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Roles and Functions of Tourism Destinations in Tourism Region of South Anhui: A Tourist Flow Network Perspective

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Abstract: Theoretic and practical significance has been highlighted in the research of the roles and functions of destinations, as destinations are restricted by the spatial structure based on tourist flow network from the perspective of relationship. This article conducted an empirical analysis for Tourism Region of South Anhui (TRSA) and revealed the necessity and feasibility of studying the roles and functions of destinations from tourist flow network′s perspective. The automorphic equivalence analysis and centrality analysis were used to classify 16 destinations in TRSA into six role types: tourist flow distribution center, hub of tourist flows, passageway destination, common touring destination, attached touring destination, and nearly isolated destination. Some suggestions were given on suitable infrastructure construction and destinations service designs according to their functions in network. This destination role positioning was based on tourist flow network structure in integral and macroscopic way. It provided an important reference for the balanced and harmonious development of all the destinations of TRSA. In addition, this article verified the applicability of social network analysis on tourist flow research in local scale, and expanded this method to destination role and function positioning.

Keywords: tourist flow network; equivalence model; roles; functions; centrality analysis; Tourism Region of South Anhui

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1 Introduction

Based on the concept of ′tourism systems′, which was established by geographers, tourist movements and flows should be located at the core of regional tourism structures (Pearce, 1979). They are fundamental to the study of all three components: origin of tourists, tourist destinations, and routes between the two locations, as a total system (Boniface and Cooper, 1994). Therefore, the patterns and rules of tourist flows are key issues in tourism geography research. In addition to the extended studies on the concept, types, characteristics and influential factors of tourist flow, various patterns of tourist flows are always the major focus in previous literature, most of which are focusing on interior issues, including spatial and temporal characteristics of tourist flow, the formation mechanism and forecast models. Until recently, the directivity and spatial guiding of tourist flow on the regional tourism system development has been taken into account by researchers (Lew and McKercher, 2006; Wang and Gao, 2008; Liu *et al*., 2010a, Yang and Wong, 2012). Lew and McKercher (2006) illustrated that tourists′ space-time movement and its influential factors have important implications for infrastructure and transport construction, product development, destination planning and new attractions establishment, as well as management of the social, environmental, and cultural impacts of tourism. Therefore, the theoretic and

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practical significance should be improved upon the exploration of spatial distribution and agglomeration of tourism industry as well as functional positioning for destination in the regional scale, by taking tourist flows as the core element within destination positioning research, because of its spatial guiding and integrating functionalities.

It is very important to the existence and development of a destination, that tourist flows inside and outside regions tend to place restrictions on sustainable development of regional tourism industry both collective and individual ways. The development, status and roles of one destination are not only bound to the quality, class and scale of tourism resources, but also subject to the generation and movement of regional tourist flows in a certain spatial scale. However, instead of from tourist flow perspective, the traditional positioning methods have been recommended by large number of researchers from marketing perspective (Crompton *et al*., 1992; Pike and Ryan, 2004; Pike, 2012), and most of destination function studies focused on the conceptual models, which were based on the spatial analysis of tourism itineraries and applied to empirical studies (Mings and McHugh, 1992; Oppermann, 1995; Lew and McKercher, 2002; Liu *et al*., 2009). Lew and McKercher (2002) divided the roles of tourism destination in Hong Kong into five types (single, gateway, egress, touring and hub destination) according to the exploration on the spatial pattern of tourist itineraries accessing various origins, Liu *et al*. (2007) have carried out an empirical study of Tunxi District, Huangshan, China. In addition, the status, functions and evolution of destinations, the spatial cooperation and competition of regional tourism, have been found to be important aspects of destination roles and functions (Yang *et al*., 2007; Jian *et al*., 2008; Li *et al*., 2008). However, most previous articles were limited to isolated and individual destinations; they failed to reflect the spatial dynamic guidance of tourist flows and consider the positioning of various destinations in whole region, which should be contacted by tourist flows. Furthermore, the studies did not provide reasonable quantitative indices for comparing the strength of destination functions. Thus, it is necessary to construct tourist flow network (TFN) based on social network theory and reveal the roles and functions of destinations through quantitative methods. Network theory has been applied in tourist flow research by some scholars. Shih (2006) investigated the network characteristics of drive tourism destinations in Nantou, Taiwan, China, while Hwang *et al*. (2006) examined international tourists′ multi-city trip patterns within the United States by using network analysis. Regarding studies conducted in China, Zhou (2008) analyzed the space structure character of aviation tourism system in Sichuan and measured the linkage between tourism destinations. Chen and Huang (2006) used network analysis to study the tourism spatial structure of Fujian Province. Furthermore Liu (2010a; 2010b) took a deep insight about the inbound tourist flow in China by social network analysis models and divided 31 provincial destinations into four groups. However, these literature are restricted to the spatial scale in the provincial or regional levels. With less instruction for the development of local tourism, there may be more practical value to analyze tourist flow network in microscopic or middle area by social network theory.

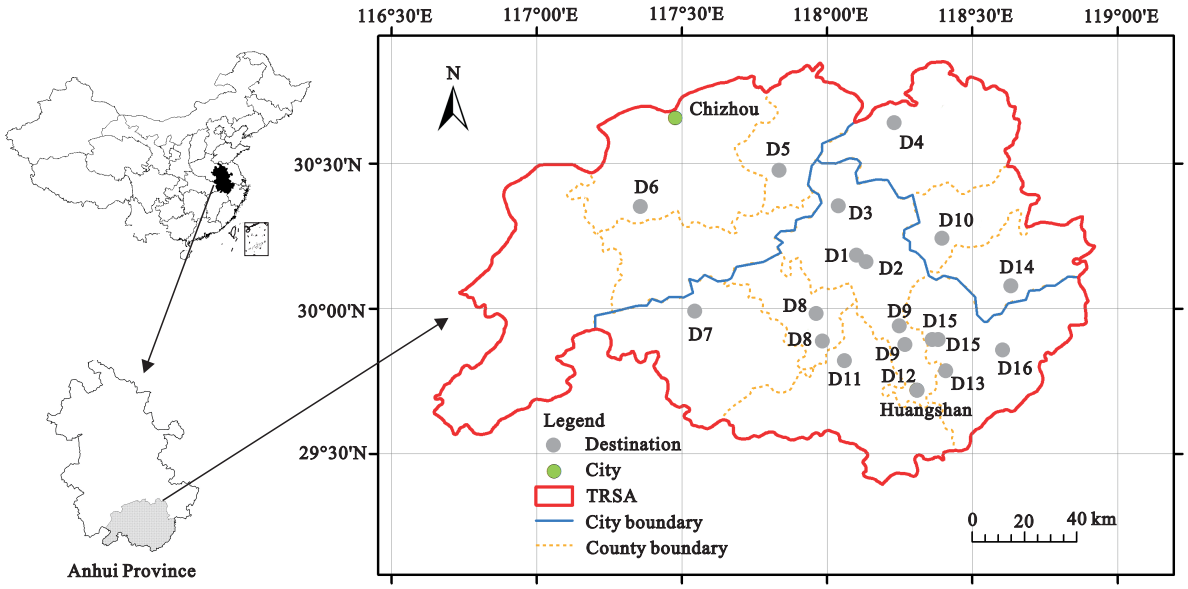
This article aims at filling the gap in this field by following attempts: firstly, we constructed a theoretical model of regional tourist flow network, and the model′s rationality and necessity in classification and positioning of roles of destinations were analyzed and explained by the social network analysis. Secondly, some indices were employed to identify the roles and functions of destination in a measureable way. Finally, based on the data from field work and internet survey, we applied the model to the Tourism Region of South Anhui (TRSA), China. By doing all of these, this paper would not only offer a new method for the study of role and position of destination, but consequently provide rational suggestions about tourist routes designing, accommodation planning and co-marketing for TRSA.

2 Study Area and Methods

2.1 Study area

For the definition of the Tourism Region of South Anhui (TRSA), this article defined it as a smaller South of Anhui Province (SAP) (Lu, 1995; Zhang *et al*., 2005), it is similar to ′South Anhui Mountains and Lakes Tourism Area′, which is defined in the ′General Development Plan for South Anhui Mountains and Lakes Area′ by WTO and the People's Government of Anhui Province, rather than the larger one defined in other studies (Zhang and Zhao, 2004; Liu *et al*., 2007) (Fig. 1). From

previous studies, tourist flows in SAP were focused on Huangshan City and its neighboring counties and rarely interrelated and interacted with other cities such as Maanshan and Tongling (Liu *et al.*, 2007). So this article defined TRSA as Huangshan City, Chizhou City, and Jinxian County, Jingde County, Jixi County of Xuancheng City (Fig. 1). Highly qualified tourism resources are abundant in TRSA, which are rarely seen in Anhui, China, even in the world, it have been the major part and representative of Anhui tourism (Table 1).



D1, Huangshan Mountain; D2, Jadeite Valley and Jiulong Waterfall; D3, Taiping Lake; D4, Headquarters of the New Fourth Army; D5, Jiuhuashan Mountain; D6, Qiupu River and Dawang Cave; D7, Guniujiang Mountain; D8, Xidi and Hongcun; D9, Qiankou and Chengkan Ancient Village; D10, Jiangcun; D11, Qiyunshan Mountain; D12, Tunxi Old Street; D13, Huashan Mysterious Grottoes; D14, Longcun Hu Families′ Ancestral Hall; D15, Bao Families′ Garden and Tangyue Memorial Archway Group; D16, Xin′anjiang River Landscape Corridor

Fig. 1 Locations of Tourism Region of South Anhui (TRSA) and destinations

Table 1 Profile of tourism resources in TRSA by August, 2009

Grade	TRSA	Anhui
World heritage	2	2
4A and 5A grade tourist attractions	19+2	42+2
National park of China	4	10
UNESCO Geopark	1	1

Note: UNESCO is abbreviation of ′United Nations Educational, Scientific and Cultural Organization′

2.2 Tourist flow network and destination role analytic model

Certain kinds of geographic flows, especially the tourist flow, can be considered as relationships connected destinations, tourism industries, channels and all of key elements within a tourism region. The network constructed by the tourist flows is evident and should be located as the core of regional tourism system. It is superior to some other structures, such as the structure of resources, infrastructures, traffic, *etc*. Moreover, it is the key factor that affects destinations′ roles and functions. The roles and functions do not only depend on the tourist perception of destination image and the market targeting, but also bring along and promote the development of other destinations, because the tourist flow interaction is one of the concrete manifestations. The positioning of a destination in the regional tourist flow network, as well as its interaction with other destinations in the network, has the important meaning to its development. Thus, this article applies social network analysis (SNA), which has been applied widely to research on management, economics, informatics and some other areas (Liu, 2004), to study the regional tourist flows and destination roles. SNA is used to reveal social structure by gathering and analyzing actors and relations of statistics (Yang and Chen, 2007). Hwang *et al*. (2006) and Shih (2006) applied this method into tourism studies. In this article, the positioning of roles and functions depends on the interactions of destinations in the tourist flow network, instead of taking the destination as an isolated unit. Therefore it would avoid the

ordinary statistical discrepancy, since the roles or functions are not equivalent to the one in the general sense of the statistical scale. The rank in terms of the tourist arrivals and tourism revenue is not the only determinant in TFN. However, the role of a destination in the network rests on the quantity and intensity of the connections with the others, which would reflect its ability of controlling and coordination of the tourist flows it connected. Therefore, the role categorization of destinations could realize in this more macroscopic system, and it is more meaningful as positioning strategies in such an integrated paradigm.

2.2.1 Tourist flow network

Social network analysis aims to examine both the contents and the patterns of relationships among actors in the network to understand their relations and interactions (Scott, 2000). The first step of the analysis is to identify the actors and their relationships. In tourism network, most of the studies take destinations which are up to a certain standard as actors, and tourist flows which are up to a certain scale as relations. The flows could possess quantitative and directional characteristics as well (Hwang *et al*., 2006; Shih, 2006; Yang *et al*., 2007). In this research, we define that the destinations and the tourist flows among them constitute the regional tourist flow network (TFN).

2.2.2 Equivalence model

Equivalence analysis is the basis of network positions and social roles in SNA (Scott, 2000). Two actors in a graph or set of relations will be called ′structural equivalence′ if they are connected in the same way to structurally related actors, and could be classified into the same role type (Lee, 1978; Liu, 2004). The contribution and refinement of equivalence model are numerous (Borgatti and Everett, 1992). According to various understanding of similarity, the qualitative definition of equivalence differs, and common equivalence measures include structural equivalence, automorphic equivalence, regular equivalence and so on. Among these measures, structural equivalence, the strictest, requires the identical pattern of relations to and from all other actors. Two actors are automorphically equivalent if they are completely indistinguishable in a graph of the network, with actors' labels removed (Michaelson and Noshir, 1992). Regular equivalence is the loosest. In TFN, if two destinations link to the same core and control or be controlled by same quantities of actors, they should be clustered in the same role group. Therefore, the automorphic equivalence is more suitable to analyze the roles of destinations in TFN. This process can be realized in the professional SNA software, Ucinet6.0178 (Borgatti *et al*., 2002).

2.2.3 Centrality analysis

The equivalence analysis could classify destinations into different categories, but the significance of each role should be demonstrated by centrality indices. Centrality analysis is an important component of SNA. It exhibits the importance, superiority and privilege of actors in network (Liu, 2004). Centrality has been widely applied to tourism issues to quantify functions, power and influences of destinations (Hwang *et al*., 2006; Shih, 2006; Yang *et al*., 2007). The common centrality models comprise of degree centrality, closeness centrality and betweenness centrality, which have been used and explained frequently (Hwang *et al*., 2006; Shih, 2006; Yang *et al*., 2007). So here is just to introduce its significance in destination positioning study.

(1) Degree centrality (DC): DC is measured simply by the number of direct ties involved a given actor (Freeman, 1979; Marsden, 2002), and could reflect the importance of destination in TFN. It can be divided into two parts: out-degree and in-degree centrality. The out-degree centrality of a destination is the indicator of the effects of tourist flow divergence to others in the region. The higher out-degree means better performance as the gateway with more tourists taking this destination as the entrance to the region. On the contrary, the in-degree centrality reflects the gathering ability of tourist flows. By examining and comparing the two indices, we can judge the function of a particular destination as a gateway, egress or hub.

(2) Closeness centrality (CC): CC depends on the geodesic distance, which is the minimal length of an indirect path from one actor to another (Freeman, 1979; Marsden, 2002; Liu, 2004). The higher CC one destination has, the more transferability it possesses to other destinations. The more possibility to be the core of the whole network, and the less will it be dominated by others.

(3) Betweenness centrality (BC): BC reflects the intermediary location of a node along indirect relationships linking other nodes (Freeman, 1979; Marsden, 2002; Liu, 2004). It is used for a destination to measure the level of its control of and dependence on other destinations in macroscopic angle. Higher BC means more

powerful control of tourist flows and more structural advantages, which indicates a destination will be depended by other destinations in a more intensive way.

DC shows the communication ability of a destination with other destinations by tourist flows. CC reflects transferability and efficiency for tourists flow in the region. BC indicates the power of one destination to control others by tourist flows. By analyzing and contrasting these indices, we could identify the strength and weakness of destinations in regional tourist flows, and judge get preliminary results in terms of their role.

2.3 Actors identifying and tourist flow data collection

Tourism destination could be defined as not only the holonomic system which is relative to tourist origin, but also a series of destinations or a single spot in travel route, such as city, village, isle, even cruise (Jafari, 2003). In the small or middle-scale area, tourism attractions, especially the higher rated tourist attractions and the accommodations around them, have been the engines of regional tourism growth (Myriam and Ruud, 2005), and determine the direction of regional tourist flows and target markets. Therefore, it would be more thorough and rational of selecting high rated tourist attractions as actors to reflect the characteristics of regional tourism. For TRSA is relative small, we took 19 National 4A and 2 National 5A Grade Tourist Attractions in TRSA as actors, then according to resource homogeneity and geographical closeness, combined them into 16 actors to facilitate the research.

One critical problem that restricts the generalizability of tourist flow research lies on the deficiency in detailed, standard and accurate data, since each tourist′s spatial movement cannot be recorded thoroughly and accurately (Myriam and Ruud, 2005; Noam and Michal, 2007). Yet some scholars collected precise tourists spatial data by passive mobile positioning methods (Ahas *et al*., 2007), and the majority of the data for studies come from investigations and panel data. On the other hand, the package travel plans and routes designed by travel agencies are still the main selection of mass tourists; the tourism itineraries designed by the travel agencies provide a lot of information guidance. So this article used both tourist survey and travel routes from travel agency to collect the tourist flow data of TRSA.

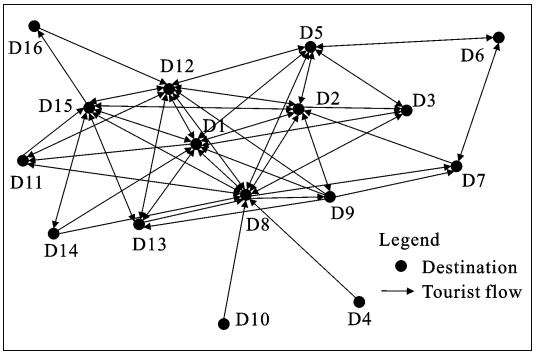
The survey was conducted on main attractions of Huangshan City and Chizhou City during October and December in 2008 by self-administered questionnaire. A total number of 500 questionnaires were issued and 456 were returned. Among them 444 copies were valid. The response rate and valid response rate were 91.2% and 88.8%, respectively. After eliminating 98 copies that only contained single destination, 346 questionnaires were used to get tourist flow data, while all available data were used to analyze the total character of interviewees (Table 2). Besides this, 308 itineraries were

Table 2 Demographic characteristics of interviewees

Information	Category	Proportion (%)	Information	Category	Proportion (%)
Gender	Male	58.6	Monthly income	2000–3000 yuan	24.7
	Female	41.4		3000–5000 yuan	26.0
Age	<14	0.5		≥5000 yuan	23.2
	15–24	19.2	Profession	Worker	6.5
	25–44	49.4		Farmer	0.9
	45–64	24.7		Student	10.6
	≥65	6.1		Government employee	13.7
Degree of education	Elementary school and below	1.6		Management personnel	8.1
	Junior high school	7.2		Commercial personnel	12.8
	Senior high school	17.4		Military personnel	1.1
	Junior college	28.5		Teacher	6.5
	Bachelor	41.9		Professional staff	10.1
	Postgraduate	3.4		Serviceman	4.5
Monthly income	>500 yuan	1.3		Private owner	4.1
	500–1000 yuan	3.3		Retired people	5.9
	1000–2000 yuan	6.6		Others	15.0

collected from 50 travel agencies in Huangshan, Chizhou, Shanghai, Beijing, Guangzhou, Chengdu and Hefei from Internet. The cities include the local, the primary (Hefei, Shanghai), secondary (Beijing, Guangzhou) and tertiary (Chengdu) tourism market of TRSA, to ensure the veracity and credibility of the data.

This article constructed a 16 × 16 matrix for representing the tourist flow network, in which a row stands for the starting point of the 16 collected attractions and a column for the terminal. The number of tourists moving from one destination to another was recorded in the relative cell. Both surveyed and travel itineraries data were arranged into the same matrix and got the tourist flow network matrix X_{ij}. Then we dichotomized it (the cut-off value is three), and get the X'_{ij}, which was the 1-mode directional network (Liu, 2004) of tourist flows among destinations in TRSA (Fig. 2).



D1, Huangshan Mountain; D2, Jadeite Valley and Jiulong Waterfall; D3, Taiping Lake; D4, Headquarters of the New Fourth Army; D5, Jiuhuashan Mountain; D6, Qiupu River and Dawang Cave; D7, Guniujiang Mountain; D8, Xidi and Hongcun; D9, Qiankou and Chengkan Ancient Village; D10, Jiangcun; D11, Qiyunshan Mountain; D12, Tunxi Old Street; D13, Huashan Mysterious Grottoes; D14, Longcun Hu Families′ Ancestral Hall; D15, Bao Families′ Garden and Tangyue Memorial Archway Group; D16, Xin′anjiang River Landscape Corridor

Fig. 2 Sketch map of tourist flow network in Tourism Region of South Anhui

3 Results and Analyses

A Euclid distance matrix was firstly worked out by equivalence analysis on X'_{ij}, which could represent the role similarity. By visualizing the matrix, we got a cluster diagram of destinations equivalence (Fig. 3).

The equivalence distance is shown in Fig. 3. By selecting 12.818 as cut-off value, we could divide the destination into seven types. After that, considering the actual conditions of the destinations, we generalize them into six role types: 1) Jiangcun, Headquarters of the New Fourth Army; 2) Xidi and Hongcun; 3) Huangshan Mountain, Tunxi Old Street; 4) Jiuhuashan Mountain, Bao Families′ Garden and Tangyue Memorial Archway Group, Jadeite Valley and Jiulong Waterfall; 5) Taiping Lake, Guniujiang Mountain, Qiankou and Chengkan Ancient Village, Qiyunshan Mountain, Huashan Mysterious Grottoes; 6) Qiupu River and Dawang Cave, Longcun Hu Families′ Ancestral Hall, Xin′anjiang River Landscape Corridor. The representative of each type should be explained comprehensively. In the light of Lew and McKercher′s study (2002), according to centralities of destinations (Table 3) and their specific conditions and characteristics, we proposed the preliminary scheme on 16 destinations in TRSA (Table 4).

(1) Xidi and Hongcun were the Tourist flow distribution center. Although they were not exclusively the key tourism element and tourism traffic hub of TRSA, they had become the representative brand of Huizhou (an ancient placename in Anhui Province) Culture, and kept lots of connections with many other tourist attractions, especially small ones. This type of diffusing function had exceeded Huangshan Mountain. Xidi and Hongcun controlled the transferability of relative tourist flows extensively. However, the lack of gateway and egress function (Lew and McKercher, 2002) hindered them to be the tourists hub and distribution center and could not control the entrance and exit of tourist flows. Therefore, it is suggested that they should tighten the relations with traffic hub of SAP and improve their own transport services in the future.

(2) As the destinations with the most tourists of TRSA, Huangshan Mountain and Tunxi Old Street were restricted by resources and route arrangement to become the hub of the region. Despite being the best-known destination, Huangshan Mountain received and carried the maximum amount of tourists. But its tourist flows linkage concentrated on limited number of destinations with a certain distance and resource types, the hub functions it carried were confined. Relying on the agglomeration of infrastructures in Tunxi District, especially the density of accommodations, transportations and tourist shopping malls, Tunxi Old Street had been the tourist flow center of the southern Huangshan City. However its radiation to the north of TRSA was limited. Therefore it was just a regional hub of TRSA.

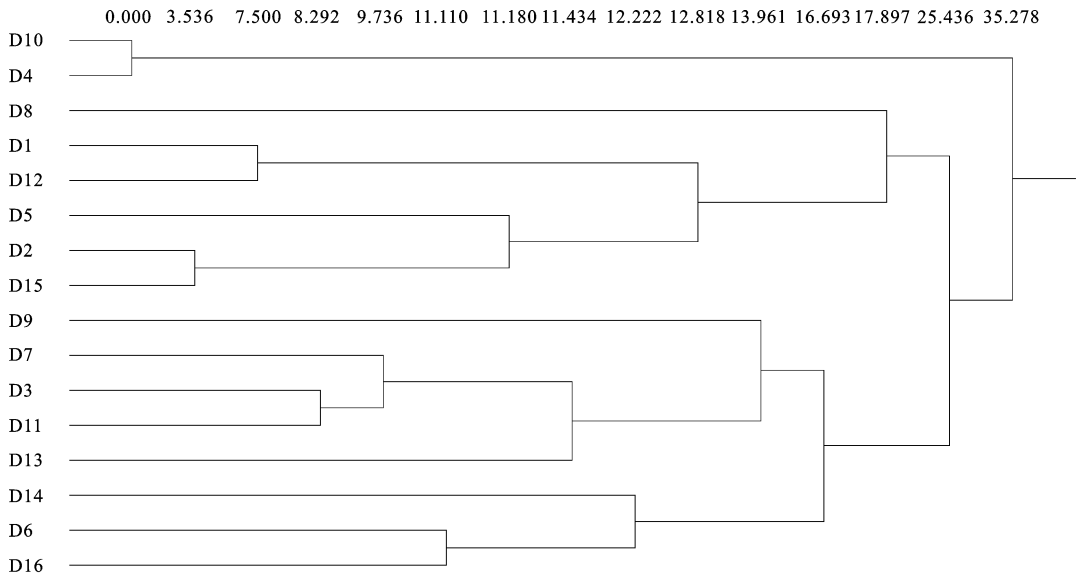


Fig. 3 Sketch of equivalence cluster about destinations

Table 3 Results of centrality analysis about tourist flows network

Destination	Degree centrality		Closeness centrality		Betweenness centrality
	In	Out	In	Out	
D1	60.00	53.33	71.43	30.00	17.22
D2	46.67	46.67	65.22	29.41	18.73
D3	26.67	20.00	55.56	26.32	0.00
D4	0.00	6.67	6.25	31.92	0.00
D5	40.00	40.00	34.09	60.00	20.12
D6	13.33	13.33	42.86	23.44	1.00
D7	20.00	13.33	53.57	25.00	5.50
D8	73.33	60.00	78.95	30.61	56.58
D9	13.33	33.33	50.00	27.27	1.75
D10	0.00	6.67	6.25	31.92	0.00
D11	20.00	20.00	51.72	26.79	0.00
D12	60.00	46.67	71.43	29.41	22.71
D13	26.67	26.67	50.00	27.27	1.00
D14	6.67	20.00	39.47	26.79	0.00
D15	46.67	46.67	62.50	28.85	31.83
D16	6.67	6.67	40.54	24.19	0.00
Max	73.33	60.00	78.95	31.92	56.58
Min	0.00	6.67	6.25	23.44	0.00
Mean	28.75	28.75	50.52	27.94	11.00
S.D.	22.33	17.44	20.04	2.45	15.57

In this article, Huangshan Mountain, the core and leading attraction, got behind with Xidi and Hongcun in tourist flow functions. This probably can be explained by two reasons. The first one is the characteristics of resources and arrangements of tourist activities. The invaluable Huangshan Mountain is easier to fulfill tourists′ needs, so tourists′ journeys usually center on Huangshan Mountain, visiting relatively few destinations. Apart from this, under the shadow effect, other mountain resorts could not be considered in the routes. On the contrary, tourists usually spend less time in Xidi and Hongcun, and always arrange some other destinations before or after their visit, so the number and diversity of tourists to Xidi and Hongcun should exceed than Huangshan Mountain.

The second reason is related to the methods and research process this article used. The cut-off value this article used was relative small and the value network was not applied to reflect the flow intensity, this would lose some important information. Moreover, Xidi and Hongcun were taken as one destination, which would increase the flow quantity and range, especially tourist flows to some peripheral spots. Therefore, this type of tourist flow function was strengthened inevitably. Meanwhile, the sample size was small and there were many students in samples of Hongcun. Many of these students came to sketch scenery, with a long length stay and had plenty of leisure times to visit most of tourism attractions in TRSA. Therefore they contributed to the kinds and large number of tourist flows that was in or out Hongcun, which would affect network analysis.

Table 4 Types and characteristics of destination role in Tourism Region of South Anhui

Type	Destination	Centrality characteristics	Required facilities and activities
1) Tourist flow distribution center	D8	Highest and balanced centralities	Information and transport center, enforcement of traffic hub services, agglomeration of tourist facilities
2) Hub of tourist flows	D1, D12	Centralities were second only to Tourist flow Distribution Center	Information center, diversification of attractions, agglomeration of tourist facilities
3) Passageway destinations	D2, D5, D15	Comparatively higher betweenness and common centralities, while in or out CC was obviously higher	Refueling services and guiding facilities, souvenir shops for tourists, regional tourist center (especially Jiuhuashan Mountain)
4) Common touring destinations	D3, D7, D9, D11, D13	Out-centralities were nearly equal to in-centrality, both were low	Restaurants and souvenir services, carrying out collaborating marketing with the hubs and centers
5) Attached touring destinations	D6, D14, D16	All centralities were relatively lower	Promotion-related facilities and activities, enhancing collaboration with other destinations
6) Nearly isolated destinations	D10, D4	Only one tourist flow that was appended to a certain hub, and the lowest centralities	Promotion-related facilities and activities, developing the relations with other destinations

Notes: D1, Huangshan Mountain; D2, Jadeite Valley and Jiulong Waterfall; D3, Taiping Lake; D4, Headquarters of the New Fourth Army; D5, Jiuhuashan Mountain; D6, Qiupu River and Dawang Cave; D7, Guniujiang Mountain; D8, Xidi and Hongcun; D9, Qiankou and Chengkan Ancient Village; D10, Jiangcun; D11, Qiyunshan Mountain; D12, Tunxi Old Street; D13, Huashan Mysterious Grottoes; D14, Longcun Hu Families′ Ancestral Hall; D15, BaoFamilies′ Garden and Tangyue Memorial Archway Group; D16, Xin′anjiang River Landscape Corridor

After all, the roles and functions this article defined, largely depended on the tourist flow relations, rather than the scale of tourists and administrative center in tourism planning. The different results would reflect some underline problems and have certain reference for destination development and research.

(3) In the passageway destinations, Jiuhuashan Mountain differed from others. The most of eliminated samples which visit single destination were about Jiuhuashan Mountain. Its independent development was still apparent, and did not change even though its location condition improved (Tongling-Huangshan Expressway was opened to traffic in 2008). Resource characters, inertial development, path-dependence and the lag of strategy adjustment hindered up its hub functions. Jiuhuashan Mountain was more likely to be the northern gateway of TRSA, especially after Tongling-Huangshan Expressway opened. It is also indicated that the large amount of visitors do not bring structural dominance in regional tourism network inevitably. As the ′front or next station′ of Huangshan and Tunxi, Jadeite Valley and Jiulong Waterfall, Bao Families′ Garden and Tangyue Memorial Archway Group, received large volume of tourist flows and became exclusive affiliations of the hubs. What was more, the higher in-centralities showed that they sometimes were the regional egress destinations.

(4) Common touring destinations included Taiping Lake, Guniujiang Mountain, Qiyunshan Mountain, Qiankou and Chengkan Ancient Village and Huashan Mysterious Grottoes, whose tourist flows were centered on communication to the centers or hubs, while their mutual relations were rare. Their tourism development mainly depended on the centers′ stimulation and their roles were limited as touring destinations. Meanwhile the lower betweenness centrality illustrated that they were constrained by the hubs in tourist flow network, rather than constraining others, they had to rely on the hubs to some extent.

(5) Attached touring destinations included Qiupu River and Dawang Cave, Xin′anjiang River Landscape Corridor, Hu Families′ Ancestral Hall. Just as the concept shows, these destinations were attached to two or three hubs. For instance, Qiupu River and Dawang Cave connected to Jiuhuashan Mountain. The lower centralities indicated their weak ability to receive tourist flows extensively, and they were short of independence.

(6) Jiangcun and Headquarters of the New Fourth Army were isolated destinations. According to social network theory, the actors which depend on relation to single destination in the network are called appendix. If the single relation is broken, it would be isolated and disconnected from the network. This situation was coincided with our investigations in Jiangcun and the previous research (Liu *et al.*, 2007; 2009). The low itinerary referred frequency led to less tourist reception and exacerbated the tourist flows with a reducing trend.

This role positioning method could help destinations to understand their functions in tourist flow network, so as to assists them to complete infrastructures to improve

tourism functions and design marketable products and itineraries. Furthermore, it would direct the integration of TRSA in a macro-scope, and provide references to tourism alliance strategy making. For instance, the attached touring destinations should not only strengthen the relation and cooperation with Huangshan Mountain, Xidi and Hongcun, but also increase the connection to other common attractions in terms of transportation and communication for accessibility concerns.

4 Conclusions

It is crucial to identify destination functions and roles in regional tourism system, which is directed by tourist flows, as to recognize the key aspects of tourism development and make effective strategies and planning. This article constructed tourist flow network of TRSA, after introducing the destination role analytic model from social network theory, and identified the roles and functions of 16 destinations. They had been classified into six role types that were demonstrated in details and advised to be equipped with suitable infrastructures and services. Though this integral method of destination role positioning contributes to reveal the general problems, it is necessary to choose suitable development strategy and solutions according to their different conditions, backgrounds and the network centralities.

Under the practical constraints, this article only categorized 16 tourist attractions in TRSA and discussed the dynamics superficially. The results could be further improved by quantitative analysis in future studies. This article took 4A and 5A grade Tourist Attractions as the actors to construct tourist flow network, and maybe we can find a better way to capture the whole structure effectively. Besides, the wide range of tourist flows, such as capital, information and material, should be applied to studies of the tourism structure and destination functions as well. Finally, this study was based on the cross-section data. It could not reflect the formation and evolution of roles of destinations. This could be improved by comparing historical data in different stages. On the other hand, from the network technique point of view, with some more advanced technics of social network theory, such as the network dynamical model, the studies of tourist flow network and the destination functions it determined would be more comprehensive and scientific in future.

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