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Analysis of communication networks among stakeholders involved in the management of Golestan national park

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ABSTRACT

Golestan National Park possesses significant conservation value due to its rich ecological, biological, and landscape diversity. The park encompasses a broad array of stakeholders. Understanding the various stakeholders and their interrelations is essential for effectively managing the challenges faced in this protected area. This study employs the snowball sampling method alongside social network analysis to identify the stakeholders engaged in the issues associated with the park, delineate their communication networks, and uncover the strengths and weaknesses inherent in these networks. Data for this research were collected through a questionnaire and a face-to-face workshop involving 59 stakeholders identified through the snowball process. The analysis was conducted using NetDraw and UCINET 6.528 software. The identification and examination of stakeholders revealed two distinct networks: referral and collaboration networks among the stakeholders associated with the park. A notable positive aspect of the referral and collaboration network among stakeholders was the high level of satisfaction with government agencies and the key role of public agencies. The analysis of this research also highlighted some negative aspects in both networks, including the presence of isolated stakeholders. The network analysis also underscored the importance of trust in public agencies regarding the issues associated with the management of the park. The findings revealed a strong mediating role for Villagers and Councils. Overall, the findings indicate that the park serves as an excellent platform for the implementation of cooperative programs. The detailed results presented in this study could help managers in establishing and executing collaborative initiatives for the park.

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1. Introduction

Protecting the environment is a complex concept that is typically regarded as an essential aspect of management strategy. Environmental conservation encompasses various objectives, including: safeguarding the environment, enhancing ecological conditions, preserving unique ecosystems, maintaining the biosphere in a balanced and stable state, promoting recreation, educating about environmental issues, optimizing and improving environmental conditions, and resolving conflicts (Majnounian, 1995). However, many protected areas are currently facing numerous threats stemming from human activities. In our country, four key different kind of protected areas categories managed by the Department of Environment are particularly significant in terms of territorial and biological diversity and are afforded substantial legal protection. Regrettably, even these areas are encountering management challenges related to controlling destructive human activities, which contribute to ecological degradation. If this trend persists, even these protected areas risk losing their viability, potentially becoming isolated zones plagued by external conflicts and internal management failures (Majnounian, 1995). These conflicts could be including land

occupation, resource destruction, disputes over land ownership and transfer, illegal hunting, unauthorized livestock grazing, deforestation, and plant destruction, compounded by inadequate judicial support, lack of awareness, insufficient budget allocations (Dabiri et al., 2009). As managers of natural resources recognized that self-organizational management alone could not ensure the sustainability of protected areas, they gradually shifted their management approach to participatory management (Mahmoudi and Eshaghi, 2022). This shift underscores the necessity of addressing the gap between stakeholders involved in the management of protected areas and the importance of considering their roles and participation in these efforts. Effective cooperative management requires the identification of relevant individuals and institutions. Misunderstandings regarding the beneficiaries of natural resources can jeopardize collaborative initiatives and lead to the degradation of these resources. One of the most effective tools for identifying stakeholders and understanding their interrelationships is the Network Analysis approach. Social Network Analysis (SNA) is an approach to studying social structures, whose main origins are the fields of social sciences, political sciences, anthropology, and theoreticians; it is actually an approach to understanding relationships. This approach dates back 50 years. Questioning can be done from individuals, groups, organizations, or societies and relationships include people's feelings towards each other, the exchange of information, and the exchange of money and goods. The analysis of the social network focuses on the relationships between the actors and does not consider the individual characteristics of the actors (Mohammadi Kangarani and Shamekhi, 2011). One of the special features of network analysis is the emphasis on relationships between actors and the ability to identify deeper layers of relationships, especially in informal formats, which are less discoverable under normal conditions (Henman Riedel and Mark., 2013) With the help of this method, it is possible to identify the governing relationships between the stakeholders and the shortcomings in the management of the regions and achieve an efficient collaborative management model. So far, many researchers have done various researches related to this topic. The research of Soleymani et al. (2021) on participatory management in desert ecosystems through surveys, interviews, and participation in meetings shows that due to insufficient attention to the position of stakeholders in the network of social relations, this ecosystem has become fragile. They expressed that the identification of key players in the collaborative management of desert ecosystems plays an important role and emphasizes involving organizations to maintain this ecosystem. The next step after identifying the stakeholders is to discover the relationships between them. Research in Osnabruck, Germany, using the social network analysis method, revealed differences between stakeholders and their cooperation; the conflicts were mainly between nature protection organizations, authorities, and people who wanted to change the use (Przesdzink et al., 2022). Research by Chen et al. (2020) in China revealed the presence of activists who had not previously been documented in official records or earlier studies. They found that local activists and civil society members could potentially facilitate interactions among local government entities, village committees, and participants from Durham natural and agricultural stations; thus, developing environmental management plans in Chinese villages should place significant emphasis on local actors and their collaborative efforts for effective participatory governance. Vazirian et al. (2021) noted that in early management research focused on collaboration with central authorities; these entities played a critical role. By identifying influential individuals within the social network as key components of management strategies, managers can considerably enhance planning processes. Their study directed towards monitoring and analyzing social networks to determine key actors for sustainable management of natural resources across three villages Izi, Buroz, and Staj utilized network analysis methods while considering indicators such as degree centrality, betweenness centrality, and closeness. This analysis identified six key actors with the highest levels of interculturality based on trust, partnership, and social capital, suggesting that individuals wielding substantial influence in these areas could assume leadership roles. In this research, social network analysis has proven effective in identifying network weaknesses and facilitating the correction process. The study by Pynnonen

et al. (2019), which focused on technical and social knowledge discontinuities in the multi-purpose management of Sosi forests in Flanders, concluded that significant gaps exist in the current flow of communication between local stakeholders and organizations within the region. Overall, these studies demonstrate the utility of network analysis in understanding social networks, along with their strengths and weaknesses.

The present research aims to investigate the social relations among stakeholders involved in the management of Golestan National Park (GNP). This park, within the forest ecosystem, represents the last remnant of the ancient Hyrcanian forests (Faramarzi and Hosseini, 2023). Due to its extensive size and the diverse climate of the region, it serves as a rare refuge for wildlife. This park is home to about 1,350 plant species and more than 300 animal species and is considered a UNESCO World Heritage Biosphere Reserve (UNESCO, 2023). The park holds significant conservation value owing to its unique diversity of fauna and flora, as well as its varied climate and ecosystems. One factor contributing to the conservation values in this area is the high diversity of stakeholders and local communities, which includes various Iranian ethnic groups such as Turkmen, Persians, Baluch, Kermanch, and Tat (Ebrahimi-Manfard et al., 2023). The multiplicity of interests among these stakeholders has resulted in conflicts and, at times, disputes, posing challenges for effective management of the park. By identifying the strengths and weaknesses within the communication networks of the stakeholders, it will be possible to implement management measures aimed at addressing these issues. In this context, the following objectives are outlined for this research:

- Identification of the communication networks among stakeholders engaged in GNP.
- Mapping the identified communication networks in GNP.
- Identification of the stakeholders involved in the conflicts within GNP.
- Analyzing the strengths and weaknesses of the communication networks within GNP.

2. Material and methods

2.1. Study Area

Golestan National Park is located in the northern part of Iran and with an area of about 91,000 hectares. This park is situated between two large cities, Gorgan and Mashhad. The park is at 37°24’N 55°58’E (37.403°N and 55.976°E) (Fig. 1) (Mirkarimi, 2024). There are 42 villages surrounding the park, each at varying distances. For most residents in the area, agriculture and animal husbandry are the primary means of livelihood. Villages located in the northwest and west of the park, such as Lehandur, Zav, Ghosh Cheshme, and Tangrah, are predominantly situated in forested regions and are inhabited by Turkmen communities. In contrast, the southwestern villages, including Kondeskuh and Dasht-Shad, are found in mountainous forest areas and are predominantly non-Turkmen. The villages to the south and southeast of the Park, such as Dasht-Shad, Cheshme Khan, Armadlo, and Rabat Qarabil, are generally located near the road in flat, plain areas, where residents primarily engage in agricultural activities (Majnounian et al., 1999).

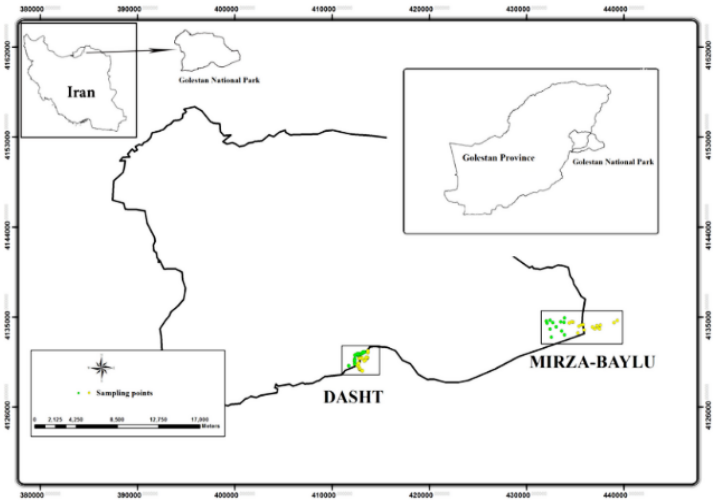

Fig. 1. Location of Golestan National Park in Iran.

2.2. Research design and methods

In this research, the snowball method was employed to identify the stakeholders involved in the management of GNP. This non-probability sampling technique is particularly useful when the target population is not easily identifiable, especially in cases where the subjects are rare or represent a small segment of a larger society, or when specific characteristics are required for respondent selection. In this method, the initial sampling unit aids in identifying subsequent units, and this process continues iteratively until no new stakeholders are identified (Kirchherr and Charles, 2018). To explore the relationships among the stakeholders identified through the snowball method, a meeting was convened at Golestan National Park during the summer of 2023, wherein a questionnaire based on network analysis was utilized for a question-and-answer session. The steps undertaken in this research are as follows:

First Step: Identifying the stakeholders and their relationships in Golestan National Park. The snowball method was utilized to identify the stakeholders, wherein each participant and representative organization was asked to identify individuals involved in the management of Golestan National Park. This process continued until responses began to repeat. Inquiries were conducted both in person and via telephone. Stakeholders questioned included representatives from the Department of Environment of Golestan Province, Department of Environment of the Gorgan City, the Golestan Province Natural Resources and Watershed Management Department, the Golestan Province Cultural Heritage, Handicrafts and Tourism Department, the Golestan Province Governorate, Village Administration Offices, Members of the Islamic Village Council, Tourists, Veterans, and Academics.

Second Step: Identifying the communication networks of stakeholders involved in Golestan National Park. During the stakeholder identification and questioning process, two referral and cooperation networks were discerned from the relationships among stakeholders associated with the park.

Third Step: Mapping the identified communication networks in GNP. This step was conducted in four phases:

1. Questionnaire design based on network analysis and validation by a group of experts
2. Organizing a meeting for questions and answers among the identified stakeholder groups.
3. Analyzing the questionnaire data and constructing the network by considering indicators such as degree centrality, betweenness, and eigenvector centrality.
4. Analyzing the referral and cooperation networks.

The first phase of the questionnaire design involved preparing a document aimed at analyzing these two networks through two distinct sets of questions regarding the referral network (communications) and the cooperation network (participation) of the stakeholders, with validation carried out by a group of experts. The questions included: "What organizations or individuals do you communicate with to perform tasks and activities related to protected areas?" and "Which organizations have collaborated with you?". A total of 59 questionnaires were completed. The analysis of social networks can involve various measures at both the micro and macro levels, such as Degree centrality, Eigenvector centrality, Grouping, Power, and Betweenness centrality. This project focuses on the analysis of three micro metrics—degree centrality, betweenness centrality, and eigenvector centrality—as part of social network analysis. Centrality refers to the extent to which an actor has direct connections with other actors in a network (Khaje Naini et al., 2021). In the context of betweenness centrality, an actor that appears frequently in the shortest paths between two other actors holds a more favorable position; the more actors rely on this actor to connect with others, the greater their influence. This measure evaluates the control exerted by each actor within the network (Riahi, 2010). Eigenvector centrality assesses an actor's position in relation to their connections with other influential actors, indicating that a point connected to many central neighbors holds significance within the network (Henman and Riedel, 2013). Following the analysis of these three parameters within two cooperation networks and the mapping of stakeholders' relations, a comparison was made to determine the level of

cooperation and participation between public and government stakeholders in the park. The second stage involved convening a meeting to collect and analyze data. To gather information and complete the designed questionnaire, a workshop meeting was held to achieve consensus among stakeholders related to the park. This meeting occurred in Shahid Bashghare Hall within the park during the winter of 2023. Participants were asked to complete questionnaires to identify referral and cooperation networks among the beneficiaries. The third step involved the analysis of the questionnaires.

3. Results and discussion

59 questionnaires were completed, and the information gathered was entered into Excel (version 2406), resulting in the extraction of a two-dimensional matrix. This matrix was subsequently analyzed using UCINET 6.528 software to create and evaluate network graphs. UCINET is specifically designed for social network data analysis. In this matrix, the rows represented individual participants, while the columns represented the organizations available for selection. Values of 0 and 1 were assigned to the cells, with selected organizations receiving a value of one and non-selected organizations receiving a value of zero. The variables investigated in this research included demographic factors (gender, age, work experience, education, and occupation) as well as social network analysis metrics. Table 1 presents the individual characteristics of the stakeholders who participated in the workshop meeting. Table 2 shows the list of stakeholders involved in the management of Golestan National Park along with the numerical values of degree centrality, betweenness and eigenvector indicators.

Table 1. Individual characteristics of the participants in the Golestan National Park workshop meeting.

Individual profile		Abundance percentage
Gender	Men	84/7
	Women	15/2
Age	X<30	2/1
	30<x<50	50/1
	50<x	47/8
Education	Up to bachelor's degree	37
	Postgraduate education	63

Table 2. The list of stakeholders involved in the management of Golestan National Park along with the numerical values of the indicators.

Stakeholders	Abbreviation	Referral Network			Collaboration Network		
		Degree	Betweenness	Eigenvrctor	Degree	Betweenness	Eigenvrctor
Department of Environment (Golestan Province -General Department)	Department of Environment (GP-GD)	0/196	0/060	0/080	0/157	0/025	0/102
Department of Environment (Golestan Province - Cities of Golestan Province)	Department of Environment (CGP)	0/451	0/130	0/394	0/451	0/164	0/133
Natural Resources and Watershed Management Organization (Golestan Province - General Department)	Natural Resources and Watershed Management Organization (GP-GD)	0/039	0/001	0/039	0/098	0/021	0/097
Natural Resources and Watershed Management Organization (Golestan Province - Cities of Golestan Province)	Natural Resources and Watershed Management Organization (CGP)	0/431	0/161	0/403	0/255	0/052	0/128
Municipality	-	0/059	0/002	0/072	0/098	0/001	0/125
Islamic Village Council	-	0/392	0/067	0/407	0/275	0/034	0/153
Village Administration Office	-	0/471	0/122	0/490	0/314	0/043	0/166
Office of the Governor	-	0/255	0/058	0/231	0/235	0/029	0/155
Provincial Government (Golestan Province)	Provincial Government (GP)	0/039	0/001	0/032	0/098	0/001	0/133
General Department of Cultural Heritage, Handicrafts and Tourism (Golestan Province)	General Department of Cultural Heritage, Handicrafts and Tourism	0/078	0/114	0/033	0/188	0/016	0/098

	(GP)						
Department of Cultural Heritage, Crafts and Tourism (Cities of Golestan Province)	Department of Cultural Heritage, Crafts and Tourism (CGP)	0/176	0/014	0/150	0/098	0/009	0/097
NGOs	-	0/039	0/001	0/045	0/118	0/007	0/131
Sport Department (Golestan Province- Gorgan City)	Sport Department (GP-GD)	0/039	0/000	0/001	0/118	0/014	0/127
Department of Sports and Youth (Golestan Province - General Department)	Department of Sports and Youth (GP-GD)	0/000	0/000	0/000	0/078	0/000	0/125
Shooting Board of Golestan Province	-	0/000	0/000	0/000	0/078	0/000	0/125
Sepah Intelligence (Golestan Province - Cities of Golestan Province)	Sepah Intelligence (CGP)	0/000	0/000	0/000	0/078	0/000	0/125
Police of the Islamic Republic (Golestan Province)	Police of the Islamic Republic (GP)	0/059	0/002	0/072	0/118	0/003	0/134
Sepah (Golestan Province)	Sepah (GP)	0/000	0/000	0/000	0/078	0/000	0/125
Basij (Golestan Province)	Basij (GP)	0/020	0/000	0/031	0/078	0/000	0/125
Red Crescent Society (Golestan Province)	Red Crescent Society (GP)	0/039	0/000	0/057	0/098	0/003	0/128
Department of Crisis Management (Golestan Province -General Department)	Department of Crisis Management (GP-GD)	0/000	0/000	0/000	0/078	0/000	0/125
Agriculture-Jahad Organization (Golestan Province -General Department	Agriculture-Jahad Organization (GP-GD)	0/137	0/020	0/137	0/216	0/025	0/147
Office of Village Affairs and Islamic Councils (Golestan Province)	Office of Village Affairs and Islamic Councils (GP)	0/000	0/000	0/000	0/098	0/001	0/133
District Office	-	0/294	0/036	0/313	0/204	0/054	0/160
Department of Veterinary Medicine (Golestan Province - General Department)	Department of Veterinary Medicine (GP-GD)	0/098	0/007	0/083	0/137	0/010	0/134
Shooting and Hunting Center	-	0/000	0/000	0/000	0/078	0/000	0/125
Regional Water Company (Golestan Province)	Regional Water Company (GP)	0/059	0/001	0/065	0/098	0/001	0/130
Provincial Security (Tamin) Council	-	0/000	0/000	0/000	0/078	0/000	0/125
Justice (Golestan Province - General Department)	Justice (GP-GD)	0/059	0/001	0/054	0/137	0/008	0/136
Water and Wastewater Company (Golestan Province)	Water and Wastewater Company (GP)	0/020	0/000	0/007	0/118	0/003	0/137
University	-	0/039	0/003	0/025	0/198	0/001	0/129
Waste Management (Golestan Province - Gorgan City)	Waste Management (CGP)	0/000	0/000	0/000	0/078	0/000	0/125
Welfare Organization (Golestan Province)	Welfare Organization (GP)	0/000	0/000	0/000	0/078	0/000	0/125
Agriculture and Natural Resources Engineering Organization (Golestan Province - General Department)	Agriculture and Natural Resources Engineering Organization (GP-GD)	0/020	0/000	0/007	0/078	0/000	0/125
Local People	-	0/078	0/002	0/060	0/137	0/008	0/134
Land Affairs (Golestan Province)	Land Affairs (GP)	0/020	0/000	0/021	0/098	0/001	0/133
Water Affairs - Water and Sewerage Company (Golestan Province)	Water Affairs - Water and Sewerage Company (GP)	0/000	0/000	0/000	0/078	0/000	0/125
Industry, Mine and Trade (Golestan Province)	Industry, Mine and Trade (GP)	0/020	0/000	0/007	0/098	0/001	0/133

Department of Fisheries (Golestan Province - General Department)	Department of Fisheries (GP-GD)	0/000	0/000	0/000	0/078	0/000	0/125
State Organization for Registration of Deeds and Properties (Golestan Province)	State Organization for Registration of Deeds and Properties (GP-GD)	0/000	0/000	0/000	0/078	0/000	0/125
Education (Golestan Province - General Department)	Education (GP-GD)	0/000	0/000	0/000	0/078	0/000	0/125
Institute for the Intellectual Development of Children and Young Adult (Golestan Province)	Institute for the Intellectual Development of Children and Young Adult (GP)	0/000	0/000	0/000	0/078	0/000	0/125
Private Companies	-	0/000	0/000	0/000	0/078	0/000	0/125
Meteorological Organization (Golestan Province -General Department)	Meteorological Organization (GP-GD)	0/000	0/000	0/000	0/078	0/000	0/125
Agricultural and Natural Resources Research Center (Golestan Province)	Agricultural and Natural Resources Research Center (GP)	0/000	0/000	0/000	0/078	0/000	0/125
Culture and Islamic Guidance (Golestan Province - General Department)	Culture and Islamic Guidance (GP-GD)	0/000	0/000	0/000	0/078	0/000	0/125
Roads and Urban Development (Golestan Province - Cities of Golestan Province)	Roads and Urban Development (CGP)	0/078	0/008	0/061	0/118	0/002	0/138
Gas Company (Golestan Province)	Gas Company (GP)	0/059	0/004	0/042	0/098	0/001	0/133
Power Distribution Company (Golestan Province)	Power Distribution Company (GP)	0/059	0/004	0/042	0/098	0/001	0/133
Administrative Center of Golestan National Park and Biosphere Reserve	-	0/235	0/048	0/154	0/078	0/000	0/125
Bank	-	0/020	0/000	0/007	0/235	0/062	0/136
Department of Endowments and Charitable Affairs (Golestan Province - General Department)	Department of Endowments and Charitable Affairs (GP-GD)	0/020	0/000	0/007	0/078	0/000	0/125
Education (Golestan Province - Cities of Golestan Province)	Education (CGP)	0/059	0/001	0/030	0/078	0/000	0/125
Roads and Urban Development (Golestan Province -General Department)	Roads and Urban Development (GP-GD)	0/039	0/000	0/031	0/176	0/044	0/131
Ministry of Interior	-	0/020	0/000	0/022	0/098	0/002	0/128
Park Rangers' Assistant	-	0/020	0/000	0/022	0/078	0/000	0/125
Firefighting and Safety Services (Golestan Province)	Firefighting and Safety Services (GP)	0/039	0/000	0/024	0/078	0/000	0/125
Islamic Revolution Housing Foundation (Golestan Province - General Department)	Islamic Revolution Housing Foundation (GP-GD)	0/059	0/001	0/065	0/118	0/006	0/125
Health Center (Cities of Golestan Province)	Health Center (CGP)	0/020	0/000	0/007	0/188	0/005	0/125

According to Table 2, the reference network indicates that the high level of participation from village administration offices, members of the Islamic village council, districts, and governorates underscores the significant role of trust in public agencies concerning the management of Golestan National Park. Furthermore, “Mediation Role” is a prominent role in this region, primarily attributed to community institutions such as Village

Administration Offices and Members of the Islamic Village Council. In terms of the Eigenvector index related to the Management of Golestan National Park, public agencies are notably significant, reinforcing the aforementioned findings. In the context of stakeholders' “Network Referrals” regarding issues related to Golestan National Park, there has been a targeted approach to referrals, resulting in a relatively good referral rate. This rate may be attributed to purposeful referrals and their subsequent success. Within the “Collaboration Network”, the centrality index highlights the prominence of community institutions, particularly councils and village councils. Generally, community institutions have expressed satisfaction with the implementation mechanisms, which is a positive outcome. Additionally, an analysis of the "betweenness centrality index corroborates the findings of the degree centrality index, indicating that, alongside government institutions, public agencies also serve as mediators’ role. This role is crucial and beneficial in fostering public participation in the management of the Park. Table 3 presents a comparative analysis of the degree centrality, betweenness, and special vector indices of reference and collaboration networks, along with the number of isolated individuals and existing groupings. Village Administration Office and Natural resources and watershed of the city mentioned in the referral network and collaboration network show the highest indicators.

Table 3. Comparison of the numerical values of the micro-indicators of the referral and cooperation network of stakeholders involved in Golestan National Park.

Indicator	Referral Network	Collaboration Network
Degree	Village Administration Office: 0/471	Department of Environment of the city: 0/451
Betweenness	Natural resources and watershed of the city: 0/161	Department of Environment of the city: 0/451
Eigenvectors	Village Administration Office: 0/490	Village Administration Office: 0/166
The number of isolates	19	5
1 k-core	12	11
2 k-core	20	10
3 k-core	25	4
4 k-core	30	42
5 k-core	-	23
6 k- core	-	15

Individuals or organizations that have not established connections within the network are referred to as isolated points. In the referral network, isolated points include the General Directorate of Sports and Youth, Shooting Board, City Information Department, General Directorate of Crisis Management, Office of Rural Affairs, Hunting and Shooting Center, Security Council, Waste Management Organization, General Welfare Department, Water and Sewerage Company, Directorate General of Fisheries, Directorate General of Education, Children and Institute for the Intellectual Development of Children and Young Adult (Golestan Province), Private Companies, Directorate General of Meteorology, Agricultural Research Center, and the Department of Culture and Islamic Guidance, in addition to the registration of documents and cooperation network, which includes Housing Foundation 1, Tourism Guide 4, Islamic Village Council 2, Natural Resources and Watershed Management Organization city 1, and the General Water and Sewerage Department 2. The numbers following the names indicate the number of indicators. These points represent individuals and organizations that either did not select other individuals or organizations within the referral and collaboration network or were not selected by others. Generally, a lower number of isolated points in a network correlates with a higher density of the network.

Multi-Core Groupings (k-core): A k-core is defined as a group of actors, all of whom are connected to a specified number (k) of group members. In this research, four groupings were identified in the referral network: single-core, two-core, three-core, and four-core. Additionally, six groupings were identified in the cooperation network: single-core, two-core, three-core, four-core, five-core, and six-core. For instance, single cores represent individuals and organizations that have selected only one other individual or organization within the referral and cooperation networks or have been chosen by a single organization or individual. Generally, a lower number of single

connections in a network and a higher number of multiple connections indicate greater network density. Single cores in the referral network include Popular Mobilization, Health Center, General Administration of Industry and Mines, Organization of Agricultural Systems and Engineering and Natural Resources of Golestan Province, park rangers' assistant, Bank, Endowments and Charitable Affairs, Water and Sewerage Company, Land Affairs - Agricultural Jihad Organization, Farmer 1, and park rangers' assistant 4. In the cooperation network, single cores include Farmer 1, park rangers' assistant 3, park rangers' assistant 1, veteran 1, park rangers' assistant 4, environment activist 2, hunter 1, park rangers' assistant 2, natural resources of the city 3, members of the Islamic village council 3, and Department of Environment (cities of Golestan Province). Moreover, the increase in groupings from the referral network to the cooperation network suggests a higher level of satisfaction among beneficiaries regarding referrals, which is considered a very positive indication. Fourth Step: Drawing Reference and Cooperation Networks. The analysis of network micro-indexes, including degree centrality and betweenness centrality, along with specific vector centrality and the visualization capabilities of Netdraw software, facilitates the interpretation of social relations in the study area of Moore. It is important to note that Netdraw is included within the UCINET 6.528 software package and enhances its capabilities by allowing for the generation of visual graphs.

3.1. Referral network

Fig. 2 illustrates the centrality of the referral network among stakeholders involved in the management of Golestan National Park who participated in the workshop meeting. In this figure, communication patterns and stakeholder choices are represented by blue squares, while the stakeholders themselves are depicted using red circles. Additionally, the size of the circles and squares reflects their centrality within the network. The most central stakeholders include the Departments of Environment of the cities, the Natural Resources and Watershed Management departments of the cities, the Village Administration Office, the Islamic councils of villages, district administrations, Governorates, Golestan National Park, and the Cultural Heritage and Tourism Departments of the Cities, respectively. This indicates that the majority of stakeholders in Golestan National Park have referred to these departments concerning management issues. On the other hand, these stakeholders have reported that they have referred to 31 public and government organizations or institutions, with many naming more than four organizations or institutions. Notably, the participants indicated that they did not refer to 19 public organizations or institutions at all, the majority of which are government entities, except private companies.

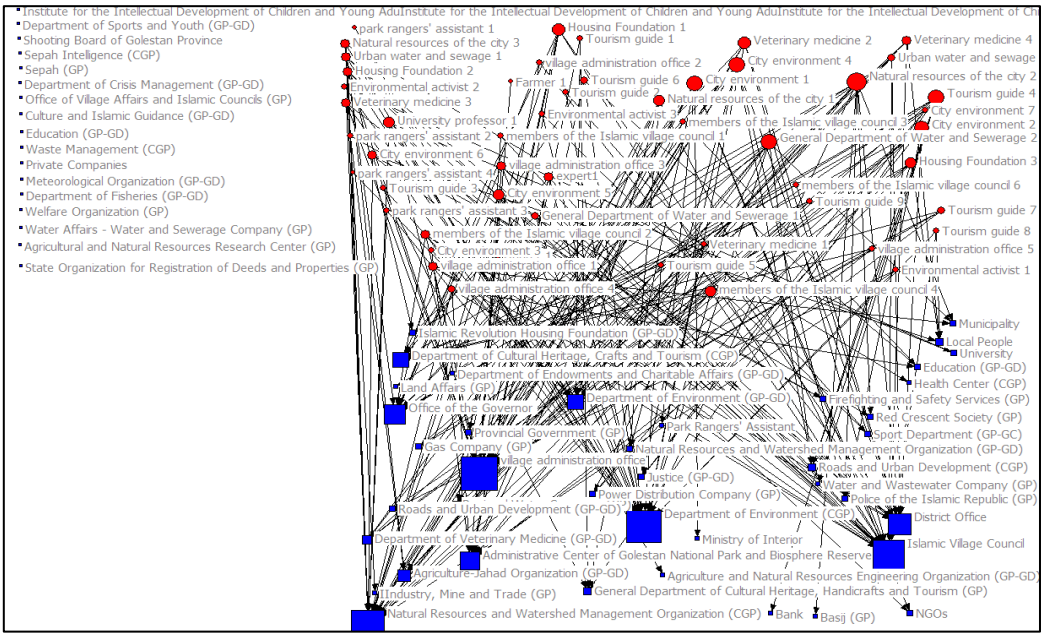

Fig. 2. Centrality of the degree of referral network of stakeholders involved in the management of Golestan National Park.

Fig. 3 illustrates the degree of centrality of the stakeholders' collaboration network involved in the management of Golestan National Park. In this figure, stakeholders' communication patterns and choices are represented by blue squares, while the stakeholders themselves are depicted with red circles. The size of the circles and squares indicates their centrality within the network. The results of the centrality calculations vary; however, the Departments of Environment of the Cities, the Departments of Natural Resources and Watershed Management, the districts, The Governorates, and the Islamic Councils of the Villages have emerged as the most frequently involved stakeholders. The variation in the special vector centrality index is more pronounced than in the other two indices, which can be attributed to the similarities in the choices made by the stakeholders involved in the management of Golestan National Park. In fact, the satisfaction patterns of stakeholders in the park exhibit significant similarity. Furthermore, these stakeholders believe that although they have not engaged with 31 organizations or institutions, they are satisfied with the cooperation and involvement of all. However, five participants in this workshop expressed dissatisfaction with the collaboration and did not select any organization or institution, highlighting a difference from the reference network that lacked an isolation point. The analysis of this network reveals a notable strength in the presence of public agencies regarding stakeholder selection and the overall level of satisfaction with the collaboration of all public agencies and organizations.

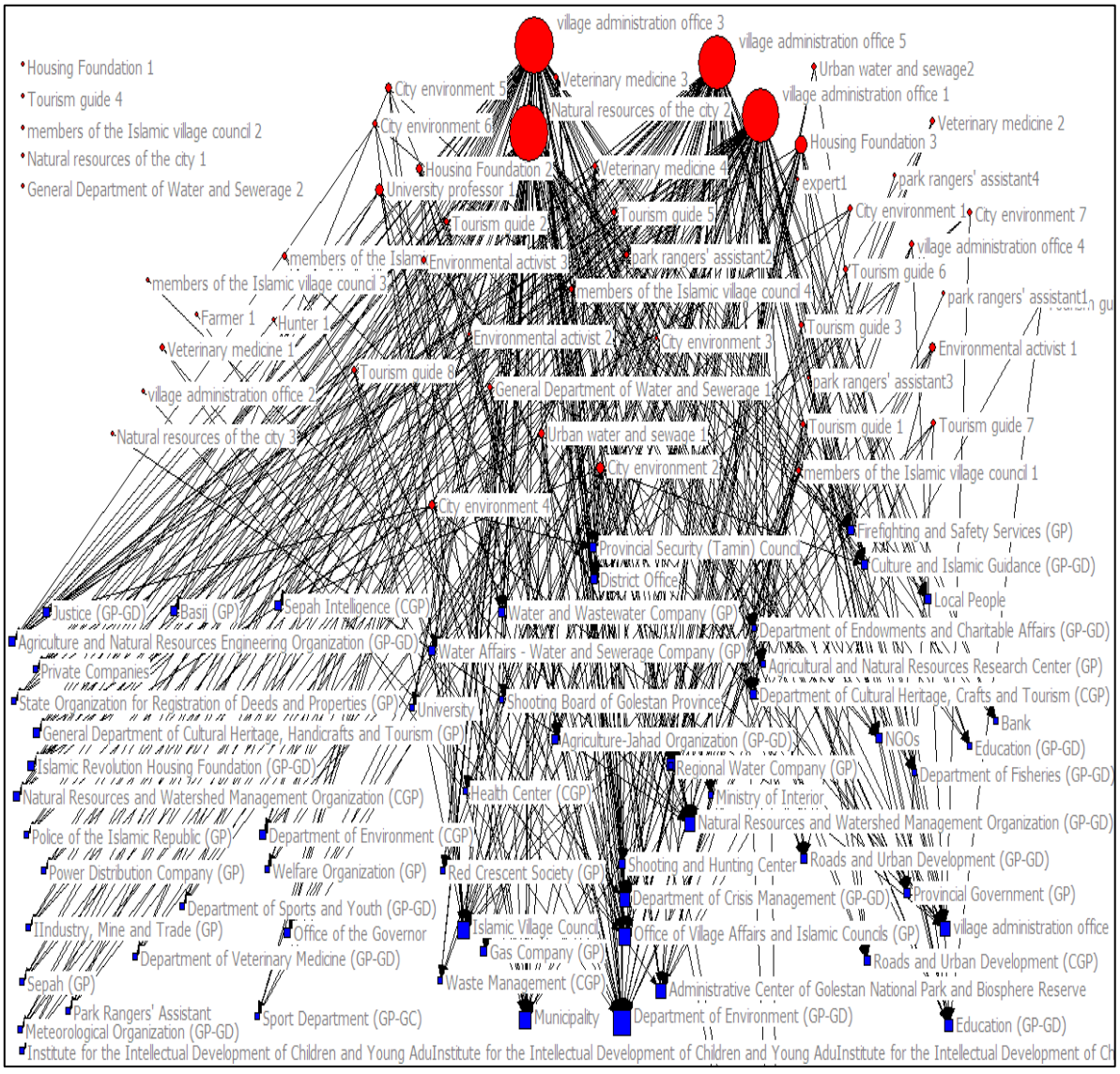

Fig. 3. Centrality of the degree of cooperation network of stakeholders involved in the management of Golestan National Park.

4. Conclusion

National parks serve as crucial biological centers that ensure the survival of ecosystems and their beneficiaries. Effective management of protected areas is best achieved through participatory management strategies. If managers do not possess a clear understanding of the stakeholders' positions within the area, management efforts are likely to encounter significant challenges. Therefore, the initial step in participatory management involves identifying the stakeholders relevant to the area of study. By identifying and analyzing stakeholder relationships, the strengths and weaknesses of communication networks become evident, allowing managers to implement necessary measures for improvement in collaboration with stakeholders. Cona and Bodin (2006) emphasize the importance of stakeholders input in the planning and management of natural areas. Establishing an appropriate platform for implementing participatory management is also of paramount importance. The objective of this research was to identify and examine the relationships among stakeholders involved in Golestan National Park, as well as to pinpoint the strengths and weaknesses of communication networks among them. In general, two types of networks—reference and collaboration—were identified and analyzed in this study. The “reference network” signifies communication, while the “collaboration network” reflects the degree of stakeholders’ participation. The findings indicate that the “communication network” established between executive bodies and public stakeholders in the management of the park have been highly positive, suggesting a favorable environment for implementing public participation projects. Notably, positive aspects identified within both the reference and collaboration networks include a high level of satisfaction among stakeholders regarding the mechanisms of implementation and a strong role played by public agencies. However, a negative aspect observed in the networks is the presence of isolation. Additionally, it was noted that the number of referrals from the reference network to the collaboration network has decreased, which can be interpreted as a positive development. Regarding micro-indicators of the network, the most centrality indicators in the reference network are associated with several departments, including Departments of Environment, Natural Resources and Watershed Management, Village Administration Offices, Islamic Councils of Villages, District Administrations, Governorates, Administrative Center of Golestan National Park and Biosphere Reserve, and the Cultural Heritage and Tourism Department of the Cities. This indicates that most stakeholders in Golestan National Park have sought assistance from these departments for matters related to park management. Furthermore, the role of law enforcement as an executive institution in the area is significant. In this context, in addition to governmental institutions, community members also have the potential to act as mediators, underscoring the park's capacity for implementing a participatory management model. According to findings related to Village Councils and Councils, these bodies can serve as vital mediators in this process. Research conducted by Chen et al. (2020) in China supports the notion that local and civil society activists may serve as effective mediators, while Ghorbani et al. (2012) highlighted the important roles played by councils and community organizations as representatives of popular structures. In summary, Golestan National Park is positioned favorably concerning stakeholder relationships and their level of satisfaction. The implementation of collaborative projects has the potential to serve as a catalyst for improved management of Golestan National Park.

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