in this study. Improvements in modern Leisure Agriculture tourism base planning may be attained via ecological agriculture by analyzing the impacts on regional planning. Fuzzy Analytical Hierarchy Technique (FAHT) was used to generate administrators' relative weights for farm leisure growth, and indicators were dynamically ranked by importance. Data Envelope Analysis (DEA) based on Circular Economy (CE) has applied to the existing state of leisure and tourism agriculture, which scales back the expansion of leisure agriculture and prioritizes growth initiatives that will have the most significant impact. This research integrates the goals of promoting rural culture with those of tourism administration and economic theory in agriculture, and it concludes with recommendations for regional growth of leisure agricultural tourist facilities. Leisure agricultural tourist base planning and administration results reveal the necessity to merge rural tradition with the sector's agrarian investment. Finally, the findings indicate that a rural-culture-based Leisure Agriculture tourist basis has some potential for success in regional development.

Keywords: circular economy; data envelope analysis; fuzzy analytical hierarchy technique; leisure agriculture

1 INTRODUCTION

Leisure Agriculture refers to a relatively recent farming method that uses farms and farmland to create opportunities for recreational and tourist activities. It is a novel strategy for maximizing farm profits by maximizing resource potential, restructuring agriculture, improving the farming environment, and enhancing agricultural productivity [1]. Visitors to the region can stay and relax in addition to seeing views, collecting fruit, experiencing farming, learning about farmers' lives, and enjoying local attractions [2]. As the global middle class expands, many nations are fretting over the future of urbanization, rural revitalization, and the travel and leisure industries [3]. Developing agricultural theme parks benefits the public by increasing the availability of recreational spaces, contributing to the smooth merging of urban and rural areas, and highlighting the innovative character of relevant technologies [4]. The successful development of agricultural rehabilitation and advancement of rural regions is directly correlated with the high-quality growth of leisure agriculture, which is an essential aspect of the pastoral industry [5]. People are drawn to parks and other green areas for a variety of reasons, including those related to recreation and tourism. However, land utilized to improve the town's biological environment is scarce, and in many places, tensions exist between urban construction and public green spaces [6]. Urban ecosystems, like other biological systems, are composed of natural components, including animals, plants, and minerals found in the earth's soil, air, and water [7]. The abovementioned components can interact within a constrained area in more extensive settings. While more people are discovering and enjoying the benefits of rural vacations and recreational agriculture, challenges remain in the design, planning, building, and ongoing growth of exploring agrarian parks [8] - the issues like landscape homogenization and iconic landscape deficiency. There is a proliferation of tourist agricultural park initiatives, all essentially the same [9]. These issues, on the one hand, are fixed by the inflexible legal framework of the growth of the farm-based tourist region itself. On the other, the expansion plan of the agricultural leisure area has received insufficient attention from planners and administrators [10].

The World Tourism Organization notes the features of agricultural leisure region such as lodging in either an original farmhouse or a guesthouse, serving dinner, and organizing the visitors' performance in their opinion and support of the agricultural industry [11]. The agricultural environment has emerged as a vital area for cultivating and exploiting tourism in response to the growing popularity of cultural, ecological, and rural travel [12]. Firstly, the study enhances the planning influence of agriculture ecology scenery by including the customary rural culture paradigm in the design phase. The circular economy (CE) has arisen to lessen resource consumption and waste creation, mitigate the damaging effects on agriculture ecosystems, and boost productivity [13]. The CE is a way of producing and consuming goods that maximize the lifespan of resources by maximizing their communication, letting, reuse, repair, refurbishment, and disposal. Second, the intricate nature of leisure farming administration calls for an empirical approach to offer administrators an overview for decision-making, given the wide range of management features in this sector. Remarkably, managers must consider the two distinct aspects of farming technology and recreational services. As a result, during decision-making in management, administrators are frequently subjected to various selection pressures [14]. The aim of this paper is as follows. It adopts FAHT to rank indicators in order of relevance continuously, synthesize leisure agriculture's evolving leadership metrics, and serve as a resource for the industry's decision-makers. The third stage of the DEA model serves as a significant guide for increasing the effectiveness of leisure agriculture [15].

The main contributions of the article include the following relationship.

- The research proposes the Agricultural and Tourism Dual Chain Model of Leisure Agriculture (ATDCM-LA) for analyzing ecological agriculture's effects on

regional development, which may lead to enhancements in contemporary Leisure Agriculture tourist base planning.
- Operators' weightings for farm leisure growth were calculated using the fuzzy analytical hierarchy technique (FAHT), and indicators were dynamically ranked.
- Data Envelope Analysis (DEA) based on Circular Economy (CE) reduces leisure and tourism agriculture expansion and prioritizes growth initiatives with the most significant impact.
- The results and aim of the study present that an agricultural, culture-based, tourist-based Leisure Agriculture basis may be successful in fostering regional growth.

Here is how this paper is organized. In Section 1, it presents a synopsis of the project, and in Section 2, it analyzes the existing literature on the topic. In Section 3, a framework for leisure farming is presented, and in Section 4, results from experiments are discussed. In Section 5, we present the study's main conclusions.

2 LITERATURE REVIEW

Shuai et al. [16] compare the habits of Xuzhou's leisure agricultural visitors in 2004 and 2019, using the Heckman two-step model to examine the influence of travellers' personal traits on their spending habits. Thirdly, to encourage the leisure agriculture sector's premium growth and supply-side structural transformation. First, maximizing exposure through online media. Second, catering to tourists with certain personality traits. Third, providing highly precise marketing to each customer.

Víctor et al. [17] examine AT-Big data as a comprehensive analytical solution for leisure agriculture and red artistic tourism that utilizes state-of-the-art big data technology and merges the real-world needs of travel data fusion. Through the data gathering layer and data independence, we can store and handle massive amounts of data, merge various knowledge resources, and support a wide range of smart applications. This study proposes cloud-based computing, fuzzy acknowledgment, and other technologies. The results indicate that the strategy described in this work effectively deals with problems connected to the combination of red cultural tourism and leisure agriculture.

Shang et al. [18] introduced the Internet of Things technology for ecological agricultural tourism (IoT-EAT) to analyze ecological tourism attractions, and it integrates experimentation to analyze the efficacy of this strategy, all while being informed by the notion of circular economy. However, the sustainable agricultural project's organizing and transformation have not been promoted, and the project industry development has not been enhanced because of the speculative arranging of the fundamental system, the basic level of operational efficiency and administration, and the lack of an academic hypothetical system for showing during the process of transformation. Research shows that this work's ecological agricultural scenic area design strategy has several positive outcomes.

Raju et al. [19] proposed the leisure agriculture industrialization by constructing a two-department general equilibrium model, which indicates that the straightforward pursuit of leisure farming growth may have an aware adverse effect on the creation of conventional sectors in rural areas. Together, the two show how the modernization of leisure agriculture and the general equilibrium model can boost rural economies and make rural areas more competitive. This essay broadens the scope of leisure farm research and provides theoretical backing for the sector's increasingly industrialized expansion.

Qiu et al. [20] examine the financial effects of the Forest-Based Recreation Sector (FBRS). Input-output modelling is applied to the forest recreation sector to get estimates for the industrial linkage and a cluster of economic multipliers. First, forest recreation's forward and backward linkages increase over time, with backward linkages increasing. Second, woodland recreation has increased its economic impact despite decreasing multipliers. In 2018, output was $838.187 billion, adding an impact of $352.713 billion. Forest Recreation could provide nearly 18 million low-skilled catering, lodging, and retail jobs with an average annual growth rate of 15.73%. Finally, policy applications offer credible and usable information.

Axhami et al. [21] introduce circular economy initiatives and practices to create value and contribute to a sustainable future through climate change, energy conservation, and alternative energy sources. An in-depth, qualitative investigation of a vacation resort is provided and studied to discover the critical CE practices triggered to create more value and promote environmentally friendly production and consumption. The results reveal that CE practices improve resource efficiency, reduce emissions, and reduce environmental consequences. This study highlights the CE's financial, environmental, and social efficacy. The report highlights CE's primary value prospects for tourism enterprises, enhancing its relevance and environmentally friendly approach to the sector. The report offers practical advice.

Joshi et al. [22] proposed the essential Circular Economy Dimensions (CE-D) in agritourism and evaluated their performance using AHP-TOPSIS. In the second stage, industrial specialists validate and finalize CE-D to determine Agri-Tourism Networks' performance. Destination Attractiveness is crucial for CE decisions, followed by regional contributions and sustainable livelihoods, according to AHP data. Agri-tourism practitioners and policymakers can use Circular Economy Dimensions (CE-D) to evaluate clusters. The paper evaluates CE in agri-tourism clusters and its benefits and drawbacks.

Shirodkar et al. [23] proposed that based on the user's preference for online activities, this study constructs an enterprise interactivity model in the form of an operations research (OR) model and integrates it with an e-commerce platform to develop a model for purchasing and using of travel services online. The weighted centrality approach can extract the significance of interest tags by locating pivotal nodes with strong connectedness in the social network. The results of this research show that the proposed model has the potential to promote the expansion of the tourism sector, improve the efficiency of related resources, yield advertising advantages, and adhere to the tenets of the circular economy.

The papers' information, networks, and digital technology serve as the primary tools of smart agriculture, while innovative production and management science provide the backbone, and agricultural production is the primary process, with operation and circulation being closely monitored - the proposed model which overcomes the limitations of previous model.

3 METHODOLOGY

3.1 Agricultural and Tourism Dual Chain Model of Leisure Agriculture (ATDCM-LA)

Corporate organizations have come to recognize that innovation beyond technology plays a more significant role in the development of the economy and society because of its over time. Industrialization leads to farming as a recreational activity. According to the theory of economic integration, recreational farming is a prime illustration of socialized industrial integration since it shifts, lengthens, and incorporates the initial agricultural economic value chain while bringing the formerly outside division of activity in agriculture in-house. Fig. 1 illustrates the structure of ATDCM-LA. The expansion of agricultural tourism and other forms of rural recreation were the primary foci of the study's research and analysis. This paper intends to assess the agricultural, natural setting by examining the evaluation method used for recreational agricultural assets and environmental advantages, the current condition of resource consumption, and the principle of utilizing resources as a foundation. This study integrates sustainable farming with these novel techniques by analyzing the history of agricultural and cultural tourism to advise community enhancements for farm tourist bases.

Furthermore, the article summarizes the challenges with regional planning for agricultural tourist bases in China. It separates them into practical categories based on such bases' present regional planning necessities. The work proposes a technique for addressing planning flaws in the real-time context of transportation for tourism monitoring systems by combining the "original scene-reduced scene" likelihood matrix with cooperative filtering. Regional planning will optimize the tourism administration chain, enhance efficiency and quality, and make intelligent selections for travel functioning defect solutions.

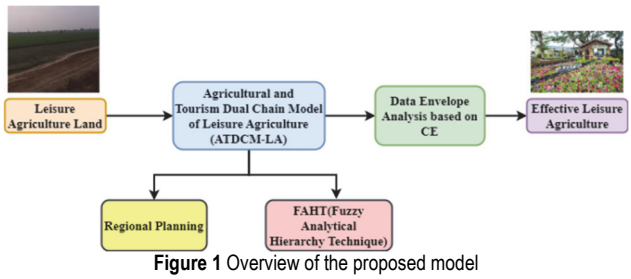

Figure 1 Overview of the proposed model

The relative significance of every measure was calculated using the Fuzzy Analytical Hierarchical Technique (FAHT), and the indicators were reordered on the fly. Additionally, the research contributed to leisure agriculture's constantly changing leadership characteristics. The findings indicate three distinct management stances concerning leisure agriculture: functioning, reasonable, and cautious. Regarding leisure agriculture businesses, the metrics appreciated by proactive executives are undoubtedly distinct from those valued by intermediate and moderate managers. Businesses in the leisure agriculture industry place a premium on recruiting capable administrators. The DEA model with CE does not join basic statistics. A quantitative assessment of the initial information is no longer necessary for gauging a decision unit's efficacy. The mission of the CE is to promote resource efficiency by developing environmentally responsible business models that increase economic growth, social justice, and employment. Applying the dual theory approach, the distance determines the point that separates the inefficient unit and the manufacturing functional frontier surface for a unit with an average effectiveness of less than 1. The selection of the unit's adjusting space is the interval between the variations. By tweaking the setup of the production inputs, the decision unit can maximize efficiency in production. The dual chain approach of agriculture and tourism based on regional planning and a fuzzy approach expands tourist spots, so local support for the hospitality sector has become necessary and sufficient for the sector to thrive. The bulk of hobby farms tend to locate in rural areas.

3.2 Regional Planning for Leisure Agriculture

Fig. 2 illustrates the regional planning analysis of leisure agriculture. At first, in regional planning, the research analyzes remote cultural tourism to study the strategic consequences of contemporary agricultural tourist bases, and it blends ecological agriculture with regional planning innovations for such bases. In addition, the existing state of agricultural tourism regional planning is analyzed. The tracking and coordinated administration of the backup connections of tourism activities have become a reality thanks to the scientific and logical application of fuzzy technology in the farming sustainable tourism business, made possible by the growing sophistication of regional planning analysis. In addition, a unified platform for agriculture and tourism has developed to meet visitors' needs in information, itinerary planning, transportation, commerce, etc. It boosts eco-tourism management's effectiveness and sophistication while encouraging its intelligent and low carbonization. Leisure agriculture and rural tourism are multifaceted, high-tech, highly industrialized, market-focused environmental agricultural systems that exemplify combining urban and rural areas for tourist's sake, and their responsible expansion is at the core of these practices. Regional point-pattern studies reveal the effects of ecological processes, including seed-sowing, biological linkage, and death, on the spatial organization of organisms. It elucidates the interrelationships between agricultural and touristic practices and their communication channels. The region's distinctive agricultural landscape and customary traditions contribute to society in terms of material products and have the effect of experiencing life, expanding knowledge, and nurturing emotion. So that wild landscapes, cultivated landscapes, and agricultural garden landscapes can coexist peacefully and productively. Maintaining a healthy ecosystem is possible. Expansion, protection, reasonable development, and the efficient use of resources are emphasized, as are the synergies between nature, economy, farming, and tourism.

Tourists add more pressure to already threatened species due to land use problems such as soil deterioration, contamination, habitat degradation, and biodiversity loss. The natural resources on which the tourism industry depends could have depleted due to these effects. Human assets refer to manufactured tourist destinations, while physical resources include beaches and lakes. One way agriculture consumers in developing nations can gain from tourism is by cultivating new business relationships. The agricultural sector not only supplies the tourism industry with the raw materials for food consumption but also provides the scenery for rural attractions.

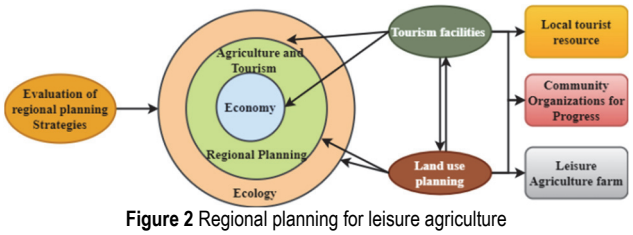

Figure 2 Regional planning for leisure agriculture

The graphic depicts a cyclical relationship between regional planning, tourism infrastructure, and economic growth. Modern individuals have a lot on their plates, so taking time out for recreation and enjoyment is essential. The combination of agriculture with tourism for leisure can provide a stunningly attractive and unspoiled setting for visitors. Tourists can appreciate farming, reconnect with nature, and get insight into conventional farming methods by selecting, fishing, exploring, experiencing, and consuming pollution-free agricultural and related commodities. Visitors can study agriculture, watch animals and plants grow, participate in agricultural production, experience life in a rural area, and gain insight into rural culture, all of which improve education and increase agricultural literacy. Increasing the standard of living requires a more active role in demonstrating the benefits of innovative farming in scientific progress, high-tech machinery for R&D, and educational opportunities made possible by recreational agriculture and rural tourism. New or improved crops, farming methods, and tools can all be showcased and taught at demonstration farms.

The expansion of leisure agriculture and rural tourism also helps farmers, increases revenue, raises farmers' living standards, reduces wealth inequality, increases intellectual resources shared by the farming and tourism industries, and encourages the two sectors to develop in tandem. Cultures can learn from one another and grow together via the shared experience of rural life that leisure agriculture and rural tourism provide. From a region planning standpoint, it has shifted from a dispersed to a clustered dispersion, moving from the peripheries of major and minor cities to the environs of tourist attractions. More than that, as a novel economic activity, leisure agriculture, and rural tourism are luring an increasing number of individuals into the sector, providing a welcome boost to the agricultural industry. Limited scale, inadequate facilities, low quality, missing features, basic and insufficient amenities, and a lack of enthusiasm and expertise are all hallmarks of the park's evolution.

The principles of "modifying solutions to local conditions", "rational layout", and "highlighting characteristics", as well as the direction of "three combinations", guide our deliberations. The proposed approach integrates immediate and future planning, ecology and economic advantages, and opposing methods regarding growth and preservation. The region's beneficial industries are identified after a thorough study and field research of the region's advantages have yielded plausible expansion ideas and directions according to the region's features. The second is an emphasis on improving the agricultural culture, ethnic habits, and agricultural features of communities with local characteristics, which highlights the limitations of traditional culture during industrial growth. Third, agricultural resource development does not negatively impact the surrounding ecosystem. The emphasis here is raising people's consciousness about preserving the natural ecosystem. The fourth goal is to build a more creative mindset, learn to work effectively with various academic organizations, and use the most innovative findings from scientific studies to develop fresh, original forms of recreation.

3.3 FAHT (Fuzzy Analytical Hierarchy Technique) for Choosing Administrators

As can be seen in Fig. 3, the FAHT was used to dynamically arrange indicators by relevance after calculating their respective weights. The FAHT method is employed, which is used in many different fields for making decisions. Since FAHT may be easily adapted to various choice problems, the study suggests a decision-making system by FAHT to evaluate the administrators. The study contributes to the growing body of literature on farming by providing a concise summary of the constantly changing management indicators used in farms. Therefore, leisure agriculture has a wide variety of management aspects, and its intricate nature necessitates an empirical approach that may serve as a decision-making guide for administrators. It is incumbent upon managers to assess the intertwined qualities of farming technology and recreational services. Decision-makers in leisure farming now have access to a database of information on fluctuating management indicators thanks to applying the fuzzy technique to rank their value dynamically. The relative importance of the goal options is represented by each paired alternative in the regular Analytic Hierarchy Process procedure, which is evaluated using a nine-point scale. Because target alternatives are often selected subjectively and inaccurately, traditional AHP cannot accurately quantify their relative weight. The Management Index, businesses can flourish. Every thriving business has its own Management Index. Still, to survive in today's fast-paced world, that index needs to be as progressive as the company itself to keep up with the changes and keep its competitive edge.

The Analytic Hierarchy Process (AHP) was modified to use fuzzy logic theory to create the Fuzzy Analytic Hierarchy Approach. The Fuzzy AHP approach is utilized similarly to the AHP approach. The AHP scale is converted into a fuzzy triangular for easier prioritization in the Fuzzy AHP approach.

- First, the issue was identified by the standards for evaluating the administrator's performance. The most essential factors in selecting administrators are expertise, originality, and clarity.

- Second, the individual's data and criteria used in hand, construct a comparison matrix. The matrix utilized is easy to understand, secure inside a reliable structure, capable of obtaining more data with all conceivable comparisons, and capable of analyzing the overall priority's responsiveness to modifications.

Eq. (1) for defining pair-wise contrasts is provided below.

$$x_{ij} = \frac{w_i}{w_j} \qquad i, j \ldots\ldots\ldots N \tag{1}$$

where N is the total quantity of requirements, w_i and w_j are the relative weights for conditions i and j, and x_{ij} is the ratio between the condition i's weight and the condition j's weight. Next, the values in columns i and j are divided by the most significant value in column i to produce a matrix representation of the data in Eq. (2).

$$x_{ij} = \frac{x_{ij}}{\max x_{ij}} \tag{2}$$

A matrix was made to contrast fuzzy tuples. Fuzzy discriminant matrices can be generated by averaging triangular fuzzy integers, as shown in Eq. (3).

$$x = \begin{vmatrix} 1 & x_{12} \ldots\ldots\ldots & x_{1n} \\ x_{21} & x_{22} \ldots\ldots\ldots & x_{2n} \\ x_{n1} & x_{n2} & 1 \end{vmatrix} \tag{3}$$

- Third, make sure everything is consistent. Matrix order N is a factor in evaluating the consistency index against a Random Index generator (RI) output. A nearly valid conclusion requires a high level of reliability.
- The formula for determining consistency's worth is shown below. The eigenvector value, the criteria's weighted value, must be determined first. The following Eq. (4) is used to determine the eigenvector:

$$w_i = \frac{x_i}{N} \tag{4}$$

where N is the total amount of criteria, and x_i is the sum of the normalized values of the matrix, w_i is the eigenvector.

- A fuzzy number in a triangular shape is the fourth step. The FAHT scale ranges from low to high, with L standing for "low", M for "middle" and U for "upper". For this reason, the Fuzzy Number scale has the form of a triangle, and each fuzzy set will be subdivided into two, except the comparison set.
- Fifth step determines the fuzzy vector's weight. After converting AHP comparative value to the FAHT scaling value, the fuzzy synthesizing value is arrived at. Following is Eq. (5), which demonstrates how to arrive at a fuzzy synthesizing value:

$$fs_i = \sum_{j=1}^{m} {m_{gi}}^j A \frac{1}{\sum_{i=1}^{n}\sum_{j=1}^{m} {m_{gi}}^j} \tag{5}$$

where fs_i denotes the synthesis using Fuzzy Values, ${m_{gi}}^j A$ by adding up the values of the cells in that column, row by row, beginning with column 1. The defuzzification of ordinate value is calculated by comparing the results of the fuzzy synthesis. The given math allows us to determine the administrative weight values.

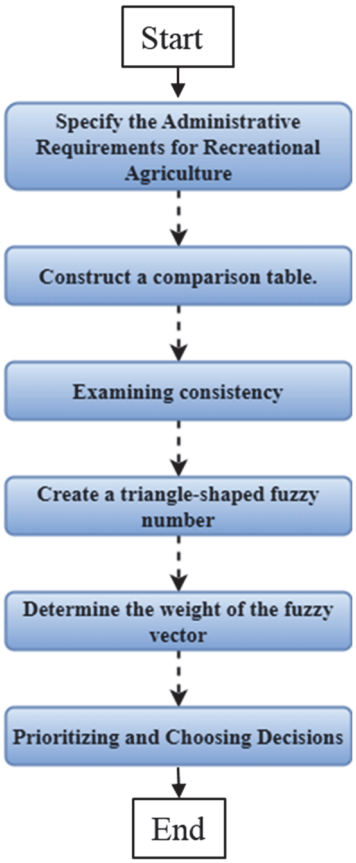

Figure 3 Flowchart of FAHT

- Choosing among alternatives is step six. The following phase is to perform a value computation using the criteria's potential resolution techniques. The standards of the feature's weight will determine the relative importance of each alternate feature and will then be applied to arrive at a final verdict.

The study's authors conclude that proper resource management is crucial to the long-term success of recreational farms. Therefore, FAHT is a better option for leisure farm sustainability planning. The hierarchical analytic approach may evaluate the relative relevance of various projects and put the most crucial ones into the sustainable development indicators of leisure farm planning in the long run. Therefore, this research aims to develop a prototype for a sustainable management index specific to recreational farms. Fig. 4 depicts the FAHT structure that ultimately chose managers to accommodate the planned changes to the leisure farms depending on various procedures. Organization and operation, recreational agricultural process, Upkeep and administration of the ecological system, administration of public facility upkeep for tourism, Agricultural resources for leisure, and Effective functioning are the five facets of evaluation that were developed for the FAHT algorithm, as shown in Fig. 4.

1. At the following level, separate projects were further segmented according to distinct features, and at the third level, an organization was built following the five evaluation standards. The projects were divided into three groups: ecological maintenance administration, infrastructure upkeep supervisors, and leisure agricultural resources. There was a total of fifteen individual projects.

2. This work developed the Delphi method index questionnaire data, including five elements and assessment indicators, by synthesizing the viewpoints from applicable scholars through literature research and giving a theoretical underpinning.

3. Five primary evaluation components and evaluation criteria made it through the initial evaluation utilizing the Delphi approach. Therefore, the organizational structure layout and all assessment components and criteria were preserved.

4. Create a comparison matrix for fuzzy pairs and create the fuzzy approach triangular number to determine the weight vector.

5. Finally, choose the best administrators for leisure agriculture with more outstanding qualities.

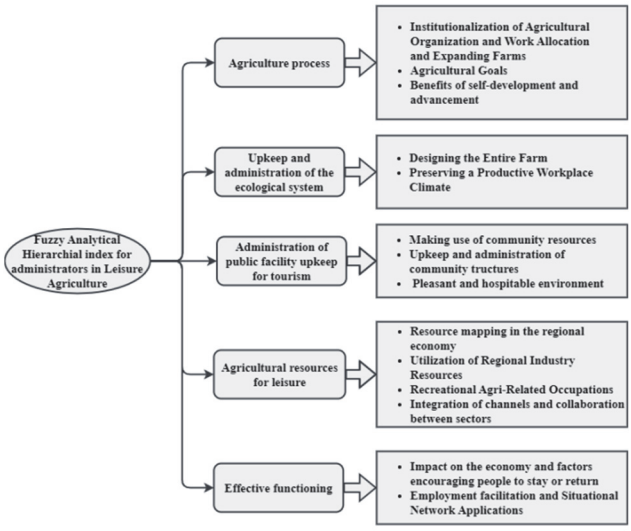

Figure 4 FAHT structure to decide administrators

3.4 Data Envelop Analysis Based on CE

The study offers an initial basis for choosing inputs and results indicators by reviewing the proposed agriculture assessment index model, adhering to the principles of completeness, independence, and direction. The DEA with CE was used to measure the growth of agriculture and tourism based on the previous results of regional planning and FAHT data. The things you choose for input and output must share the same relationship. As a result, the Pearson correlation coefficient is utilized to analyze the input/output data. The study relies heavily on previous work done by national and global academics to develop an evaluation index system for recreational agriculture. Fig. 5 shows the evaluation index based on the CE of the proposed model, which is used to recognize the growth of leisure agriculture. Regarding the use of circular models in the agricultural context, it is essential to examine the progress achieved in adopting these models throughout the many phases indicated, the main contributions made in each step, and the obstacles and openings that now exist to further their use. It was accomplished by picking relevant research on CE in agriculture from the source mentioned above material.

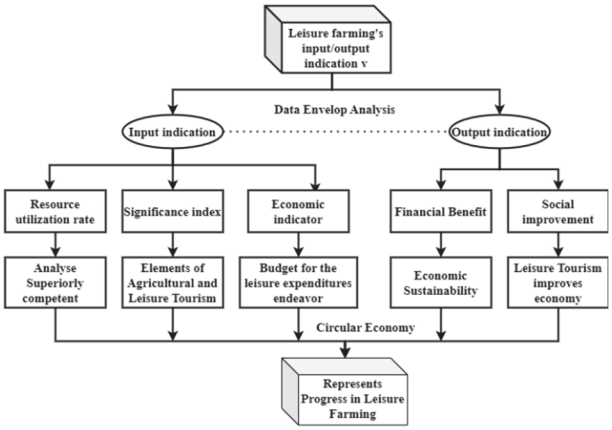

Figure 5 Data envelop analysis based on CE

Based on the Pearson correlation between input and output components, the data envelop analysis yields the following results in the CE. There is a strong positive correlation between the indicators of talent input, the indicators of income from output, and the number of people with jobs. Input indicators define how leisure agriculture progresses. In addition, a macroeconomic indicator allowed for a review and analysis of data from the agriculture and tourism industries from prior years.

Leisure and tourism agriculture evaluation often use people resources, capital, and technical equipment as input indicators. Factors such as labor count, square footage, and capital expenditure on farm equipment are mentioned explicitly. The work uses the prior literature to estimate the total number of people, total floor space, and total power of agricultural machines necessary to accomplish the stated goals of the research. The agricultural sector's efficiency may be inferred from the entire output of the sector's machinery. Total output value, annual operational revenue, and employee per capita income are the most common measures of output used in the extant literature. Total output value or annual company profits do not adequately reflect the expansion of agriculture targeted toward tourism and recreation. In the study, the DEA with CE is used in an empirical analysis of the agricultural and tourism sector's production efficiency. The research findings demonstrate total, pure technical, and scale efficiency in recreational agriculture production. The method demonstrates that leisure and sightseeing of agriculture's production level and development size are suboptimal. Various areas have different production technology levels, leading to differences in tourist agriculture development. These differences are most evident in differences in pure technological efficiency. Different cities have varying levels of leisure and sightseeing of agricultural production. Hence, different cities have varying levels of leisure and tourism agriculture.

4 RESULTS AND DISCUSSION

The proposed method utilizes all agriculture-related datasets for India. https://www.kaggle.com/datasets/

thammuio/all-agriculture-related-datasets-for-india [24].

With the correct information, this dataset hopes to aid the Indian agricultural ecosystem. With so little reliable information, this seems the perfect time to compile a database to aid India's agricultural sector. There were 63218 page views and 9861 downloads. The performance metrics of the proposed method are compared with the other techniques, such as AT-Big data, FBRS, and IoT-EAT.

4.1 Resources Utilization Efficiency

The widespread approach to economic growth that has developed as a direct result of inefficient resource usage is to blame for the current state of resource waste. Regional planning approaches to the growth and use of its recreational agricultural assets mirror this unjustified expansion mode. Despite the rural areas' abundance of land and natural resources, inefficient resource exploitation has resulted from their unique economic development methods. Fig. 6 shows that the proposed strategy significantly improves leisure agriculture's usage efficiency over conventional approaches like AT-Big data FBRS and IoT-EAT. Along with continuing economic growth, regional development is getting more successful in advancing the goal of higher standards of life in recreational pursuits. Compared to other leisure pursuits, leisure agriculture stands out due to various unique characteristics, most notably its strong cultural roots in rural areas. However, studies and inquiries into this topic have revealed a lack of innovation in how leisure farming resources are used and that the predominant mode of putting these resources to work is relatively static. The study and analysis of ATDCM-LA's agricultural resources are used for the dual chain of agriculture and Tourism.

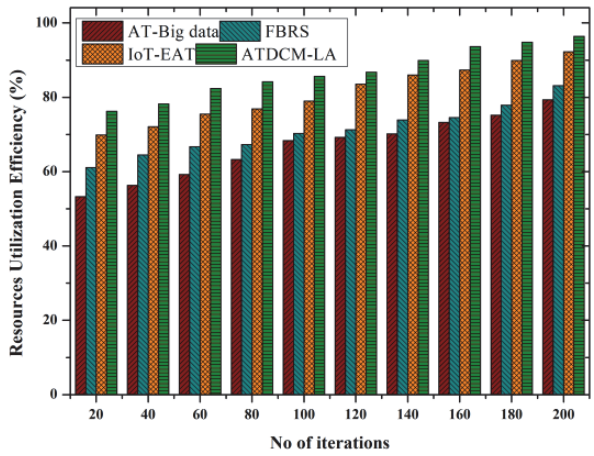

Figure 6 Resources utilization efficiency

4.2 Quantitative Analysis of Socioeconomic Benefits Ratio

The quantitative analysis presented in Fig. 7 aims to quantify the economic and social benefits of leisure farming. As a result of their respective index factors and outside variables, Eq. (6) depicts the alteration rate in the agriculture region's macroeconomic benefit (x) and environmental and social advantages system (y). The change is attributed to the combined impact of these components.

$$V_x = \frac{\mathrm{d}x}{\mathrm{d}t}; V_y = \frac{\mathrm{d}y}{\mathrm{d}t}, V = f\left(V_x, V_y\right) \tag{6}$$

V_x and V_y are the rates of change in systems x and y, respectively. Since the entire complex system comprises two infrastructures, x and y, the rate of evolution of the entire complicated system can be stated in terms of V_x and V_y. The land advantages linking model employs V_x and V_y as controlling controls and sets up a spatial framework with V_x and V_y as the coordinates to study the development of the type of the complicated system V in the 2-dimensional system (V_x, V_y) constituted of two parameters. A complicated system's connectivity level can be considered the angle between the system's rate of evolution and its growth rate regarding economic and social advantages. The proposed methodology uses the FAHT and innovative regional planning, improving financial and social benefits. On comparing the different methods of leisure agriculture technology, the ATDCM-LA has improved socioeconomic benefits.

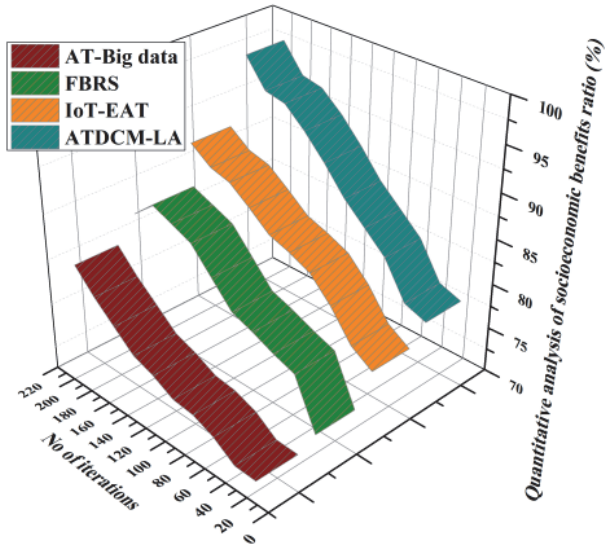

Figure 7 Quantitative analysis of socioeconomic benefits ratio

4.3 Leisure Agriculture Economic Index Evaluation

According to the results of the primary study conducted on the evaluation of the condition of crop production and ecological habitats, the following data was collected for a broader assessment of the excellence of farming. The leisure farming economic holistic index was plotted as a time series line chart (Fig. 8), and it was observed that the agricultural and tourism economy had an upward tendency, which is in line with the present-day economic scenario. It was the case since the leisure agriculture economy was consistent with the overall economic trend. The amount of grain produced per person was reduced in both 2018 and 2020 due to natural disasters, leading to a decrease in the value-added index of the agricultural tourist industry and a general negative trend in the total assessment scale. Farmers' disposable income and agricultural earnings per capita value rose dramatically between 2020 and 2023 due to the booming agricultural sector. Overall development in the complete evaluation index was 140%, or 17.39% per year, from 0.50675 to 1.008.

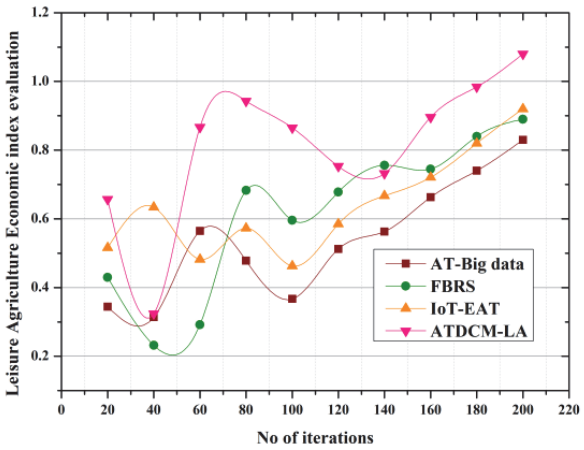

Figure 8 Leisure agriculture economic index evaluation

4.4 Statistical Analysis of DEA using Circular Economy

Starting with establishing and growing villages, relevant tourism departments can market via mass media, plan tour itineraries of agricultural culture heritage, and create connected tourism products. After the leisure agricultural system has been conceptualized and designed, it may be evaluated and analyzed utilizing the Pearson correlation between the input and output components approach described in this study. To begin, we will use the entropy technique to assign a value to agricultural traditional culture as a tourist attraction and then compare these scores to those assigned by a panel of experts. The preceding research demonstrates that CE and the planning of agricultural ecological landscapes have achieved some success, providing a foundation upon which to assess the efficacy of FAHT in regional planning and decision-making. Fig. 9 presents the statistical map for 2018-2023 that results from the evaluation of the design of the agricultural ecological landscape.

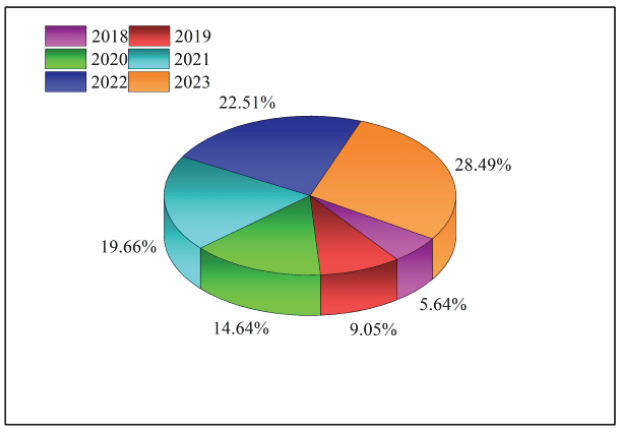

Figure 9 Statistical analysis of DEA using circular economy

5 CONCLUSION

This paper analyzes the circular economy and proposes a new model - the Agricultural and Tourism Dual Chain Model of Leisure Agriculture (ATDCM-LA). Leisure agriculture lacks scientific planning, management has not been standardized enough, overall service quality is low, scale is not large, and taste is not high. The development of characteristic local resources is not comprehensive enough, and it has not yet formed its own characteristics. Analyzing the effects of ecological agriculture on regional development may lead to enhancements in contemporary Leisure Agriculture tourism base planning. Indicators were dynamically sorted by importance using the Fuzzy Analytical Hierarchy Technique (FAHT), and administrators' relative weights for farm leisure expansion were thus generated. Data envelope analysis (DEA) based on circular economics (CE) principles is used in the recreational and tourist agricultural sector's state to constrain its expansion and boost its growth activities where they would have the greatest impact. The research assesses the current situation of the leisure farming and tourist business worldwide and recommends how it might be better planned. Beneficial results, such as the sustainable management of natural resources, have resulted from the rise of recreational farming and tourism in farms. These tourist pursuits encourage ecosystem preservation and restoration, using environmentally friendly farming methods and the development of fresh revenue streams in rural communities. Thus, a more environmentally conscious and sustainable development can be fostered by encouraging recreational farming and rural tourism in the future. It is of immeasurable significance to promote the sustained and good development of local agricultural economy and tourism, and enhance the vitality of China's agricultural economy.

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6 REFERENCES

[1] Wang, N. (2020). Construction of the Connotation and Its Theoretical Analysis Framework of Sustainable Development of Rural Tourism in the Context of New Urbanization. *IOP Conference Series: Materials Science and Engineering*, *750*(1), 012065. https://doi.org/10.1088/1757-899X/750/1/012065

[2] Vargas-Sánchez, A. (2021). The new face of the tourism industry under a circular economy. *Journal of Tourism Futures*, *7*(2), 203-208. https://doi.org/10.1108/JTF-08-2019-0077

[3] Sun, H., & Tang, S. (2022). Planning of agricultural ecological scenery based on the concept of traditional rural culture. *Acta Agriculturae Scandinavica, Section B-Soil & Plant Science*, *72*(1), 333-343. https://doi.org/10.1080/09064710.2021.1993320

[4] Hutsaliuk, O., Bondar, I., Sereda, N., Babych, O., & Shchoholieva, I. (2021). Organization and management of the development of ecological tourism in a circular economy. *E3S Web of Conferences*, *255*, 01026. https://doi.org/10.1051/e3sconf/202125501026

[5] Kazmina, L., Makarenko, V., Provotorina, V., & Shevchenko, E. (2020). Rural tourism (agritourism) of the Rostov region: condition, problems and development trends. In*E3S Web of Conferences*, *175*, 10001. https://doi.org/10.1051/e3sconf/202017510001

[6] Waiyasusri, K. & Chotpantarat, S. (2022). Spatial evolution of coastal tourist city using the Dyna-CLUE model in Koh Chang of Thailand during 1990-2050. *ISPRS International Journal of Geo-Information*, *11*(1), 49. https://doi.org/10.3390/ijgi11010049

[7] Liu, S. & Gao, B. (2022). Econometric analysis of leisure agriculture and rural tourism scenery based on spatial data

analysis. *Computational Intelligence and Neuroscience*, *2022*. https://doi.org/10.1155/2022/2286803
[8] Chang, Y., Li, D., Simayi, Z., Ren, Y., & Yang, S. (2022). Spatial distribution of leisure agriculture in xinjiang and its influencing factors based on geographically weighted regression. *Sustainability*, *14*(22), 15002. https://doi.org/10.3390/su142215002
[9] Suharsono, D., Kamal, M., & Wicaksono, J. (2023, January). BIPA-Based Educational Tourism Model Development. *Proceedings of the 3rd International Conference on Social Science, Humanity and Public Health, ICoSHIP 2022, 05-06 November 2022, Banyuwangi, East Java, Indonesia*. https://doi.org/10.4108/eai.5-11-2022.2326522
[10] Tubtim, S., Nillakan, L., & Sumethokul, P. (2022). Agricultural Resource Management Model for Sustainable Tourism by The Regional. *Journal of Positive School Psychology*, *6*(8), 4050-4059.
[11] Chen, Z., & Diao, B. (2022). Regional planning of modern agricultural tourism base based on rural culture.*Acta Agriculturae Scandinavica, Section B - Soil & Plant Science*, *72*(1), 415-428. https://doi.org/10.1080/09064710.2021.2008481
[12] Liu, Y., Zhang, M., Cao, Q., Wang, E., & Zou, B. (2023). Can Integration of Agriculture and Tourism Promote Rural Green Development? Empirical Evidence from 152 Cities in China. *Agriculture*, *13*(2), 405. https://doi.org/10.3390/agriculture13020405
[13] Bi, W., Wang, G., & Zhang, M. (2022). Personalized recommendation of rural tourism based on traffic classification and user data analysis. *Security and Communication Networks*, *2022*, 1-7. https://doi.org/10.1155/2022/4434833
[14] Gao, S., Yang, X., Long, H., Zhang, F., & Xin, Q. (2023). The Sustainable Rural Industrial Development under Entrepreneurship and Deep Learning from Digital Empowerment. *Sustainability*, *15*(9), 7062. https://doi.org/10.3390/su15097062
[15] Sultonovich, A. A. (2022). Assessment of the Influence of Factors on Choosing a Model for the Development of Agrotourism Activities. *International Journal of Business Diplomacy and Economy*, *1*(5), 198-204.
[16] Shuai, M., Liu, C., Ahmed, F., & Wang, R. (2022). Analysis on the change of tourists' leisure agricultural tourism behavior and the influence of individual intrinsic characteristics. *Asia Pacific Management Review*, *27*(2), 115-119. https://doi.org/10.1016/j.apmrv.2021.06.001
[17] Albornoz, V. M., Cancela, H., Cawley, A. M., Maturana, S., & Weintraub, A. (2023). Preface to the special issue on or and big data in agriculture. *International transactions in operational research: A journal of the International Federation of Operational Research Societies*. https://doi.org/10.1111/itor.13244
[18] Raju, L. V. V. (2020). Iot technologies in agricultural environment: a survey. *Wireless personal communications: an Internaional Journal*, *113*(4). https://doi.org/10.1007/s11277-020-07334-x
[19] Li, B. & Du, K. (2023). Analysis on the development mode of leisure agriculture industrialization based on general equilibrium model. *Land*, *12*(1), 170. https://doi.org/10.3390/land12010170
[20] Qiu, Y., He, D., Xu, Z., & Shi, X. (2023). The Role of the Forest Recreation Industry in China's National Economy: An Input-Output Analysis. *Sustainability*, *15*(12), 9690. https://doi.org/10.3390/su15129690
[21] Axhami, M., Ndou, V., Milo, V., & Scorrano, P. (2023). Creating Value via the Circular Economy: Practices in the Tourism Sector. *Administrative Sciences*, *13*(7), 166. https://doi.org/10.3390/admsci13070166
[22] Joshi, S., Sharma, M., & Kler, R. (2020). Modeling circular economy dimensions in agri-tourism clusters: Sustainable performance and future research directions. *International Journal of Mathematical, Engineering and Management Sciences*, *5*(6), 1046. https://doi.org/10.33889/ijmems.2020.5.6.080
[23] Shirodkar, N., Mishra, A., Patil, R., Shete, A., & Deshmukh, G. (2021). E-commerce application for agricultural products. *IJARIIE*, (3).
[24] https://www.kaggle.com/datasets/thammuio/all-agriculture-related-datasets-for-india

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