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Modeling Circular Economy Dimensions in Agri-Tourism Clusters: Sustainable Performance and Future Research Directions

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Abstract
The purpose of this research is to identify the key Circular Economy dimensions (CE-D) in Agri-tourism industry and to determine the performance of these dimensions using AHP-TOPSIS method. The research is carried out in two stages, firstly 11 CE-D were identified using systematic literature review. In stage two, industrial experts validate and finalize 9 CE-D which can decide the overall performance of Agri-Tourism Networks. The AHP analysis shows that Destination Attractiveness is valued highest for making CE decisions, whereas, community contributions and sustainable livelihoods valued second and third as important dimensions. Moreover, TOPSIS shows that Pithoragarh is emerged as the best cluster among all Agri-tourism clusters selected for the study, whereas, Almora stood in second position. The Agri-food clusters are becoming more complex and flexible and started putting pressure on existing supply chains to re-design the existing value chain and incorporate more sustainable practices and performances. The identification of Circular Economy Dimensions (CE-D) to evaluate the performance of clusters can serve as guiding tool for the Agri-tourism Practioners and policy makers. Besides, the study examines relevant issues related to CE in Agri-tourism clusters, major advantages and challenges of building CE driven Agri-tourism clusters. The limitation of the study is the geographical coverage and limited demography of the respondents. The research study is among very few works on evaluating Agri-tourism supply chain practices in India, with the case reference of Uttarakhand.

Keywords- Agri-tourism clusters, Sustainable transition, Circular economy, Circular economy dimensions (CE-D), MDCM techniques.

1. Introduction

Agriculture and allied sectors is the largest livelihood generator in India (FAO, 2019). With 25% of global production, India demonstrates strong potential as a global food grain producer. Whereas, tourism emerged as a livelihood generation industry and also a strategic tool for poverty alleviation with 6.7% GDP contribution (WTTC, 2019). The food culture and consumption patterns of a tourist destination play a significant role in creating a tourism product Food supply chain has the vital contribution in the tourism economy and involves various stakeholders to create an Agri-tourism ecosystem (Nematpour and Khodadadi, 2020). The term 'Agri-tourism' incorporate activities based association between agriculture and tourism (Schilling et al., 2019).

Agri-tourism network is a cross linkage between clusters to formulate an optimum structure that ensure destination attractiveness and sustainable livelihood. Agri-tourism supply chain network confirms to provide variety of tourism activities through a robust it ensures destination attractiveness, sustainable livelihood (Rachão et al., 2019). Various supply chain partners involved in the co-creation, design, and development of the product/ services (Jonkman et al., 2019). A responsive Agri-Tourism Supply Chain has proximity towards a balanced tourism demand and supply (Nematpour and Khodadadi, 2020). In context to Agri-tourism, an effective food supply chains ensures farm to fork sequence inclusive of distinguish activities including, food production, grading, sequencing, packaging and serving as Agri-tourism sites that on one hand increase the livelihood capabilities of the community involved as well ensure the social belongingness and increase the destination branding (Rachão et al., 2019). It may also include, other activities of routine Supply chain including, warehousing, transportation, sales and distribution (Jonkman et al., 2019). A typical Agri-tourism cluster generates an ecosystem to create tourism services in alignment with the farm networks. Thus, it also aims to maintain the sustainability from the livelihood purpose and also attractiveness of the place (Barbieri et al., 2019). During such alignments the ‘sustainable transitions’ of the place can be maintained by strategies related to biodiversity, water recycling and food security (Dasgupta et al., 2019; Yap & Truffer, 2019; Degarege and Lovelock, 2019). Due to distinct competitive advantage of having high level of flora-fauna with diverse climatic conditions, Indian Himalayan region has great potential to facilitate the Agri-Tourism Activities. Tourism is evolvement as one of the thrust domain for Sustainable Livelihood opportunity to the Stakeholders in the Himalayan region and has the potential to be transformed as a growth engine for the future development of the region (Badola et al., 2018; Bhalla and Bhattacharya, 2019; Xue and Kerstetter, 2019). The Agri-tourism based economies are slowly transforming from linear to the circular economy (UN, 2018). The present study has taken Uttarakhand as the case study, where tourism and agriculture collectively contribute 13.5 percent to the GDP (Joshi et al., 2020). Very few studies attempt to explore applications of circular economy principles in context to Agri-tourism supply chain to ensure the destination development and sustainability (Vargas-Sánchez, 2018). The study evaluates various Circular Economy dimensions from the perspective of designing, modeling and evaluating the performance of Agri-tourism clusters. The study suggest framework to evaluate the performance of Agri-tourism clusters. The organization of the paper is arranged as: Section two discussed the literature on Agri-Tourism Supply Chain Clusters in context to CE. Further the section discussed theoretical framework developed to evaluation the Agri-Tourism Supply Chain Networks. Section third discusses the research methodology. The research findings and discussions are explained in the last section along implications and limitations of the study.

2. Review of Literature

Globally, the Tourism industry has witnessed the paradigm shift, from linear to circular economy, it creates a ‘multiplier effect’, among suppliers and customers and also increases the opportunities for bring new business models (Scheepens et al., 2016; Schroeder et al., 2019; Senbeto and Hon 2019). With the absolute advantage of Natural Capital, Such robust business models makes Service ecosystem more use-friendly and highly responsive (Ryser and Halseth, 2010; Buckley, 2012; Schroeder et al., 2019). In developing countries like India, tourism becomes a growth enabler for economic development, although sustainable development remains the key concern (Thomas-Francois et al., 2017). Community involvement for holistic growth and development through inter-sectoral linkage through strategy to maximize the economic linkages (Yang and Wong, 2012; Sellitto et al., 2018; Comerio and Strozzi, 2019; Yap and Truffer, 2019). In the literature numbers of terms are used interchangeably to the Agri-tourism such as farm tourism, farm stay and rural tourism (Busby and Rendle, 2000; Yang and Wong, 2012; Capriello et al., 2013; Chuang, 2013). Understanding the importance of Agri-tourism activities, government at centre and state level start encouraging investments in this area. The Agri-tourism help the government to provide the economic benefit to the rural farmers and opportunity to develop the less developed areas (Dimitrovski et al., 2012; Heringa et al., 2013; Joshi et al., 2020). Previous studies indicate the needs of making tourism green and more adoptive towards allied industries including agriculture and small and medium enterprises (Strzelecka et al., 2017; Kardashina and Nikolaeva, 2018; Pan et al., 2018). The role of stakeholders and government become important to make the business ecosystem more transparent, Traceable and sustainable (Călina, 2017; Kubickova and Campbell, 2020; Sharma et al., 2020b). In the literature, very few tourism studies are focusing on resource mobilization, investment criteria for creating a circular economy in convergence with agriculture sector (Azman et al., 2012; Songkhla and Somboonsuke, 2013; Karimi et al., 2018; Kapsalis et al., 2019; Niñerola et al., 2019). A circular economy creates a system that economically uses recycle and reuse existing resources to create value, and to sustain that value (Franklin-Johnson et al., 2016; Blomsma and Brennan, 2017; Winans et al., 2017; Lüdeke-Freund et al., 2019; Sharma et al., 2020a). The purpose is to combat challenges related to food production, consumption, growth and resource depletion (Rasul, 2016; UN, 2018). CE comply the Triple Bottom Line Philosophy and creates a right balance between Economic, Ecological and Social Dimensions (Mihalic, 2016; Blomsma and Brennan, 2017; Schroeder et al., 2019). Conceptually, CE in context to developing countries, ensuring the food security and availability alongside tourism development becomes a key concern in recent times (Bengtsson et al., 2018; Kalmykova et al., 2018). It would shift the whole economy into a zero waste and fully recyclable assets and resources across the supply chains (Lieder and Rashid, 2016; Kirchherr et al., 2017). For Himalayan mountain region, farmers face irrigation water availability, with the limited or seasonal water supply (Saner et al., 2019). Developing a Convergence between tourism and Agri-Food Supply Chains could be a win-win situation to ensure inclusive growth and sustainable Livelihood activities among stakeholders (Anderson, 2018). In Uttarakhand, government is advancing its support to identify and develop various Agri-Tourism Clusters in each of the 11 hilly districts of Uttarakhand, to ensure circular economy based approaches across the Agriculture Supply Chains, by 2030 (Joshi et al., 2020). The aim is developing the cross-values chains and allied services ecosystems to support the Integrated Livelihood and Sustainable Income Generating activities to the stakeholders (Farmers, Tourist operators and Supply Chain partners) (Anderson, 2018; Corrado and Sala, 2018; Arru et al., 2019). Therefore, to ensure sustainability of CE for developing countries we should analyze the determinants that influence the conceptualization, development and implementation of 'Agri-tourism' Clusters. Table -1 presents the CE-D dimensions extracted from literature.

Table 1. CE-D dimensions

S. No.	Determinants	Citations
1	Network Design	Czernek-Marszałek(2019), De Montis et al. (2019), Joshi et al. (2020)
2	Product design and visibility	Manikas et al. (2019), Martins and Ferreira (2017), Musa et al. (2014)
3	Traceability and Transparency	Tukker (2015), Sharma and Joshi (2019)
4	Co-creation	Alkier et al. (2015), Mihalic (2016), Battistella et al. (2018)
5	Destination Attractiveness	Kapsalis et al. (2019), Niñerola et al. (2019), Songkhla and Somboonsuke (2013)
6	Adoption to Climate Change	Pan et al. (2018), Azman et al. (2012)
7	Governance	Alkier et al. (2015)
8	Forward Linkage	Brelik (2013), Stamboulis and Skayannis (2003), Vargas-Sánchez (2018)
9	Local Community Contribution and Sustainable Livelihoods	Bachok et al. (2019), Ciolac et al. (2019)
10	Food Security	Degarege and Lovelock (2019), Manikas et al. (2019), dos Reis et al. (2019)
11	Self –Efficacy	Karimi et al. (2018), Mancini et al. (2019)

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3. Research Methodology
This study has applied two-stage multiple criteria decision methods- a) AHP; (b) TOPSIS. In the first stage the CE-D for performance is selected and priorities are computed by AHP method, which further analyzed by TOPSIS to rank nine clusters of Uttarakhand region. By implementing both the methods the best cluster performing in Agri-tourism is identified. The selection of the dimensions is done through literature review further validated by the group of experts. For the dimension selection, the pool of journals is extracted from the databases like Scopus, Web of science, Emerald Insight and Google scholar. The group of 15 experts is asked to provide the pair-wise comparisons of the nine dimensions. The methodology is elaborated in the following stages.

3.1 Stage 1: CE-D Selection and Weight Computation Using AHP
Table 1 elaborates the CE-D representing performance indicators of Agri-tourism supply chain management. Fifteen experts in the fields of agriculture, tourism, and supply chain management are asked to provide pair wise comparisons for the nine dimensions. Five experts belong to the tourism area with an experience of more than seven years, five experts are from the department of the agriculture, with an experience of ten years, and three experts are associated in supply chain management area with an experience of five years. Two professors from the area of sustainability are also the part of the expert group. From the literature review, the experts using pair-wise comparisons rate the nine performance indicators.

3.1.1 AHP Methodology
Analytical Hierarchy process (AHP) is used as a tool used to help decision makers in solving complex problems (Ossadnik and Lange, 1999). This method is based on intuitive approach through which decision makers use their judgments to evaluate the alternatives (Sharma and Joshi, 2019). The two elements are compared on a relative basis on a scale of value 1, 3, 5, 7 and 9 where 1 indicates “equally important”, 3 indicates “slightly more important,” 5 denotes “strongly more important”, 7 indicates “demonstrably more important”, and 9 indicates “absolutely more important”. On the basis of responses n-by-n matrix A is established shown below:

$$A=\left[a_{ij}\right]=\begin{array}{c} \begin{array}{cccccc} C_1 & C_2 & ..... & & & C_n \end{array} \\ \left[\begin{array}{cccccc} 1 & a_{12} & . & . & . & a_{1n} \\ 1/a_{21} & 1 & . & . & . & a_{2n} \\ . & . & . & . & . & . \\ . & . & . & . & . & . \\ . & . & . & . & . & . \\ 1/a_{n1} & 1/a_{n2} & & & & 1 \end{array}\right] \end{array} \begin{array}{c} C_1 \\ C_2 \\ . \\ . \\ . \\ . \\ C_n \end{array} \tag{1}$$

where a_{ii}= 1 and a_{ji}= $1/a$; j=1,2,….n. W_1, W_2…W_n that denotes the judgments. If A is a

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consistency matrix, the relation between weights *W*, and judgments aij are simply given by $W_i W_j = a_{ij}$ (for *i*, *j*=1,2,…..*n*) (Ossadnik and Lange, 1999; Sharma and Joshi, 2019).

3.1.1.1 Eigen-Value and Eigenvector

According to Ossadnik and Lange (1999), the largest eigen-value λ_{max} can be calculated by the formula.

$$\sum_{j=1}^{n} a_{ij} \frac{W_j}{W_i} \tag{2}$$

In a consistency matrix *A*, eigenvector *X* can be measured by the following formula

$$(A - \lambda_{max}) X = 0 \tag{3}$$

3.1.1.2 Consistency Test

Ossadnik and Lange (1999) proposed utilizing consistency index (CI) and consistency ratio (CR) to inspect the consistency of the comparison matrix. CI and CR are computed as follows:

$$CI = (\lambda_{max} - n)/(n-1) \tag{4}$$

$$CR = CI/RI \tag{5}$$

Where, RI represents the average consistency index over numerous random entries of same order reciprocal matrices. If the value of CR is less than 0.1, the estimate is accepted and otherwise, a new comparison matrix is solicited the value is less than 0.1.

3.2 Stage 2: Ranking of Clusters using TOPSIS Methodology

There are main nine clusters in Uttarakhand area. These clusters are performing in Agri-tourism SCM and thus need to be evaluated to identify the best performer in the area. TOPSIS method developed by the Hwang and Yoon (1981) and is one of the most practical and useful methods for ranking the alternatives by distance measures. Moreover, the preference of more than one decision maker is aggregated in the method. The best alternative should have the shortest distance from the ideal solution and farthest from the negative-ideal solution from geo-metric mean using Euclidean distance to determine the relative proximity of an alternative from the optimal solution. The positive ideal solution is computed by the sum of all the best attainable values for each attribute while the negative ideal solution consists of all the worst values obtained for each attribute. The relative distance is compared and the performance score is calculated to finally rank the alternatives (Rohmatulloh and Winarni, 2014). The steps of the TOPSIS method (Hwang and Yoon, 1981), is as follows:

$$D = \begin{array}{c} \\ A_1 \\ A_2 \\ . \\ . \\ . \\ A_i \\ . \\ . \\ . \\ A_m \end{array} \begin{array}{c} \begin{array}{cccccc} x_1 & x_2 & \ldots & \ldots x_j & . & \ldots\ldots x_n \end{array} \\ \begin{bmatrix} x_{11} & x_{12} & .. & x_{1j} & .. & x_{1n} \\ x_{21} & x_{22} & .. & x_{2j} & .. & x_{2n} \\ . & . & .. & . & .. & . \\ . & . & .. & . & .. & . \\ . & . & .. & . & .. & . \\ x_{i1} & x_{i2} & .. & x_{ij} & .. & x_{in} \\ . & . & .. & . & .. & . \\ . & . & .. & . & .. & . \\ . & . & .. & . & .. & . \\ x_{m1} & x_{m2} & & x_{mj} & & x_{mn} \end{bmatrix} \end{array} \tag{6}$$

In the above matrix, $A_{i=}$ i^{th} alternative considered $X_{ij=}$ The value of i^{th} alternative with respect to j^{th} criterion.

3.2.1 Computing Normalized Decision Matrix using the Formula

$$r_{ij} = x_{ij} / \sqrt{\sum_{i=1}^{m} x^2{}_{ij}}, i = 1, 2, \ldots, m; and, j = 1, 2, \ldots n \tag{7}$$

3.2.2 Developing Weighted Normalized Decision

$$V = \begin{bmatrix} v_{11} & v_{12} & \ldots & v_{1j} & \ldots & x_{1n} \\ . & . & \ldots & . & \ldots & . \\ . & . & \ldots & . & \ldots & . \\ . & . & \ldots & . & \ldots & . \\ . & . & \ldots & . & \ldots & . \\ v_{i1} & v_{i2} & \ldots & v_{ij} & \ldots & v_{in} \\ . & . & . & . & \ldots & . \\ . & . & . & . & \ldots & . \\ . & . & . & . & \ldots & . \\ v_{m1} & v_{m2} & . & v_{mj} & \ldots & v_{mn} \end{bmatrix} = \begin{bmatrix} w_1 r_{11} & w_2 r_{12} & \ldots & w_j r_{ij} & \ldots & w_n r_{1n} \\ . & . & \ldots & . & \ldots & . \\ . & . & \ldots & . & \ldots & . \\ . & . & \ldots & . & \ldots & . \\ . & . & \ldots & . & \ldots & . \\ w_1 r_{i1} & w_2 r_{i2} & \ldots & w_j r_{ij} & \ldots & w_n r_{in} \\ . & . & . & . & \ldots & . \\ . & . & . & . & \ldots & . \\ . & . & . & . & \ldots & . \\ w_1 r_{m1} & w_2 r_{m2} & . & w_j r_{mj} & \ldots & w_n r_{mn} \end{bmatrix} \tag{8}$$

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This matrix is developed by multiplying each column of the matrix in step 1 with its associated weight Wj.

3.2.3 Determining the Positive Ideal Solution (PIS) & Negative Ideal Solution (NIS)

Using the following equation.

$$A^{*}=\left\{(\max_{i} V_{ij} \mid j\in J),(\min_{i} V_{ij} \mid j\in J') \mid i=1,2,........,m\right\}$$
$$=\left\{v_1^{*},v_2^{*},......v_j^{*},......v_m^{*}\right\} \tag{9}$$

$$\overline{A}=\left\{(\min_{i} V_{ij} \mid j\in J),(\max_{i} V_{ij} \mid j\in J') \mid i=1,2,........,m\right\}$$
$$=\left\{\overline{v}_1,\overline{v}_2,......\overline{v}_j,......\overline{v}_m\right\} \tag{10}$$

3.2.4 Calculating the Separation Measure by using Euclidean Distance

$$S_{i}*=\sqrt{\sum_{j=1}^{n}(v_{ij}-v_{j}*)^{2}}\, where, i=1,2,.....,m \tag{11}$$

$$S_{i}*=\sqrt{\sum_{j=1}^{n}(v_{ij}-v_{j}*)^{2}}\, i=1,2,.....,m \tag{12}$$

3.2.5 Calculating the Relative Closeness (RC) of an Alternative to the Ideal Solution using the Following Equation

$$C_{i^*}=S_{\bar{i}}\Big/(S_{\bar{i}}+S_{i^*});\quad 0<C_{i^*}<1;\quad i=1,2,.....m \tag{13}$$

3.2.6 Determining the Rank of Alternatives

The higher RC value indicates that the alternative is the best solution or the most preferred.

4. Model Application

4.1 AHP Application

It includes the performance measurement of Agri-Tourism SCM on nine dimensions of Network Design (D1), Product design and visibility (D2), Traceability and Transparency (D3), Co-creation (D4), Destination Attractiveness (D5), Adoption of Climate Change (D6), Governance (D7), Market Linkage (D8) Local Community Contribution and Sustainable Livelihoods (D9), Food Security (D10) and Self- Efficacy (D11). The two dimensions Governance (D7) and Self-Efficacy (D11) are dropped by the expert judgment. Finally, the nine dimensions are considered for pair-wise comparison matrix. The pair-wise comparison matrix of decision elements made by the decision maker and relative scores is calculated followed by the calculation of eigenvalue and

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eigenvector using the equation 1, 2, and 3 discussed in section 3. Aggregation of the relative scores provided by decision-makers is done by the geometric mean method. This classifies the goal, criteria, three major levels, as depicted in Figure 1. The first level of the hierarchy is the overall goal. Level 2 denotes the criteria for selecting the best cluster. At Level 3 there are nine clusters placed C1, C2, C3, C4, C5, C6, C7, C8, and C9 respectively.

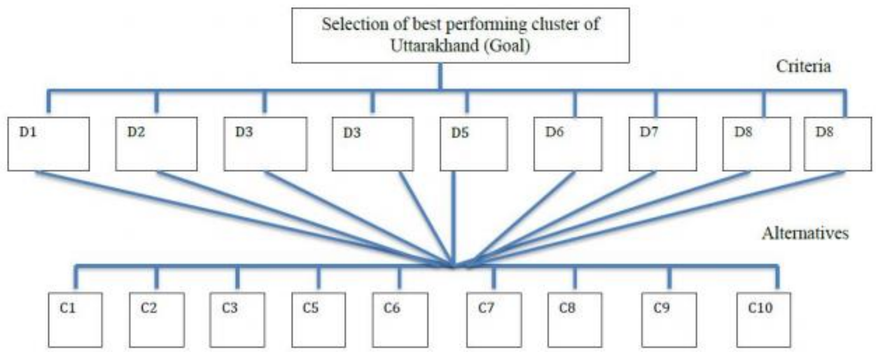

Figure 1. Hierarchical structure for AHP

On the basis of the expert's responses the pair-wise comparison matrix is developed to identify the weights of the performance indicators (Table 2).

Table 2. Pair-wise comparison matrix of nine dimensions

	D1	D2	D3	D4	D5	D6	D7	D8	D9
D1	1.000	0.200	0.333	1.000	3.000	1.000	3.000	7.000	9.000
D2	5.000	1.000	3.000	1.000	1.000	1.000	1.000	3.000	5.000
D3	3.003	0.333	1.000	3.000	1.000	0.200	3.000	1.000	3.000
D4	1.000	1.000	0.333	1.000	3.000	1.000	3.000	3.000	3.000
D5	0.333	1.000	1.000	0.333	1.000	3.000	1.000	1.000	3.000
D6	1.000	1.000	5.000	1.000	0.333	1.000	3.000	1.000	1.000
D7	0.333	1.000	0.333	0.333	1.000	0.333	1.000	3.000	3.000
D8	0.143	0.333	1.000	0.333	1.000	1.000	0.333	1.000	7.000
D9	0.111	0.200	0.333	0.333	1.000	1.000	0.333	0.143	1.000

Using the equations 2 and 3 discussed in section 3, the priorities are calculated for the dimensions. The dimensions D1, D2, D3, D4, D5, D6, D7, D8, D9 have 0.156, 0.165, 0.131, 0.130, 0.101, 0.131, 0.075, 0.072, 0.039 weights respectively exhibited in Table 4.

Table 3. Priorities for Dimensions

D9	Local Community Contribution and Sustainable Livelihoods	0.156
D5	Destination Attractiveness	0.165
D1	Network Design	0.131
D4	Co-creation	0.130
D6	Adoption to Climate change	0.101
D3	Traceability and Transparency	0.131
D2	Product Design and Visibility	0.075
D8	Forward Linkage	0.072

D10	Food Security	0.039

4.2 TOPSIS Application

Nine clusters of Uttarakhand are taken as alternatives for performance evaluation. The responses for the nine clusters are taken from Uttarakhand region for each dimension. A decision matrix is developed on the aggregation of 138 responses for each dimension. In this stage, the respondents were asked to provide values for the nine clusters on the basis of the nine dimensions on a scale of 1-9. The respondents are supposed to evaluate the clusters compared to each other in context to each dimension. The scale 1 denotes '*very less related' and* scale 9 denotes *'very strongly related'* which were expressed to the respondents before filling up the questionnaire. The decision matrix is established from Eq. (6). The decision matrix is further used to calculate the best positive and negative ideal values (Si+ and Si-), Euclidean value and finally performance score. The clusters are ranked on the basis of performance score from Eq. (10).

Table 4. Decision matrix for TOPSIS

Ideal	**Max**	**max**	**max**	**Max**	**max**	**max**	**max**	**max**	**max**
priorities	0.156	0.165	0.131	0.130	0.101	0.131	0.075	0.072	0.039
	D1	D2	D3	D4	D5	D6	D7	D8	D9
C1	7.160	7.860	7.070	2.010	7.000	7.800	8.010	6.510	6.940
C2	5.120	7.860	5.010	5.310	6.930	4.960	5.080	5.030	5.030
C3	5.120	5.750	5.420	5.310	4.250	6.000	4.000	6.000	5.000
C4	6.970	4.100	5.010	4.890	4.960	6.930	6.150	5.020	4.960
C5	3.850	4.060	2.050	4.910	4.000	3.170	2.040	5.030	5.030
C6	3.150	3.270	3.220	5.970	5.010	3.140	5.890	5.000	6.900
C7	7.160	7.860	7.070	5.310	6.930	5.310	5.080	6.930	5.030
C8	4.190	5.310	3.140	3.040	3.920	3.180	3.940	1.780	3.100
C9	4.890	5.180	4.980	4.840	3.270	3.960	5.480	3.200	2.150

The weighted normalized decision matrix is computed from Eq. (7) & Eq. (8) showing the results of positive ideal and negative ideal solutions (Table 5).

Table 5. Weighted normalized decision matrix

	D1	**D2**	**D3**	**D4**	**D5**	**D6**	**D7**	**D8**	**D9**
C1	0.0680	0.0728	0.0612	0.0183	0.0443	0.0655	0.0377	0.0302	0.0176
C2	0.0486	0.0728	0.0434	0.0482	0.0438	0.0417	0.0239	0.0233	0.0128
C3	0.0486	0.0533	0.0469	0.0482	0.0269	0.0504	0.0188	0.0278	0.0127
C4	0.0662	0.0380	0.0434	0.0444	0.0314	0.0582	0.0289	0.0233	0.0126
C5	0.0366	0.0376	0.0178	0.0446	0.0253	0.0266	0.0096	0.0233	0.0128
C6	0.0299	0.0303	0.0279	0.0542	0.0317	0.0264	0.0277	0.0232	0.0175
C7	0.0680	0.0728	0.0612	0.0482	0.0438	0.0446	0.0239	0.0322	0.0128
C8	0.0398	0.0492	0.0272	0.0276	0.0248	0.0267	0.0185	0.0083	0.0079
C9	0.0464	0.0480	0.0431	0.0439	0.0207	0.0333	0.0258	0.0149	0.0055

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The Positive ideal solution (PIS) & Negative ideal solution (NIS) are calculated using the Eq. (9) & Eq. (10) (Table 6).

Table 6. Positive ideal solution (PIS) & negative ideal solution (NIS)

ideal best	0.068	0.073	0.061	0.054	0.044	0.065	0.038	0.032	0.018
ideal worst	0.030	0.030	0.018	0.018	0.021	0.026	0.010	0.008	0.005

The separation measure by using Euclidean distance is calculated by Eq. (11), Eq. (12). Relative closeness (RC) of an alternative to the ideal solution is calculated by Eq. (13) and ranking of the alternatives are done on the basis of this score.

Table 7. Relative closeness (RC) of an alternative to the ideal solution& ranking of clusters

Si+	Si-
0.0360	0.0930
0.0399	0.0705
0.0439	0.0614
0.0451	0.0670
0.0835	0.0331
0.0790	0.0471
0.0262	0.0880
0.0783	0.0271
0.0608	0.0474

Table 8. Relative closeness (RC) of an alternative to the ideal solution& ranking of clusters

Almora (C1)	0.7209	2
Tehri (C2)	0.6387	3
Bageshwar (C3)	0.5829	5
Dehradun (C4)	0.5980	4
Pauri (C5)	0.2837	8
Chamoli (C6)	0.3733	7
Pithoragarh (C7)	0.7705	1
Rudraprayag (C8)	0.2569	9
Uttarkashi (C9)	0.4378	6

5. Results and Discussion

The AHP-TOPSIS results exhibited in Table 3 and Table 8 demonstrates that Destination Attractiveness (D5) (0.165) has attained the highest priority. This shows that experts firmly believe that destination attractiveness is the key driver for developing Agri-tourism supply chains in Uttarakhand. Local Community Contribution and Sustainable Livelihoods (0.156) has the second highest dimension (0.165) which supports that Agri-tourism supply chains can be developed with the help of local community contribution. Network design (D1) and Traceability and Transparency (D3) have the same weights (.131) which shows that these two dimensions are equally important for Agri-tourism supply chains in Uttarakhand. The other dimension's Co-creation (D4), Adoption to Climate change (D6), Product Design and Visibility (D2), Forward Linkage (D8), Food Security (D9) have 0.130, 0.101, 0.075, 0.072, and 0.039 respectively. Therefore, the results from AHP corroborate that District attractiveness, Local community contribution and sustainable livelihoods, Network design, Traceability and Transparency are the essential dimensions for the clusters to perform and compete among them. On the contrary the dimension's Co-creation, Adoption to Climate change, Product Design and Visibility, Forward Linkage, Food Security are less important for performance evaluation. The results from table 7 displays that *Pithoragarh* (C7) is the key performer among all the clusters and has the highest value (0.7705) followed by Almora (C1) and Tehri with 0.7209 and 0.6387 values. This shows that these two clusters have high attractiveness as well as community contribution, which has led both these cluster to perform exceptionally well as compared to the other clusters.

6. Conclusion

The Agri tourism not only bring urban people close to the lives of farmers but also has economic value. On one hand it creates life long memories to the tourists with a pollution-free, calm and peaceful stays and on other hand it supports the income of farmers. The Agri tourism has twofold objective of recreation and education. In a country like India and state like Uttarakhand has a high potential in this regard. The Uttrakhand state is divided into two divisions such as Gharwal and Kumaon. Around 11 districts of the state has been identified by the government as potential destinations for the development of Agri tourism. The government is committed to develop the ecosystem that ensures the recreation of tourists and sustainable income of the farmers through CE concept. Hence, this study is conceptualized to determine the influence of Agri-tourism clusters. This has been done in a two-way approach. First with the application of AHP, the prioritization of identified parameters for Agri tourism has been utilized. After pair wise comparison weights of the identified constructs were calculated and it is found that destination attractiveness is one of top reason to be selected by tourist for Agri tourism activities and compete among themselves. Further the analysis indicates that clusters also fairly compete on the sustainable livelihood, the network and roads to reach to the destination and traceability and transparency of agricultural activities. On the other Food linkage, linkage and product visibility are not found to be important in the consideration of tourist. This may help the local administration and state government to look into the specific issues related to Agri tourism. The initiative to improve upon their cluster can include the stakeholders from supply chain partners, farmers and NGOs.It is important to compare the geographies for Agri-tourism development and have competitive spirit. With this view the selected nine geographies were accessed on the prioritized dimensions. A total of 15 experts have been consulted to collect data for TOPSIS evaluation. These experts are the agriculture development officers for the Uttarakhand state and know the Agri-tourism activities from last several years. After conducting the analysis Pithoragarh district has been found high (0.7705) on attracting the tourist for Agri tourism. This was due to the few practices that they had adopted in their cluster those are different than other clusters. The Pithoragarh as a district had developed many social dimensions of Agri-tourism such as 'goat farming', home stays and offering the local delicacies to tourists. Out of around 1700 villages in the district around 1550 village farmers and hosts are trained towards environment, conservation, economic and social benefits of Agri tourism. The traditional agricultural activities are developed in the region due to its historical rulers of Chand Kings and the region is the starting place toward shrines of Mansarovar and Kailash and the last district towards the neighboring country Nepal. Additionally, tourist can buy the Nepal made product, if required. The district is well connected and have decent infrastructure to encourage the Agri tourism. Other districts are bigger in size as comparison to Pithoragarh, and therefore it requires more investment for agricultural development. Other districts have less literacy rate as comparison to Pithoragarh and it may be one of reason for the district to learn in all the nine dimensions. The findings of the study can help policy makers and Supply chain partners to strategically enhance the economic spin-off from tourism to Agri-tourism. This will also encourage next generation farmers, to become the part of mainstream Circular Economy (CE) for sustainable development.

7. Limitations and Scope for Future Research

The study offers a framework for defining the important dimensions to compete for Agri tourism in a hilly geography. The present study covered a particular state of Uttarakhand and its nine districts those are actively involved and supported by state government. The study has limitations in terms of geography and demography. In the selected demography women were more active in the Agri tourism activities. The future studies may include the regions with a mix of plain and hilly areas for the comparison and different dimensions. The dimensions for other selected geographies may feature some additional or new areas of competitiveness for Agri-tourism. The upcoming studies can include the agriculture ministers and the civil service employees working for agriculture sector for a better pair-wise comparison. The future studies also can include the adjacent activities those encourage or aid the Agri-tourism. The role of different stakeholders can be assessed in the development of an ecosystem of Agri-tourism.

Conflict of Interest

The authors confirm that there is no conflict of interest to declare for this publication.

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