

Research Article

Understanding the network dynamics of sustainable community-based ecotourism in Lorestan, Iran

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ABSTRACT- Since many key actors intervene in providing services and meeting the needs of ecotourism and local communities, it is necessary to identify their position, cooperation and communication in order to strengthen interests, plan and empower organizational interactions and provide the needs and services of ecotourists and local people. Based on this, the purpose of this research was to analyze the network of sustainable community-based ecotourism (SCBET) actors. In this regard, from key informants in 20 responsible organizations in SCBET in Lorestan province, Iran, through purposeful snowball sampling, the necessary information was collected through a network analysis questionnaire and through social network analysis (SNA), UCINET and NetDraw software were analyzed. The results were extracted six dimensions of sustainability (management, environmental, economic, social, political and cultural) based on micro-level indicators (in-degree centrality, out-degree centrality, eigenvector centrality, closeness centrality (proximity) and betweenness centrality) and the diagrams of the networks of the mentioned dimensions of 20 key actors were drawn. The results obtained in the form of SNA can help tourism policy makers and decision makers to identify the challenges facing ecotourism and to analyze the various relationships between actors and stakeholders (private sectors, government and local communities).

INTRODUCTION

Given its multidimensional nature, the tourism industry not only caters to the needs of tourists but also engenders significant transformations within the host society system, impacting aspects such as cultural practices, economic structures, and environmental sustainability (Ma et al., 2024; Yang et al., 2024). Therefore, the authorities attempt to provide the opportunity to benefit from the positive aspects of this industry by preparing and showing the real value of tourism attractions in high potential areas (Rosentraub et al., 2016), because the development of the tourism industry, if it is aligned with social goals, can lead to the welfare of the whole community (Meliou & Maroudas, 2010). The advantages of tourism industry development include developing new businesses, increasing revenue, marketing new products

and services, creating new job opportunities, improving infrastructure, and encouraging diversity. Furthermore, it helps to link different sectors of the national economy and increase the society's welfare level (UNWTO, 2017). In recent years, many researchers have emphasized on creating sustainable tourism indicators with the aim of actualizing this concept, and community participation is regarded by the most researchers as one of the most essential tools for the sustainable tourism development at the national and local levels (Johnson & Smith, 2024). As community participation based on various methods leads to sustainable tourism and host communities play a crucial role in the execution of programs. Thus, their participation in the sustainable tourism planning process is a must (García-Herrero & Rodríguez-Sarrell, 2023).

On the other hand, the rapid and considerable growth of the tourism industry has led to concerns about its impacts and consequences on the environment, societies

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and cultures. The ecotourism philosophy, which was proposed in 1980, has been a response to the human concerns and worries, that means ecotourism emerged as a solution to growing worries about the negative impacts of traditional tourism on the environment and local communities and today, ecotourism has turned into one of the ever-growing sectors in the tourism industry (Buckley, 2012; Hafezi et al., 2023). Community-based ecotourism (CBE) can be defined as a form of sustainable tourism that seeks to empower local communities by integrating their cultural, social, and economic aspirations into tourism development. CBE emphasizes local control and benefits, ensuring that tourism activities are managed by the community and that a significant portion of the revenue generated remains within the local area. This approach not only promotes environmental preservation but also encourages active participation from community members in decision-making processes, capacity building, and fostering an appreciation for biodiversity and cultural heritage. It recognizes the importance of local knowledge and practices in achieving sustainability in tourism (Sebele, 2010).

The main focus of community-based ecotourism (CBET) is on the participation of local communities in the development and planning processes of sustainable tourism. Also, this type of tourism aims to attain the goals of sustainable development of the community and it can be considered as an instrument to implement the development of sustainable community-based ecotourism (SCBET). Successful CBET projects often demonstrate strong community engagement, facilitating a sense of ownership among local populations, which is critical for the long-term sustainability of tourism initiatives. Research indicates that when local communities are actively involved in the planning and implementation of ecotourism efforts, there tends to be a greater alignment of tourism activities with preservation goals, promoting not only environmental sustainability but also social equity and cultural integrity (ibid).

In this regard, SCBET maximizes comprehensive local benefits and emphasizes on capacity building and empowerment of local people as instruments to achieve community development. Being formed on a participatory approach, this type of tourism focuses on the intervention of the community or their control over the tourism planning process, in all stages of beginning work, management, implementation, evaluation and sharing of benefits, it brings many advantages to the society, facilitates the active participation of the community in tourism planning, enhances mutual relations between tourists and the community, and conserves the cultural and natural heritage of the region (Tolkach & King, 2015; Siphannara, 2019).

The goals of SCBET emphasis on political, economic, socio-cultural and conservation aspects. From a political point of view, society should be able to make decisions and have control over the speed and direction of development. From an economic point of view, the economic benefits from this type of tourism and the job opportunities formed should be fairly distributed among the society. From a socio-cultural point of view, the SCBET development should result into the preservation of cultural values and traditions, enhance cohesion and

cooperation in the society, and lead to an increase in self-confidence and pride of the community. Natural resources protection is also one of the main goals of SCBET development (Kontogeorgopoulos, 2005).

While there is ample literature addressing sustainable community-based ecotourism (SCBET) globally, limited research specifically focuses on the social network dynamics of SCBET in Iran, and particularly in Lorestan Province. This gap suggests an under-exploration of local actors, practices, and issues that significantly affect the sustainability of ecotourism initiatives in the region. Despite the growing global interest in SCBET, there is a significant lack of localized studies that explore the dynamics between key actors within this context in Lorestan Province, Iran. Existing research fails to address the specific socio-economic and environmental challenges that local communities face in maximizing the benefits of ecotourism. Furthermore, the absence of comprehensive analyses using social network analysis (SNA) limits our understanding of the relationships, cooperation, and communication among stakeholders, which are crucial for effective planning and management.

Current literature often emphasizes broader national or international perspectives on ecotourism, neglecting the role of local community stakeholders. This is particularly pertinent in Lorestan, where specific cultural, economic, and environmental factors influence community engagement and benefits derived from ecotourism.

While the application of SNA has been noted in other regions, there seems to be a lack of empirical studies utilizing SNA to evaluate the interactions and relations among SCBET actors in Lorestan Province. This creates a significant gap in understanding how these networks can influence the success and sustainability of ecotourism initiatives.

The literature has not sufficiently addressed the unique environmental and socio-economic challenges faced by Lorestan Province. Factors such as its mountainous topography, unique biodiversity, and cultural heritage offer distinctive characteristics that contribute to the ecotourism potential, necessitating targeted research to develop appropriate sustainable practices.

As many key actors are engaged in the implementation of SCBET and any goal setting and determining strategies is done with their cooperation; therefore, identifying their situation, cooperation and communication is necessary for their interests, planning and empowering organizational interactions and meeting the needs and services of tourists and local people. Accordingly, SNA via tourism social studies can help tourism managers and planners to detect the challenges facing tourism and various relations between activators and tourism stakeholders (private and state sectors and local communities) to promote the necessary coordination between these institutions and other activators in order to determine policies and strategies. The main idea in the issue of networks is that each one in a network has a one-to-one relationship with another one. In SNA, depending on the purpose of the study, many indicators can be used which can be divided into three levels: "macro", "medium" and "micro". The most

important micro metrics of SNA include: “in-degree centrality”, “out-degree centrality”, “eigenvec centrality”, “closeness centrality” and “betweenness centrality” (Georgiou, 2023).

In this study, “out-degree centrality” is important as activators with higher out-degree have more linkage and cooperation in the field of eco-tourism management and planning and are more active than others. In fact, these activators could make their opinions known by creating communication and cooperation with other activators.

The control and power of activators is shown by “in-degree centrality”, which is important in this study as activators with higher in-degree centrality is known as informed and expert activators and other activators try to establish communication and cooperation with these activators, and they have a high ability for network interactions.

In this study, “closeness centrality” of tourism measures the distance of each activator with other activators in this field in the network. So, the closer an activator is to others, that activator is selected and receives information faster than others because there are fewer activators among them.

Activators with higher “betweenness centrality” are those who are the mediators of many activators to establish cooperation and communication in this field, and many activators rely on them for establishing communication and cooperation.

Finally, a high “eigenvec centrality” in this study shows an activator that has a more central aspect than the main pattern of distances between all activators and is a stronger guide and decision maker. This study was aimed to analyze the network of SCBET actors. The novelty of this study was focusing on SCBET using SNA, which was carried out in a geographical location with high CBET potential (Lorestan province in Iran). The study focusing on SCBE and SNA is important because it provides valuable insights into the complex relationships and interactions between key actors in the ecotourism industry. By analyzing the network of SCBE actors, we are able to identify the strengths and weaknesses of the current network, as well as potential opportunities for collaboration and improvement. This information is crucial for tourism policymakers and decision-makers, as it helps them understand the dynamics of the industry and make informed decisions to enhance sustainability, community involvement, and overall success of ecotourism initiatives.

The use of SNA allows for a more nuanced understanding of the connections between actors, leading to more effective strategies for promoting sustainable practices and enhancing the overall impact of ecotourism on both the environment and local communities.

MATERIALS AND METHODS

This research is qualitative in terms of research paradigm, applied in terms of research type, non-experimental in terms of research design, and descriptive in terms of research method which was done using SNA technique. In order to identify the actors engaged in the CBET of Lorestan province in the west of Iran (Fig. 1), two instruments of semi-structured interview and

secondary data. The sampling method of domestic experts in ecotourism in Lorestan was targeted and snowball. The snowball sampling technique was employed to expand the sample by asking initial key informants to recommend other individuals who are also knowledgeable and active in SCBET. This method is particularly useful in research contexts where the population of interest may be difficult to identify or access through traditional sampling methods. By using snowball sampling, researchers can tap into the existing networks and connections of the initial key informants, thereby ensuring a more comprehensive and relevant sample for the study (Guest et al., 2006). It is worth to mention that the research population at this stage of the research was some staffs and employees of the General Department of Cultural Heritage, Handicrafts and Tourism of Lorestan and Tehran Provinces, as a number of key informants with high participation in the CBET activities was selected as a research sample. To identify the actors, they were asked questions such as: What is your idea about what institutions are involved in SCBET in Lorestan province? What are the most known stakeholder institutions in this field? Thus, according to the findings of the informants participating in this process, SCBET activators were gradually identified in Lorestan province. Based on the opinions of the activators and key stakeholders in SCBET, the activities of these institutions were divided into three groups: “supervisory”, “supportive” and “leading”. The triple division was based on the role of each actor in organization and administration. Some cases overlapped in two categories, but one prevailed and was placed in the dominant category.

The next step of the research was designed and implemented using the survey technique. So, among the staffs and employees of organizations related to ecotourism (Table 1), some of key informants were selected as research samples based on their knowledge about SCBET programs through purposive sampling in the snowball method. In the next step, information about the cooperation status of organizations and institutions was obtained in the field of SCBET standards using the SNA questionnaire and completing it by experts and related staffs. It is worth to mention that before performing the survey, the validity of the questionnaire was verified by a panel of subject experts. In the relevant questionnaire, the list of key institutions (activators) was included, and the respondents were asked to rate the level of cooperation of their institution with other institutions in the mentioned fields in a spectrum (not at all = 0, very little = 1, little = 2, to some extent = 3, much = 4 and very much = 5). After collecting the data obtained via the given questionnaire, the collected data was analyzed using the SNA method and UCINET software. For this purpose, micro-level indicators (in-degree centrality, out-degree centrality, eigenvec centrality, closeness centrality and betweenness centrality) were used. Finally, NetDraw software was employed to draw network diagrams. In these diagrams, the size of the nodes shows the in-degree and out-degree centrality of activators, and the color of the nodes displays the classification of tasks into three groups: “supervisory (yellow), “supportive (green)” and “conductor (blue)”.

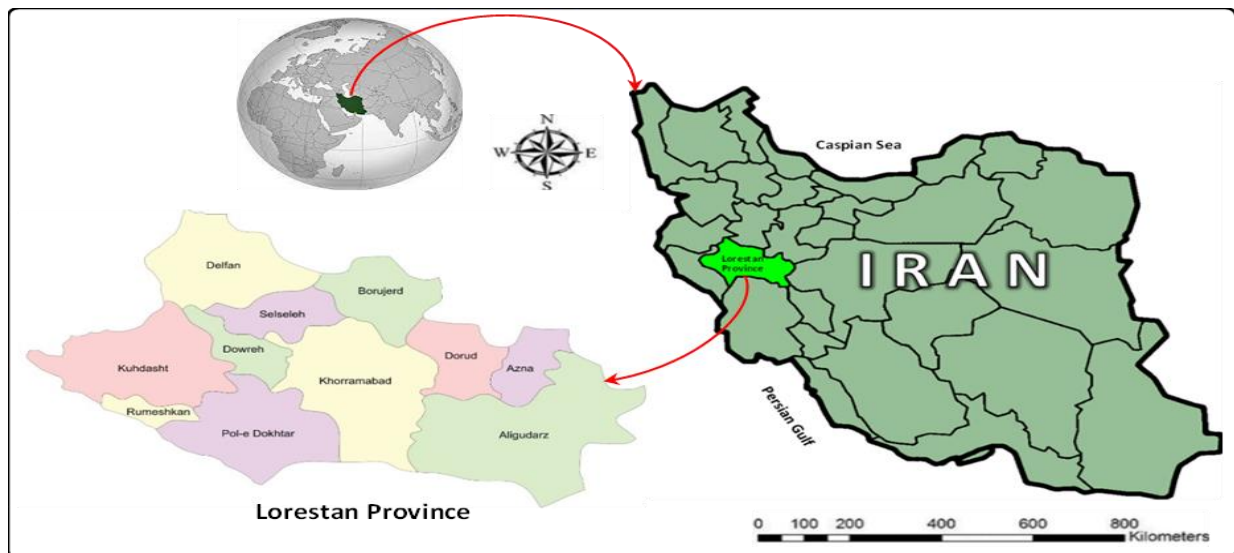


Fig. 1. The site of Lorestan province in Iran (Hafezi et al., 2023).

Table 1. List of selected stakeholders

Row	Stakeholder	Category
1	General Directorate of Cultural Heritage, Handicrafts and Tourism	Supervisory
2	General Department of Natural Resources and Watershed Management	
3	Department of Environmental Conservation	
4	Law Enforcement Police	
5	Municipality	
6	Village Affairs Department	
7	University of Medical Sciences and Health Services	Supportive
8	Red Crescent Society	
9	Broadcasting	
10	Tourism Bank	
11	General Directorate of Sports and Youth	
12	Association of Hoteliers	
13	Travel and Tourism Service Offices	
14	Ecotourism Residences	
15	Directorate General of Communications and Information Technology	
16	Active NGOs in CBET	
17	Local Government (Crisis Management sector)	Conductor
18	Agriculture Organization (Extension Coordination Department)	
19	Road and Transport Administration	
20	General Department of Culture and Islamic Guidance	

RESULTS

Degree centrality of the cooperation network of activators in the field of sustainable management of CBET

In this section of the research, based on the data matrix, in-degree centrality, out-degree centrality, closeness centrality, eigenvector centrality and betweenness centrality were calculated using UCINET software. Table 2, Fig. 2 and Fig. 3 show the general results of information exchange and cooperation among active activators in the field of sustainable management of CBET based on the degree centrality indicators in NetDraw software. According to the values displayed in Table 2, Broadcasting has established more cooperation with

other activators in the field of CBET management with 79 and 61 in-degree centrality and out centrality, respectively. Also, the General Directorate of Cultural Heritage, Handicrafts and Tourism has the highest closeness centrality and eigenvector centrality, with degrees of 81 and 0.302, respectively. In the current study, the communication path of most activators in the field of CBET management and planning is through Travel and Tourism Service Offices with a score of 4.943, which has the highest betweenness.

- Confirmability: Different methods including detailed examination of interviews, documents, and recording of interviews about selected documents with experts were used to verify the findings.

Table 2. Degree centrality in the community-based ecotourism (CBET) sustainable management network

Row	Stakeholder	Out-degree centrality		In-degree centrality		Closeness Centrality		Eigenvector Centrality		Betweenness Centrality	
		Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
1	Broadcasting	79	1	61	1	88	9	0.298	2	2.579	9
2	General Directorate of Cultural Heritage, Handicrafts and Tourism	68	2	59	2	81	1	0.302	1	4.684	2
3	Local Government (Crisis Management)	67	3	54	3	83	2	0.265	3	4.484	3
4	Municipality	54	4	47	9	89	10	0.223	6	3.257	7
5	Law Enforcement Police	52	5	42	15	95	15	0.223	7	2.526	10
6	Road Transport Administration	52	6	41	17	97	16	0.219	11	1.632	14
7	Village Affairs Department	51	7	46	10	85	4	0.215	13	4.358	4
8	Association of Hoteliers	51	8	42	14	84	3	0.221	8	3.614	6
9	Red Crescent Society	50	9	43	13	89	11	0.210	14	0.590	17
10	General Department of Natural Resources and Watershed Management	48	10	53	4	88	8	0.235	4	0.680	16
11	Directorate General of ICT	48	11	44	11	93	14	0.220	10	0.974	15
12	Ecotourism Residences	45	12	49	7	87	6	0.221	9	2.529	11
13	Department of Environmental Conservation	44	13	53	5	89	12	0.224	5	3.674	5
14	Travel and Tourism Service Offices	43	14	51	6	87	7	0.218	12	4.943	1
15	University of Medical Sciences and Health Services	41	15	48	8	99	18	0.198	17	0.000	19
16	Tourism Bank	39	16	42	16	98	17	0.199	16	0.500	17
17	Jihad-e Agriculture Organization (Extension Coordination Department)	38	17	44	12	100	19	0.203	15	1.737	13
18	Active NGOs in CBET	37	18	41	18	86	5	0.193	18	3.105	8
19	General Department of Culture and Islamic Guidance	32	19	40	19	92	13	0.174	19	1.789	12
20	General Directorate of Sports and Youth	8	20	40	20	102	20	0.157	20	0.000	20

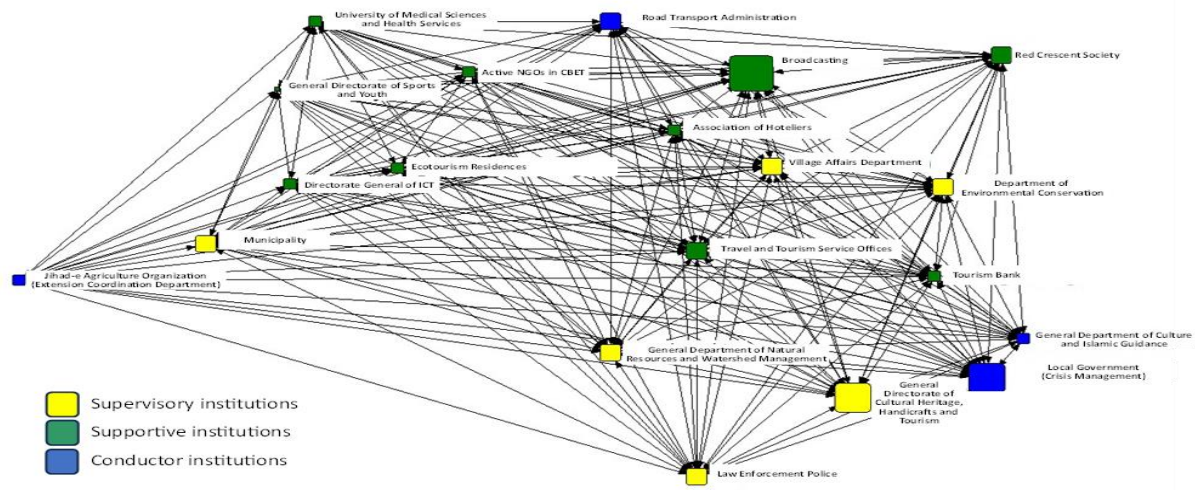


Fig. 2. Out-degree centrality of the cooperation network of stakeholders in the field of community-based ecotourism (CBET) sustainable management.

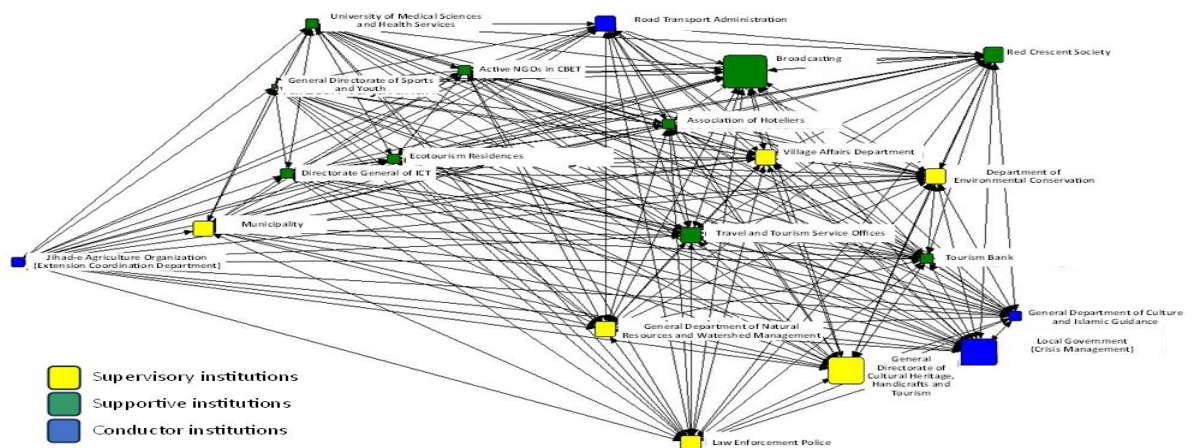


Fig. 3. In-degree centrality of the cooperation network of stakeholders in the field of community-based ecotourism (CBET) sustainable management.

The degree centrality of the cooperation network of activators in the field of CBET environmental sustainability

Based on the values presented in Table 3 and Fig. 4, it is shown that Municipality with out-degree centrality 68 has established more cooperation with other activators. By comparing the input and output data obtained from the two diagrams of the cooperation network of activators in the field of SCBET environmental issues, it can be stated that the status of the activators in this field is different. In Fig. 5, which indicates the in-degree centrality of the cooperation network of activators in the field of CBET environmental issues, the Department of Environmental Conservation receives the highest in-degree with a value of 61, which is identified as the most reliable institution in this field. The General Department of Natural Resources and Watershed Management is the closest to the center with closeness centrality of 61, and the communication path of many activators passes via Ecotourism Residences, which has the most betweenness (4.995). General Department of Natural Resources and Watershed Management and Municipality have also achieved the highest rank with eigenvector value of 0.278.

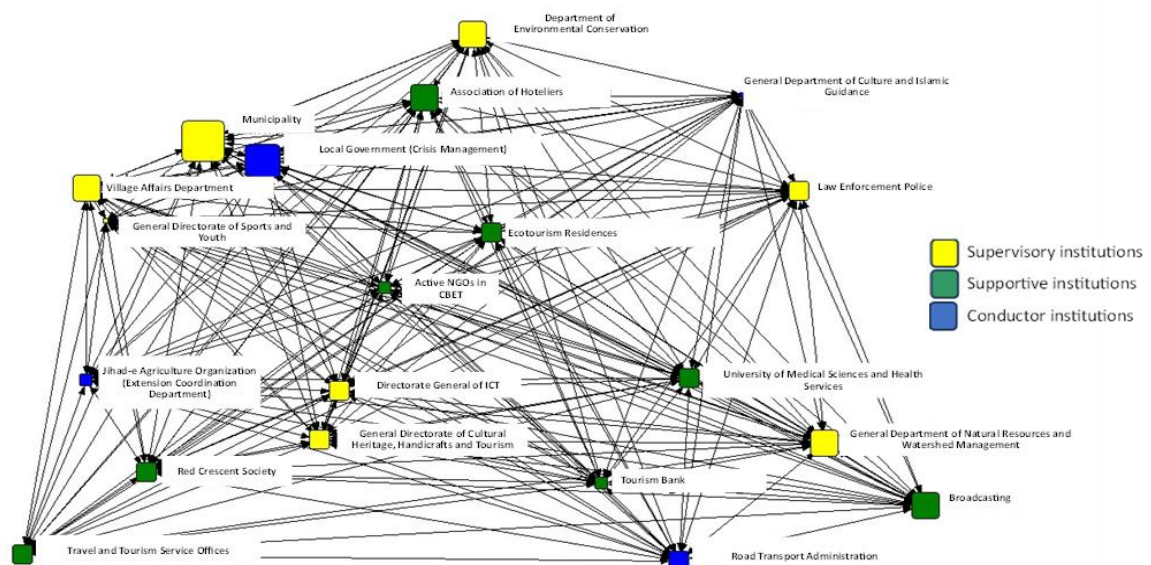
The degree centrality of the cooperation network of activators in the field of CBET economic sustainability

The results related to the cooperation network of activators in the field of SCBET economic issues indicate the high out-degree centrality of Village Affairs Department of 72. As shown in Table 4, the General Directorate of Cultural Heritage, Handicrafts and Tourism has the highest score in economic cooperation with the in-degree centrality of 57, but the out-degree of cooperation in this institution is 54, which demonstrates the lower effect of this institution in receiving economic cooperation compared to other actors.

Also, Local Government (Crisis Management) has the most closeness to the center with its closeness centrality of 73, and the communication path of many activators passes through this institution, which also has the most betweenness (4.551). Ecotourism Residences and Tourism Bank have the highest rank with eigenvector value of 0.298. Fig. 6 and Fig. 7 show the out-degree centrality and the in-degree centrality in the field of CBET economic sustainability, respectively.

Table 3. Degree centrality in CBET environmental sustainability network

Row	Stakeholder	Out-degree centrality		In-degree centrality		Closeness Centrality		Eigenvec Centrality		Betweenness Centrality	
		Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
1	Municipality	68	1	55	4	69	5	0.278	1	1.194	15
2	Local Government (Crisis Management)	60	2	53	5	71	6	0.264	4	2.896	11
3	Department of Environmental Conservation	59	3	61	1	68	4	0.267	3	4.101	7
4	Broadcasting	57	4	60	2	67	3	0.255	5	4.373	4
5	General Department of Natural Resources and Watershed Management	56	5	51	7	61	1	0.278	2	4.195	5
6	Village Affairs Department	51	6	48	9	64	2	0.246	6	4.510	3
7	Association of Hoteliers	51	7	40	14	84	11	0.231	9	2.316	12
8	Directorate General of ICT	49	8	39	15	96	17	0.212	11	1.176	16
9	Road Transport Administration	47	9	43	13	93	15	0.213	10	0.103	17
10	General Directorate of Cultural Heritage, Handicrafts and Tourism	46	10	51	6	90	13	0.246	7	4.663	2
11	Red Crescent Society	46	11	45	11	91	14	0.209	12	3.629	8
12	Law Enforcement Police	46	12	32	19	81	10	0.196	16	4.198	6
13	University of Medical Sciences and Health Services	44	13	57	3	72	7	0.242	8	3.293	9
14	Ecotourism Residences	42	14	46	10	95	16	0.207	13	4.995	1
15	Travel and Tourism Service Offices	42	15	45	12	79	9	0.201	15	0.650	19
16	Tourism Bank	38	16	33	18	98	18	0.176	18	2.888	10
17	Jihad-e Agriculture Organization (Extension Coordination Department)	34	17	48	9	86	12	0.204	14	1.083	18
18	Active NGOs in CBET	34	18	39	16	101	19	0.184	17	1.852	14
19	General Department of Culture and Islamic Guidance	31	19	34	17	78	8	0.159	19	0.000	20
20	General Directorate of Sports and Youth	10	20	32	20	106	20	0.140	20	2.091	13

**Fig. 4.** Out-degree centrality of the cooperation network of stakeholders in the field of community-based ecotourism (CBET) environmental sustainability.

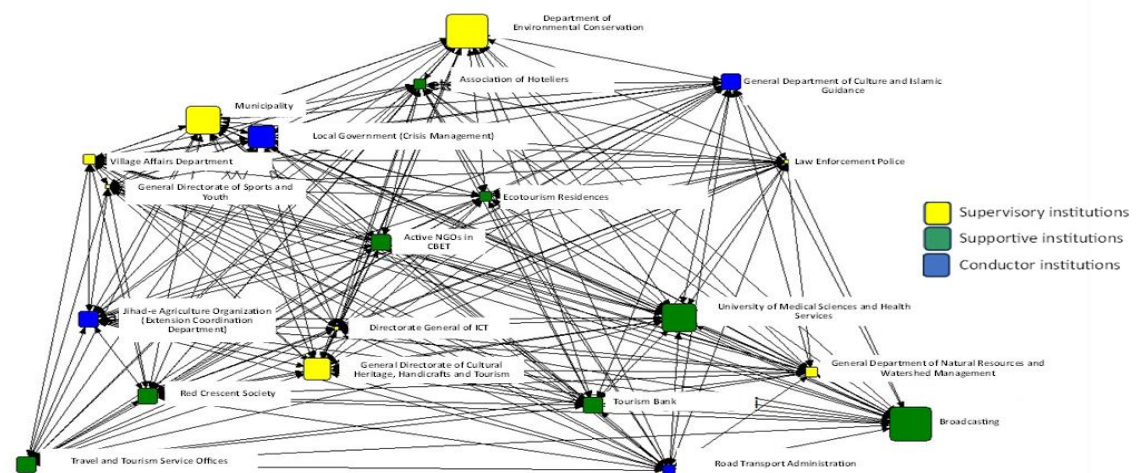


Fig. 5. In-degree centrality of the cooperation network of stakeholders in the field of community-based ecotourism (CBET) environmental sustainability.

Table 4. Degree centrality in CBET economic sustainability network

Row	Stakeholder	Out-degree centrality		In-degree centrality		Closeness Centrality		Eigenvec Centrality		Betweenness Centrality	
		Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
1	Village Affairs Department	72	1	53	5	77	3	0.243	9	2.184	11
2	Broadcasting	65	2	56	2	82	6	0.264	5	3.896	3
3	Local Government (Crisis Management)	64	3	55	3	73	1	0.267	4	4.551	1
4	Travel and Tourism Service Offices	56	4	54	4	86	10	0.255	6	4.303	2
5	General Directorate of Cultural Heritage, Handicrafts and Tourism	54	5	57	1	76	2	0.278	3	3.195	5
6	Association of Hoteliers	51	6	47	9	83	7	0.242	11	3.110	6
7	Department of Environmental Conservation	50	7	47	8	95	18	0.231	13	1.336	13
8	Municipality	48	8	51	6	81	5	0.254	7	2.176	12
9	Directorate General of ICT	48	9	40	17	83	8	0.213	14	0.163	16
10	Active NGOs in CBET	47	10	43	14	80	4	0.244	8	0.000	17
11	Road Transport Administration	47	11	42	15	85	9	0.209	15	2.529	7
12	Ecotourism Residences	46	12	49	7	93	16	0.298	1	2.398	9
13	General Department of Natural Resources and Watershed Management	46	13	44	13	90	12	0.242	12	1.233	14
14	Red Crescent Society	45	14	42	16	88	11	0.207	16	3.495	4
15	Tourism Bank	40	15	46	10	97	19	0.298	2	0.000	18
16	University of Medical Sciences and Health Services	38	16	45	12	97	20	0.176	19	2.188	10
17	Law Enforcement Police	37	17	38	18	94	17	0.204	17	1.033	15
18	Jihad-e Agriculture Organization (Extension Coordination Department)	35	18	46	11	93	15	0.184	18	2.552	8
19	General Department of Culture and Islamic Guidance	35	19	37	19	92	14	0.159	20	0.000	19
20	General Directorate of Sports and Youth	0	20	35	20	91	13	0.243	10	0.000	20

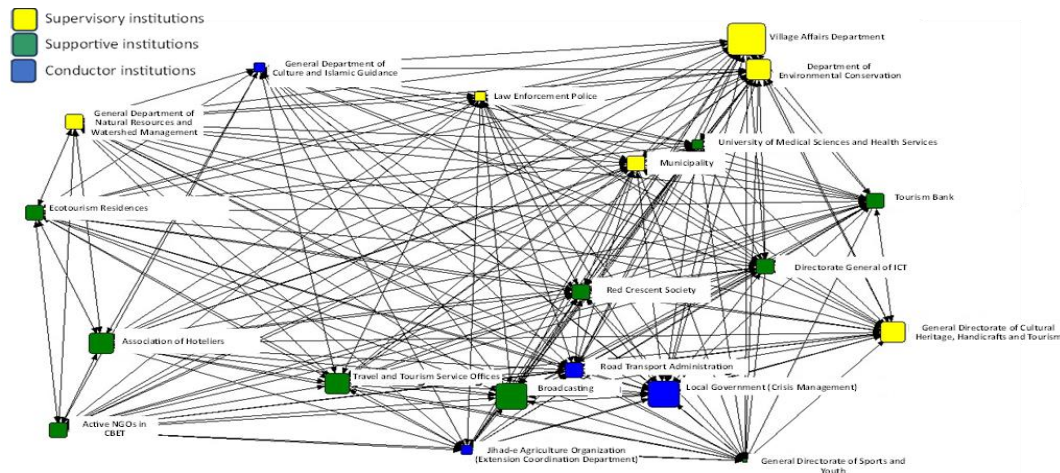


Fig. 6. Out-degree Centrality of the cooperation network of stakeholders in the field of community-based ecotourism (CBET) economic sustainability.

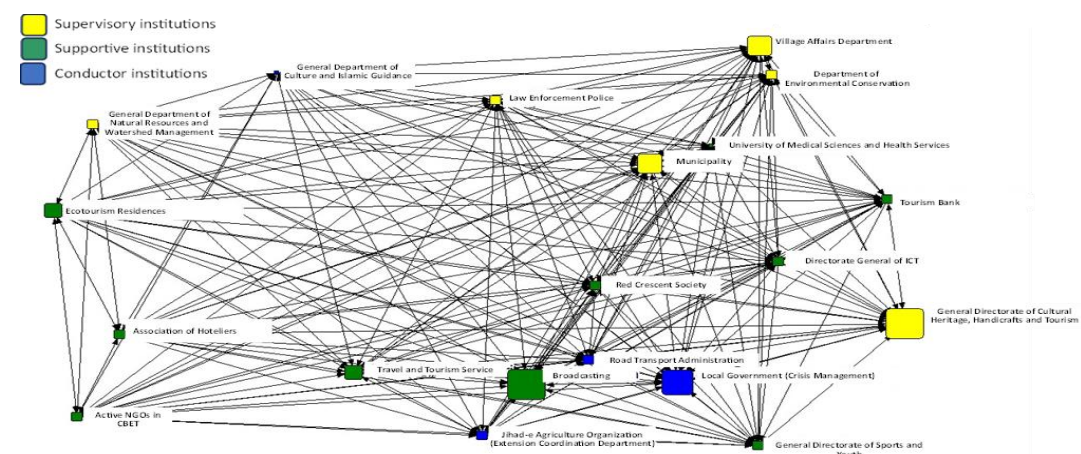


Fig. 7. In-degree centrality of the cooperation network of stakeholders in the field of community-based ecotourism (CBET) economic sustainability.

The degree centrality of the cooperation network of activators in the field of CBET social sustainability

By comparing the in-degree and out-degree of data in Fig. 8 and Fig. 9, it can be seen that activators are in different situations in the field of social debates. In the out-degree data, Village Affairs Department has the highest centrality rank with an out-degree of 69 (Table 5).

In in-degree data, the General Directorate of Cultural Heritage, Handicrafts and Tourism has the highest centrality rank with an in-degree of 65 and has attracted a high percentage of cooperation from other activators. This institution has also the highest closeness with the center with a centrality of 73. On the other hand, the communication path of many activators goes through Broadcasting, which has the highest betweenness (4.431). Also, this institution has the highest rank with the eigenvector value of 0.267.

Degree centrality of cooperation network of activators in the field of CBET political stability

Regarding SCBET political challenges, it was concluded that the General Directorate of Cultural Heritage, Handicrafts and Tourism had the most cooperation and interactions in this field with an out-degree of 69 and

eigenvector value of 0.282 (Table 6), which indicates the importance and role of this specialized organization in cooperation with actors. Also, Local Government (Crisis Management) has achieved the highest rank among activators with the in-degree centrality of 62, closeness centrality of 83 and betweenness centrality of 4.263, respectively. Fig. 10 and Fig. 11 demonstrate the out-degree and in-degree centrality in the field of CBET political sustainability, respectively.

The degree centrality of cooperation network of activators in the field of CBET cultural sustainability

Another aspect that was examined from the cooperation of CBET activators was based on its cultural issues. The SNA results indicated that the General Directorate of Cultural Heritage, Handicrafts and Tourism with an out-degree of 74, an in-degree of 69, a closeness degree of 82 and an eigenvector degree of 0.272 is considered a type of power and has the highest cultural influence compared to other activators (Table 7). Also, the communication path of most actors in the context of CBET cultural sustainability passes through Broadcasting, which has the most betweenness (4.774). Fig. 12 and Fig. 13 show the centrality of output and input degree in the field of cultural sustainability of CBET, respectively.

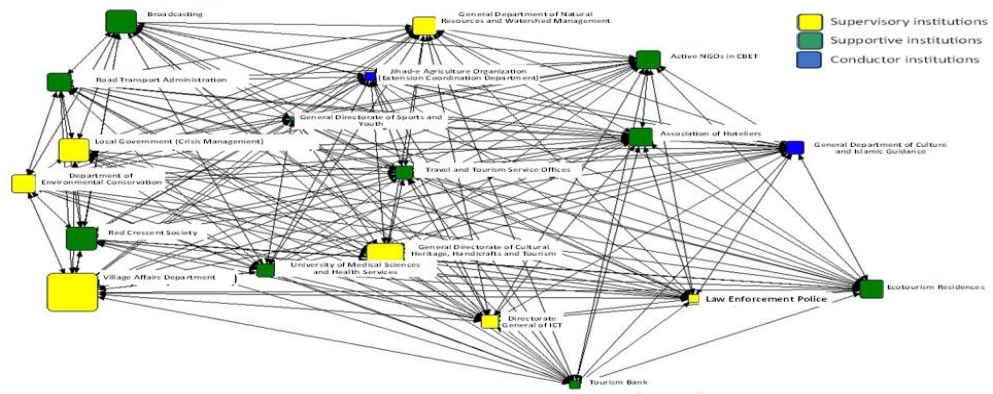


Fig 8. Out-degree centrality of the cooperation network of stakeholders in the field of community-based ecotourism (CBET) social sustainability.

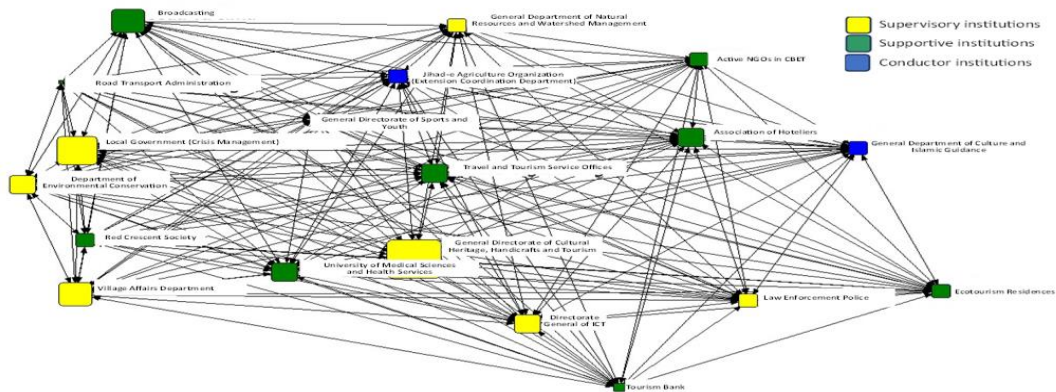


Fig. 9. In-degree centrality of the cooperation network of stakeholders in the field of community-based ecotourism (CBET) social sustainability.

Table 5. Degree centrality in CBET social sustainability network

Row	Stakeholder	Out degree centrality		In-degree centrality		Closeness Centrality		Eigenvec Centrality		Betweenness Centralit	
		Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
1	Village Affairs Department	69	1	59	4	83	5	0.264	2	126/3	4
2	General Directorate of Cultural Heritage, Handicrafts and Tourism	65	2	65	1	73	1	0.259	3	236/4	2
3	Local Government (Crisis Management)	63	3	64	2	81	4	0.258	4	2.421	3
4	Broadcasting	61	4	61	3	86	8	0.267	1	4.431	1
5	Red Crescent Society	61	5	49	12	75	2	0.249	5	2.259	9
6	Municipality	59	6	55	5	91	9	0.240	6	0.590	16
7	Department of Environmental Conservation	58	7	54	7	98	13	0.239	7	3.103	5
8	Road Transport Administration	57	8	44	17	85	6	0.225	8	1.895	12
9	General Department of Natural Resources and Watershed Management	55	9	49	11	86	7	0.220	11	0.590	17
10	Ecotourism Residences	53	10	49	13	97	12	0.224	9	0.000	20
11	Association of Hoteliers	51	11	50	10	91	10	0.212	14	1.684	13
12	Active NGOs in CBET	51	12	45	15	95	11	0.213	13	0.178	15
13	University of Medical Sciences and Health Services	47	13	50	9	79	3	0.206	16	2.259	10
14	General Department of Culture and Islamic Guidance	47	14	43	18	107	15	0.211	15	2.426	6

Table 5. Contonue

Row	Stakeholder	Out degree centrality		In-degree centrality		Closeness Centrality		Eigenvec Centrality		Betweenness Centralit	
		Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
15	Travel and Tourism Service Offices	46	15	53	8	112	17	0.216	12	2.421	7
16	Directorate General of ICT	43	16	55	6	108	16	0.222	10	2.421	8
17	Jihad-e Agriculture Organization (Extension Coordination Department)	38	17	45	14	119	19	0.193	17	0.590	18
18	Law Enforcement Police	38	18	44	16	102	14	0.185	18	2.259	11
19	Tourism Bank	36	19	35	19	114	18	0.173	19	1.119	14
20	General Directorate of Sports and Youth	11	20	40	17	121	20	0.157	20	0.000	19

Table 6. Degree centrality in community-based ecotourism (CBET) political sustainability network

Row	Stakeholder	Out-degree centrality		In-degree centrality		Closeness Centrality		Eigenvec Centrality		Betweenness Centrality	
		Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
1	General Directorate of Cultural Heritage, Handicrafts and Tourism	69	1	58	2	87	2	0.282	1	4.213	2
2	Village Affairs Department	63	2	45	10	93	6	0.252	4	3.378	4
3	Local Government (Crisis Management)	61	3	62	1	83	1	0.267	3	4.263	1
4	Broadcasting	59	4	56	3	108	17	0.276	2	1.947	15
5	Travel and Tourism Service Offices	54	5	50	6	105	15	0.233	5	2.632	8
6	Department of Environmental Conservation	50	6	50	7	93	7	0.230	7	2.632	9
7	Law Enforcement Police	49	7	39	17	89	3	0.210	14	3.059	7
8	Municipality	48	8	52	5	93	5	0.233	6	3.737	3
9	Road Transport Administration	47	9	39	18	96	9	0.200	18	2.053	14
10	Association of Hoteliers	47	10	45	11	98	10	0.208	15	2.368	12
11	General Department of Natural Resources and Watershed Management	46	11	49	8	95	8	0.225	8	0.000	17
12	Directorate General of ICT	46	12	45	13	103	14	0.212	12	2.368	13
13	University of Medical Sciences and Health Services	43	13	55	4	101	12	0.201	17	0.000	18
14	Active NGOs in CBET	38	14	45	12	111	19	0.216	9	2.368	11
15	Red Crescent Society	38	15	44	14	90	4	0.215	10	3.316	5
16	Tourism Bank	36	16	35	20	112	20	0.208	16	0.000	19
17	General Department of Culture and Islamic Guidance	35	17	41	15	107	18	0.188	19	3.158	6
18	Jihad-e Agriculture Organization (Extension Coordination Department)	35	18	49	9	105	16	0.212	13	2.579	10
19	Ecotourism Residences	32	19	40	16	101	13	0.215	11	0.895	16
20	General Directorate of Sports and Youth	3	20	36	19	98	11	0.148	20	0.000	20

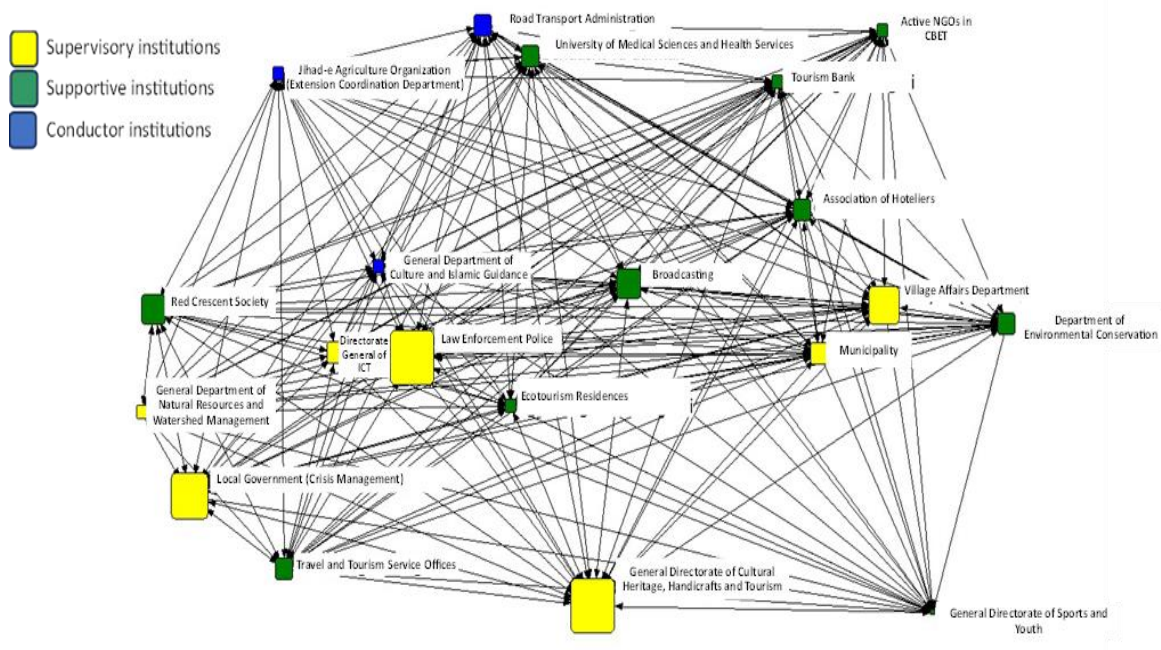


Fig. 10. Out-degree centrality of the cooperation network of stakeholders in the field of community-based ecotourism (CBET) political sustainability.

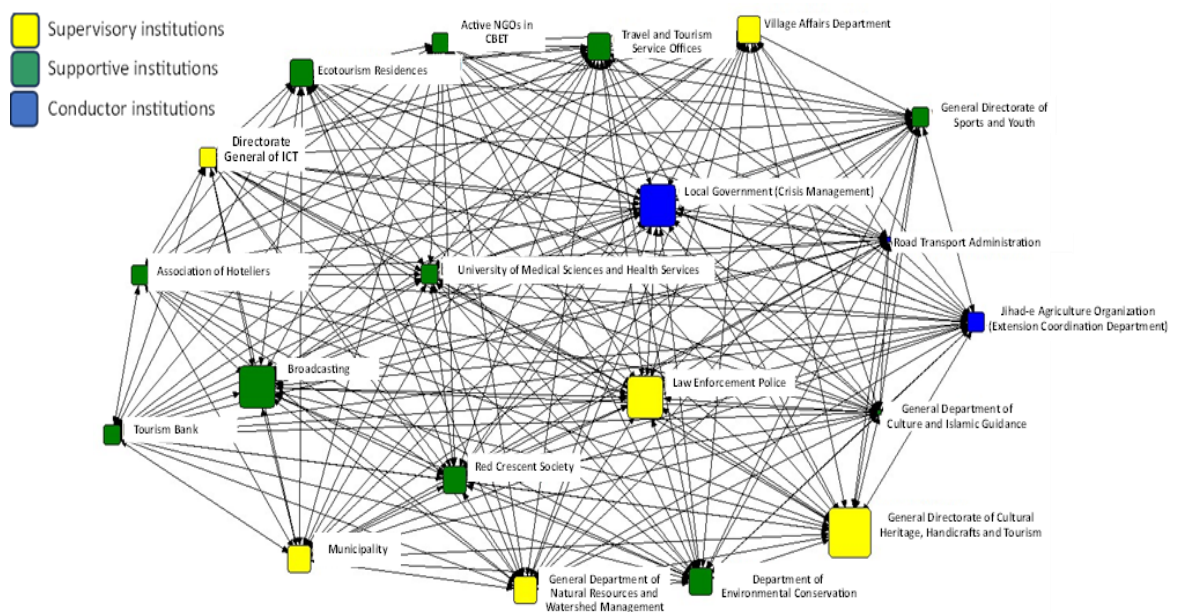


Fig. 11. In-degree centrality of the cooperation network of stakeholders in the field of community-based ecotourism (CBET) political sustainability.

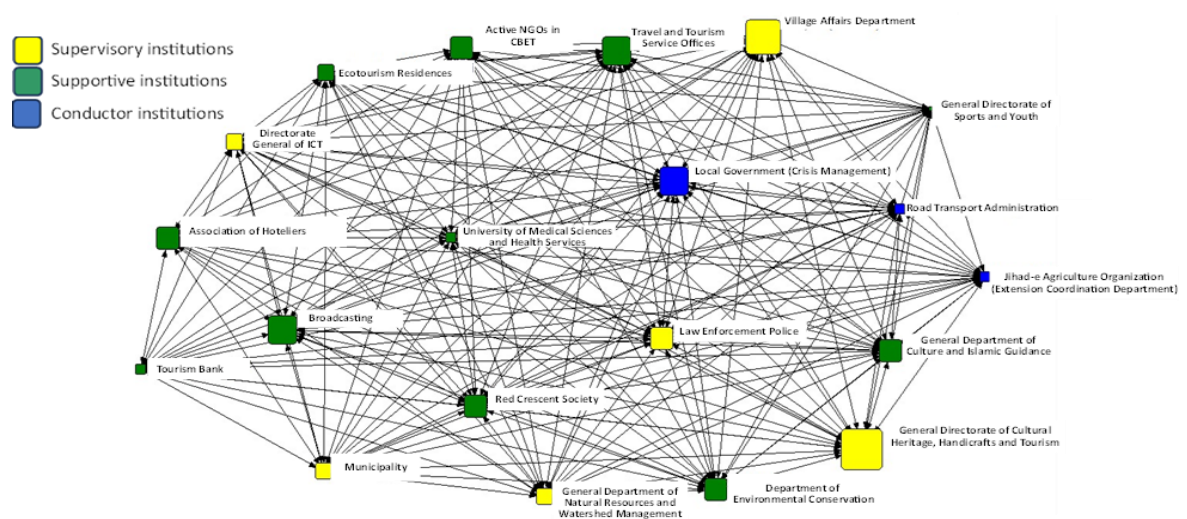
DISCUSSION

The present study identified and analyzed the key institutions involving SCBET by using SNA method. Indeed, identifying the situation, the level of collaboration and communication of activators in this field are necessary in planning for the development of relations and strengthening their interests, empowering

organizational interactions, management and predicting long-term and short-term goals and meeting the needs and services of tourists and local people. These actors were evaluated based on their amount of centrality. For this purpose, the indexes of out-degree centrality, in-degree centrality, betweenness centrality, closeness centrality and eigenvector centrality were applied.

Table 7. Degree centrality in community-based ecotourism (CBET)cultural sustainability network

Row	Stakeholder	Out-degree centrality		In-degree centrality		Closeness Centrality		Eigenvec Centrality		Betweenness Centrality	
		Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
1	General Directorate of Cultural Heritage, Handicrafts and Tourism	74	1	69	1	82	1	0.272	1	4.579	2
2	Village Affairs Department	68	2	56	5	94	8	0.252	5	3.316	7
3	Broadcasting	66	3	68	2	85	2	0.265	3	4.774	1
4	Travel and Tourism Service Offices	62	4	53	7	90	4	0.266	2	4.263	3
5	Local Government (Crisis Management)	60	5	67	3	97	11	0.233	7	3.158	8
6	General Department of Culture and Islamic Guidance	57	6	43	19	92	6	0.260	4	3.995	4
7	Department of Environmental Conservation	53	7	52	9	98	12	0.210	15	2.759	10
8	Association of Hoteliers	53	8	45	14	101	14	0.233	6	2.189	16
9	Active NGOs in CBET	53	9	44	15	103	17	0.200	19	2.789	9
10	Red Crescent Society	52	10	53	8	91	5	0.208	16	2.737	11
11	Law Enforcement Police	50	11	63	4	89	3	0.225	9	3.632	5
12	Ecotourism Residences	49	12	52	10	96	9	0.212	13	2.579	12
13	General Department of Natural Resources and Watershed Management	49	13	50	11	94	7	0.201	18	2.579	13
14	Municipality	48	14	54	6	96	10	0.216	10	3.526	6
15	Directorate General of ICT	48	15	44	16	101	15	0.215	11	2.526	14
16	Road Transport Administration	48	16	36	20	109	19	0.208	17	0.000	18
17	Jihad-e Agriculture Organization (Extension Coordination Department)	46	17	49	12	99	13	0.188	20	2.421	15
18	Tourism Bank	38	18	44	17	109	20	0.212	14	0.000	19
19	University of Medical Sciences and Health Services	35	19	47	13	104	18	0.215	12	0.000	20
20	General Directorate of Sports and Youth	23	20	44	18	101	16	0.230	8	1.211	17

**Fig. 12.** Out-degree centrality of the cooperation network of stakeholders in the field of community-based ecotourism (CBET) cultural sustainability.

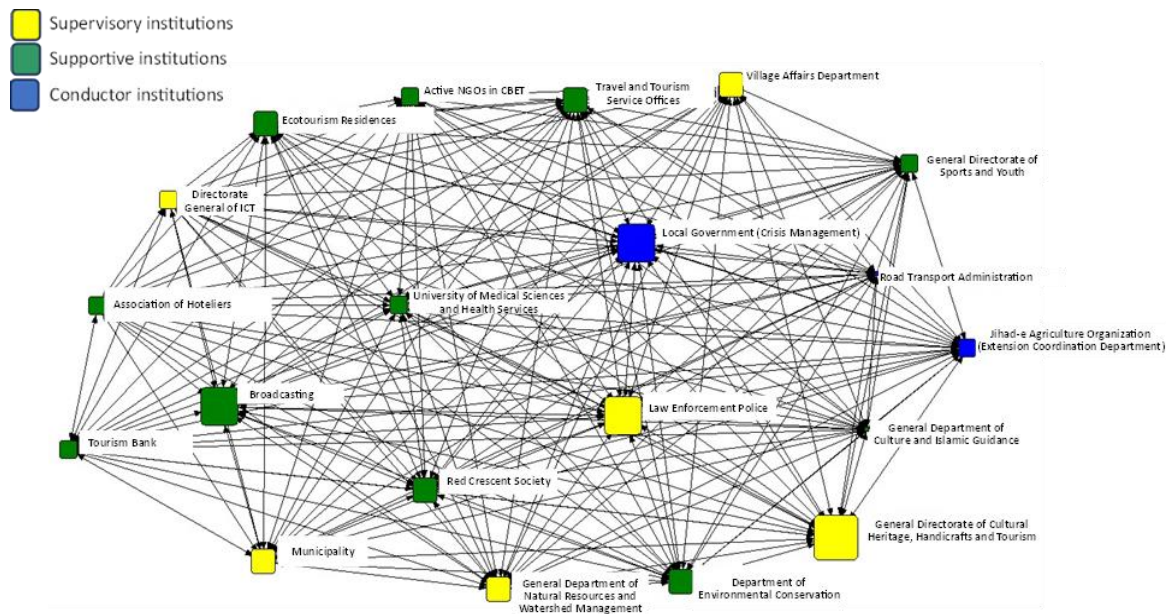


Fig. 13. In-degree centrality of the cooperation network of stakeholders in the field of community-based ecotourism (CBET) cultural sustainability.

The findings showed that in the field of CBET sustainable management, Broadcasting, General Directorate of Cultural Heritage, Handicrafts and Tourism and Local Government (Crisis Management sector) are the institutions with high in-degree and out-degree centrality. In this regard, the General Directorate of Cultural Heritage, Handicrafts and Tourism of Lorestan, which is the main authority of tourism, has unfortunately not been placed in its original position. However, Broadcasting, which mainly plays the role of creating culture, informing and attracting the participation of communities, has played a crucial role. The reason for this can be found in the formulation of written programs for making film or documentary productions with the aim of developing the province's eco-tourism industry, providing funds and supporting projects from the Broadcasting Center of Lorestan Province and its planning for communication with international networks for the provincial products broadcasting. Considering that currently the General Directorate of Cultural Heritage, Handicrafts and Tourism is acting as the main authority of eco-tourism management, it is necessary to have more cooperation in the field of structure and management framework and the participation of activators for the SCBET implementation. Regarding the power and influence within the network and quick access to other activators, the General Directorate of Cultural Heritage, Handicrafts and Tourism has obtained the highest degree of closeness degree, which seems to be a suitable position. In management and planning for SCBET, the communication path of many activators goes through Travel and Tourism Service Offices, which has the highest degree of betweenness centrality. These offices have the power to influence and control cooperation and could gain a favorable and strong position in this field.

Jihad-e Agriculture Organization (Extension Coordination Department) and Law Enforcement Police are other institutions whose cooperation is necessary to be more consistent in the field of CBET management in Lorestan

province. The high eigenvalue of the General Directorate of Cultural Heritage, Handicrafts and Tourism indicates that this institution has the most information exchange and cooperation with other institutions with high centrality and has been able to benefit from their capacity and ability in SCBET management issues.

Regarding the CBET environmental sustainability, Municipality, Local Government (Crisis Management) and Department of Environmental Conservation have obtained the highest out-degree centrality, respectively. The general duties of the Municipality in the field of environmental issues have been raised in three fields: solid material pollution, water and sewage pollution, and air and noise pollution. However, the cooperation of this institution in environment for the implementation of SCBET is one of the tasks and actions that it performs beyond its organizational powers, so that this institution has been able to play a crucial role in enhancing the quality of these sites and attracting more and better tourists and increasing their comfort regarding visiting tourism places by following environmental risks through the participation of non-governmental and governmental institutions. On the other hand, by educating other institutions about waste management and optimal use of energy, Municipality has been able to play an important role in the field of environmental issues for the implementation of CBET, along with other institutions. By comparing the in-degree and out-degree centrality of the data obtained from the network of cooperation of activators in the environmental field of CBET, it can be stated that the status of the cooperation of activators in this field is different, so that the Department of Environmental Conservation receives the highest in-degree. This high level of in-degree shows the power and control of this institution in cooperation for the environmental projects of production, industrial, service and tourism units in the framework of sustainable exploitation and also issuing relevant licenses that many

clients refer to this organization for this purpose. Department of Environmental Conservation is ranked second in the out-degree centrality of the cooperation network, which is necessary that this activator to have a position based on his power and interests. High eigenvalue of General Department of Natural Resources and Watershed Management and Municipality indicates that these institutions have the most information exchange and cooperation with other institutions with high centrality and could benefit from their capacity and capability in issues related to SCBET management.

Examining the results related to the cooperation network of actors in the field of CBET economic sustainability shows the high out-degree of Village Affairs Department, Local Government (Crisis Management) and Broadcasting. Prosperity of the rural economy is one of the duties of the Village Affairs Department. By cooperating and directing the relevant organizations and attracting credits, this institution could take common actions with other actors such as creating employment, establishing craft markets and providing facilities to the local people, which has led to an increase in its centrality degree. Also, the General Directorate of Cultural Heritage, Handicrafts and Tourism of the province has the highest credit in economic cooperation with the highest in-degree centrality, but the out-degree centrality of cooperation in this organization is lower, which indicates the lower influence of this organization in receiving economic cooperation from other activators. On the other hand, policy-making and planning to attract domestic and foreign resources and capital for the development of tourism activities is one of the tasks of the General Directorate of Cultural Heritage, Handicrafts and Tourism. For this purpose, in the input of information, this institution has received a high centrality degree. According to the results obtained from the betweenness and closeness centrality, it was found that Local Government (Crisis Management), which is one of the government institutions, has the highest influence in the economic cooperation network, and there are more activators in the betweenness, and indeed, it is the linkage between them. Tourism Bank is one of the other institutions whose cooperation in the economic field is necessary for the implementation of CBET in Lorestan province, because its investment focus is on tourism. However, according to the results, it is far from other activators and ranks lower in terms of centrality. Therefore, besides banking duties, it is necessary to have support and cooperation in the development of production and tourism infrastructures. Nevertheless, Tourism Bank and Ecotourism Residences have the highest information exchange and cooperation with other institutions with high centrality and could benefit from their capacity and ability in issues related to SCBET economy.

In the dimension of social sustainability of CBET, Village Affairs Department has obtained the highest out-degree. With the participation of other actors, this institution could play an effective role in the fields of educating local forces and councils with their heritage and its conservation, holding training courses for women and job seekers, holding business workshops, holding festivals in order to introduce their products and

handicrafts to tourists and so on and achieve the highest out-degree centrality. In the input of information, the General Directorate of Cultural Heritage, Handicrafts and Tourism has a high centrality rank and has attracted a high percentage of cooperation from other actors. For this purpose, it receives the plans prepared by other activators in the organization's power and issues the required approvals for their implementation, which seems to be consistent with the description of its organizational duties. Also, General Directorate of Cultural Heritage, Handicrafts and Tourism and Broadcasting have obtained the highest closeness and betweenness degree, respectively. Broadcasting has the highest information exchange and cooperation with other institutions with high centrality and could benefit from their capacity and ability in social fields to implement SCBET. In this regard, enhancing the linkage and cooperation of institutions such as the Association of Hoteliers, the General Department of Culture and Islamic Guidance, and the Directorate General of ICT, which have low centrality, can be a good choice for recommendation, which can be effective in promoting social cohesion for CBET.

The General Directorate of Cultural Heritage, Handicrafts and Tourism has the most cooperation and interactions with other activators in the field of CBET political sustainability, which indicates the importance and role of this specialized organization in cooperation with actors. The dominant activity of this organization is determining the policies and performing the necessary planning in order to raise the level of awareness and knowledge of the private and non-governmental institutions in the field of Cultural Heritage, Handicrafts and Tourism. On the other hand, the high position of Local Government (Crisis Management) regarding quick access to other activators and obtaining a high rank of closeness and betweenness shows two important points. First, on the one hand, this issue is due to the high position of government institutions in the Iran's tourism planning system, and on the other hand, the high position of Local Government (Crisis Management) confirms the necessity of taking the necessary political measures as one of the most important criteria for the SCBET implementation.

Another aspect of SCBET that was examined was the cultural dimension. It was found that the General Directorate of Cultural Heritage, Handicrafts and Tourism is regarded a kind of power and has the highest cultural influence compared to other activators. Therefore, it can be stated that the power and authority of cultural heritage, tourism and handicrafts is related to its organizational responsibility regarding the formulation of the necessary rules and instructions regarding the protection, retaining, restoration and revival of cultural heritage. Regarding power and influence within the network and quick access to other activators, Broadcasting has obtained the highest closeness degree, which seems to be a suitable position. By using media facilities to transfer cultural concepts and introduce customs and traditions and preserve public places, this institution provides the necessary grounds for the awareness of people. The important point is regarding two of SCBET's main activators in the field of culture,

including the General Department of Culture and Islamic Guidance and the General Directorate of Sports and Youth, which do not have a good position. These two institutions can have an effective cooperation in the implementation of cultural, artistic, advertising, accommodation and hospitality activities, as well as desired local native sports and games of tourists. If these two institutions cooperate effectively, we can observe the realization of CBET in the future.

A notable source by Smith et al. (2022) delves into the network analysis of sustainable tourism actors in a similar context to this study in Iran. Their findings align with this research by emphasizing the significance of actor collaboration and communication for the success of sustainable ecotourism initiatives. In contrast, a study by Li and Wang (2015) presents differing results regarding the role of governmental institutions in ecotourism management. Their research highlights the dominance of private sectors over governmental bodies in shaping sustainable tourism practices. The discrepancy in these findings could stem from variations in local governance structures and dynamics, impacting the centrality and influence of different actors within the ecotourism network. Combining these contrasting perspectives can serve as a foundation for future research to explore additional important factors and stakeholders in ecotourism sustainability. This can lead to a more comprehensive understanding of the dynamics within sustainable community-based ecotourism networks, offering valuable insights for policymakers and practitioners in the field.

Building upon analysis of SCBET actors' networks, it is essential to consider the significance of stakeholder collaboration and communication in promoting sustainable practices. As highlighted by Jones (2020), effective stakeholder engagement is crucial for fostering partnerships and fostering community resilience in ecotourism initiatives. By emphasizing the importance of multi-stakeholder cooperation, the study contributes to the ongoing dialogue on sustainable tourism governance.

Furthermore, identification of six dimensions of sustainability in SCBET aligns with the findings of Smith & Williams (2018), who underscore the interconnectedness of environmental, economic, and social factors in promoting community well-being through ecotourism. By elucidating the role of these dimensions in shaping SCBET networks, this research adds nuance to the discourse on holistic sustainability approaches in tourism management.

Moreover, the insights gained from our SNA align with the observations of Tran et al. (2016) on the utility of network metrics in assessing collaboration patterns and power dynamics among tourism stakeholders. By applying SNA methodologies to map out actor relationships, this study offers a novel perspective on enhancing organizational interactions and decision-making processes in SCBET contexts.

In addition, emphasis on the challenges facing ecotourism echoes the concerns raised by Li and Song (2016) regarding the need for effective governance mechanisms and policy interventions to address sustainability issues in tourism development. By identifying areas of improvement and potential areas for

intervention, the findings contribute to the ongoing discourse on policy formulation and implementation in sustainable tourism practices.

Finally, the integration of cultural dimensions into our analysis resonates with the insights of Zhang and Wang (2019) on the importance of cultural heritage preservation and community engagement in ecotourism initiatives. By recognizing the cultural significance of SCBET activities, the study underscores the value of promoting cultural diversity and inclusivity in tourism planning and management.

CONCLUSION

Based on the results obtained from this research, the CBET development has been performed mostly with the cooperation of institutions such as General Directorate of Cultural Heritage, Handicrafts and Tourism, Broadcasting, Local Government (Crisis Management), Municipality, Department of Environmental Conservation and Village Affairs Department. It should be said that CBET is not exclusive to these organizations and every organization has its own little role and position in this field. In this regard, through the formation of a headquarters committee at the province level, including all the stakeholder institutions that have the most missions in the mentioned fields, the General Directorate of Cultural Heritage, Handicrafts and Tourism can increase and enhance the cooperation capacity of the relevant institutions and promote the plans of SCBET in Lorestan province. The pre-requirement for the cooperation and support of organizations for SCBET is the participation of the local community and the sending human resources of organizations to tourism areas in order to achieve information in all dimensions of CBET.

Like any other study, this study has its own limitations. One of the limitations is related to the specific nature of the research, which was carried out with a small sample size and SNA, which limits its generalizability. However, this study can serve as a guide for those interested in replicating the research in other areas and with different actors. Also, its results can be useful for extended studies, especially in the studied area (Lorestan province). The results obtained in the framework of SNA can help tourism policymakers and decision-makers to identify the challenges facing ecotourism and analyze the various relations between activators and stakeholders (private and government sectors and local communities). Also, it would be mentioned regarding the distinction between political stability and political sustainability, is necessary to acknowledge that political stability refers to the consistency and resilience of governance structures within a given context, which may encompass factors beyond the provincial level, including national policies and socio-political dynamics. Political sustainability, on the other hand, emphasizes the capacity of political systems to maintain and adapt to the needs of community stakeholders over time without sacrificing democratic principles and inclusive governance. In the context of our study in Lorestan, Iran, we recognize that political stability may influence SCBET initiatives; however, our

focus was on the interactions and collaborations among local stakeholders.

The findings of this study provide valuable insights into the network of SCBET actors in Lorestan province, Iran. The analysis revealed six dimensions of sustainability (management, environmental, economic, social, political, and cultural) based on micro-level indicators, as well as the relationships between various stakeholders including private sectors, government, and local communities. These findings have important implications for both theoretical and practical aspects of sustainable ecotourism development.

This research contributes to the existing literature by providing a comprehensive analysis of the network of SCBET actors and their relationships, based on a social network analysis approach. The identification of dimensions of sustainability and the visualization of actor networks offers a deeper understanding of the complex interactions and dynamics within the ecotourism system. This contributes to the theoretical development of sustainable tourism and network analysis in the context of community-based ecotourism.

- Policymakers and decision-makers can use the results of this study to identify the challenges facing ecotourism and develop targeted policies and interventions to address these challenges.

- The findings can be utilized to strengthen cooperation and communication among SCBET actors, promoting better coordination and collaboration in providing services and meeting the needs of ecotourists and local communities.

- Local communities and stakeholders can use the insights from this research to enhance their involvement in ecotourism activities, fostering a sense of ownership and empowerment.

- The dimensions of sustainability identified in this study can serve as a framework for evaluating the effectiveness of ecotourism initiatives and guiding future development efforts.

- The network analysis can assist in identifying key actors and influential stakeholders, facilitating the mobilization of resources and support for sustainable ecotourism projects.

- The visualization of actor networks can be utilized as a tool for stakeholders to understand their position and connections within the ecotourism system, fostering strategic planning and decision-making.

In summary, this research not only contributes to the theoretical understanding of sustainable community-based ecotourism but also provides practical insights and recommendations for stakeholders and policymakers to promote sustainable development in the context of ecotourism in Lorestan province, Iran.

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There was no funder for the research.

CRedit AUTHORSHIP CONTRIBUTION STATEMENT

Conceptualization: Fereshteh Hafezi, Masoud Bijani and Saeed Gholamrezai; Methodology: Fereshteh Hafezi,

Masoud Bijani and Moslem Savari; Validation: Fereshteh Hafezi, Masoud Bijani, Saeed Gholamrezai, Moslem Savari and Sabine Panzer-Krause; Formal analysis, Fereshteh Hafezi; Investigation: Fereshteh Hafezi; Resources: Fereshteh Hafezi and Masoud Bijani; Data curation: Masoud Bijani, Writing-original draft preparation: Fereshteh Hafezi; Writing-review and editing: Masoud Bijani, Saeed Gholamrezai, Moslem Savari and Sabine Panzer-Krause; Visualization: Fereshteh Hafezi and Masoud Bijani; Supervision: Masoud Bijani; Project administration: Masoud Bijani; Funding acquisition: Fereshteh Hafezi and Masoud Bijani.

DECLARATION OF COMPETING INTEREST

The authors declare no conflict of interest.

ETHICAL STATEMENT

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Research Ethics Committees of Tarbiat Modares University (TMU) (Date 2024-02-24 /No 1402.230).

DATA AVAILABILITY

The data utilized in this study are outlined within the article.

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