Emerging Social Media and Social Networks Analysis Transforms the Tourism Industry: Living Green Smart Tourism Ecosystem

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Abstract. Using the smart tourism ecosystem model as its framework as well as the strength of ties theory and the SNS social computing formula as a theoretical basis, this study establishes the Living Green tourism ecosystem to improve connections between businesses and the smart travel itinerary recommendation mechanism to promote the development of the entire industry. The Living Green tourism ecosystem has two major innovative features. (1) Visualizing industrial activity intensity and social connection intensity between businesses can not only help clearly understand the development of local businesses and assist in evaluating the effectiveness of industry development but also provide a reference for destination marketing organizations or relevant government agencies in terms of supporting the development of disadvantaged business segments. (2) The application of social media and social networks analysis helps implement the travel and tourism industry's development strategies. Based on businesses' social behaviors and interaction modes on social platforms, the tourism ecosystem calculates industrial connection intensity, uses it as an index for smart travel itinerary recommendations, and further enhances the overall promotion and development of the travel and tourism industry network.

Keywords: Smart tourism ecosystem · Strength of ties theory
Social networking activity intensity · Green tourism · Mobile application

1 Introduction

The proliferation of Internet technologies and smartphones has affected the travel and tourism industry and led to the popularity of mobile smart tourism applications. In short, smart tourism uses smartphones to provide travelers with personalized smart travel information services and to establish smarter, more effective and more sustainable connections between travelers and tourist attractions [1]. Smart tourism is also defined as the provision of ubiquitous tourism information services. It not only changes the travel behavior patterns of travelers, facilitates the acquisition of rich information, and creates

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relaxing and flexible travel experiences but also enables the travel and tourism industry to add value through the new service model [2]. In addition to smart tourism, the smart tourism ecosystem (STE) has also received considerable attention. The STE emphasizes that different economic entities in the travel and tourism industry, such as producers, distributors, consumers and government agencies, establish an environment for product promotion or service creation and distribution through competition and cooperation [3]. The establishment of shared value in business ecosystems not only improves business competitiveness and socio-economic conditions, enabling the generation of new species in the ecosystems, but also serves as a basis for promoting innovation and sustaining productive forces in business ecosystems. Tourism ecosystems are a typical example of this feature [4]. For instance, a tourism ecosystem is usually composed of many microorganisms. In addition to being defined by geographical location, the microorganisms place more emphasis on the connections and interactions among themselves. The introduction of intelligent technologies can effectively set up links between nodes in order to create a more active and intelligent network [5]. Through proper integration of smart sciences and technologies, a smart tourism ecosystem creates, manages and transfers intelligent tourism services and experiences. The information gathering and processing analysis following the acquisition of high-intensity travel-related information and shared value through these services is the main function of an STE [6]. The common goal of an STE is to create a rich, highly valued, meaningful and sustainable tourism experience through the information provided [7].

The current research classifies the member species of a smart tourism ecosystem into touristic consumer (TC), resident consumer (RC), tourism supplier (TS), other industry supplier (OS), and destination marketing organization (DMO). In terms of smart tourism applications, popular social media and mobile apps currently allow consumers to have a high degree of willingness to share and enhance their motivation to receive information, that is, when participating in social networking sites (SNSs) (i.e., Facebook) or experiencing location-based mobile services, touristic consumers or resident consumers also receive information provided by different species or the environment. As regards its applications in the context of tourism suppliers, smart tourism focuses on providing smart technology services and offering richer, more efficient and more effective services through data and information feedback to ensure service sustainability. DMOs are responsible for information and equipment, marketing management and quality control in innovative service patterns [8]. This shows that in order to create sustainable and intelligent digital services, the information chains between the supplier network and the consumer community need to be connected. Only in this way can efficient, effective and sustainable travel services be created through user activity and the feedback provided by user data. Unfortunately, current links between smart travel and the tourism industry are limited to the exchange and flow of information, and it is difficult to strengthen the mutually beneficial relationship between businesses in the industry, while relevant research is lacking on the reciprocity among businesses and the promotion of the industry's synergic development within the STE structure. To strengthen the connections in industrial networks and enhance the overall development of the travel and tourism industry, this study uses the strength of ties theory and the SNS social computing formula as the theoretic basis to establish a smart tourism ecosystem that can improve connections within the industry: Living Green. The study develops the Living

Green mobile app to provide innovative and intelligent mobile sightseeing services for smartphone users. This study is based on the travel and tourism industry in Chia-Yi, Taiwan. By selecting and connecting related local "natural," "environment-friendly" and "green" businesses, it builds a smart tourism industry network and ecosystem.

2 Design and Development of the Living Green Smart Tourism Ecosystem

2.1 Design Rationales of the Living Green Ecosystem

Using Granovetter's strength of ties theory and Gilbert's SNS social computing formula as its theoretical basis, the Living Green ecosystem developed in this research is a tourism ecosystem that promotes social connections in the travel and tourism industry. The strength of ties theory emphasizes the different intensity and relevance of social connections between nodes in social networks and divides social relations into ones with strong connections and ones with weak connections based on the connection intensity generated by different social behaviors and emotional interactions [9]. In reference to the social network theory proposed by Granovetter, Gilbert formulated a computing model of social connection intensity and applied it to SNSs to quantify social connection intensity [10]. This study first analyzes the SNS social tools currently used by the tourism industry, defines social function items, informationizes social behaviors, and then establishes a social behavior database of the tourism industry's social networking sites and develops a social networking analysis system by developing the specifications of application program interfaces (APIs) provided by community service software as well as community service communication. With the automatic scheduling and automatic analysis capabilities of the social platform and the industrial social behavior database, the study is able to quantify the industrial social index, which can be used to provide smart travel itinerary recommendations and prioritize related industrial information. The Living Green system's industrial social behavior gathering mechanism and industrial social connection computing mechanism are explained below.

(a) **Definition of social behavior within the industry.** In terms of gathering industrial social behavior, social connections between businesses in the industry can stem from a relationship of close cooperation based on category or of close competition based on geographical features. In addition, social behavior is established mainly through the flow of individuals (travelers) between businesses, and social interactions between travelers and tourism businesses are also related to the businesses' active performance. This study first summarizes the types of communities that current businesses form and the function projects for social interactions between individuals and businesses and classifies and defines the encoding. That is to say, based on businesses' profiles on their Facebook fan page, such as industry category, geographic location, business hours, frequency of events and number of users, we collect and encode all of users' social interactions on the Facebook fan page and then calculate their cumulative number, frequency and text data, and multiply relevant information's floating weight and corresponding judging

conditions to calculate the interactions between individuals and industries, which constitutes the industrial activity index. Finally, we use the sum of inter-industry social index calculations as a reference to evaluate the promotion mechanisms between businesses and intelligent services in the smart tourism ecosystem.

(b) **Calculation of the social connection index between businesses.** This study uses the social connection index calculation model proposed by Gilbert to calculate the social index between businesses [10]. The connection intensity in SNSs is determined based on the aspects of intensity, intimacy, duration, reciprocal services, structural, emotional support and social distance, while the measured functional items include number of exchanges of messages and feedback on the dynamic wall, content analysis of the dynamic wall, number of messages left by friends on the dynamic wall, number of message exchanges, message intensity analysis, dynamic updates of users, dynamic updates of friends, responses to friends' photos, number of friends, number of friends' friends, number of days from the last reply, data analysis of content intensity (topic) on the dynamic wall, co-annotated photos, number of times that users appear in others' photos, distance from home, relationship status of friends, number of days since the first response, shared links, recommended apps, number of common friends, common social circles, common interests, common concerns, and the age, education level, work experience, religious affiliation, and political affiliation of users and friends. The following equation describes Gilbert's calculation formula for social connection intensity.

$$\begin{aligned} s_i &= \alpha + \beta R_i + \gamma D_i + N(i) + \epsilon_i \\ N(i) &= \lambda_0 \mu_M + \lambda_1 med_M + \sum_{k=2}^{4} \sum_{s \in M} \lambda_k (s - \mu_M)^k \\ &+ \lambda_5 min_M + \lambda_6 max_M \\ M &= \{ s_j : j \text{ and } i \text{ are mutual friends} \} \end{aligned} \tag{1}$$

2.2 Specific Features of the Living Green Tourism Ecosystem

This study considers Living Green as a brand and emphasizes the characteristics of green tourism. In addition to selecting related local "natural", "environment-friendly" and "green" industries in the Chia-Yi region of Taiwan and establishing a tourism ecosystem network platform, this study also develops the Living Green mobile app to provide smart travel itinerary recommendations and innovative interactive experiences for smartphone users. It is worth mentioning that based on the analysis of the social connection index between members of the Living Green tourism ecosystem network and taking into account users' personal preferences and needs, Living Green's smart travel services can not only recommend suitable travel itineraries for users but also promote social connections between businesses and the overall development of the local travel and tourism industry. The following aspects describe the system function features of the Living Green ecosystem.

(a) **Create function:** To create industrial connections (Create), establish the Living Green tourism network and its nodes between businesses, and calculate its degree of activity, this study first constructs a tourism industry supplier network based on the organizational structure of the tourism ecosystem, establishes nodes between suppliers, analyzes data on the industrial community platform and the social behavior of individuals on the platform, collects relevant function projects and informationizes industrial social behavior so as to calculate the industrial activity index and the industrial social index. Subsequently, we divide activity intensity into four levels to create a visual industrial social map. To be consistent with the theme of green tourism, the image of sapling growth serves as a pin on the map to symbolize industrial activity intensity, and the corresponding icons are placed on the map according to the activity intensity of each business's development. Figure 1 shows the social activities among green tourism businesses in the Chia-Yi area. It is worth mentioning that the Create function can be seen as a reference to gauge the effectiveness of industrial development as well as an indicator for DMOs or relevant government agencies to support the development of disadvantaged business segments.

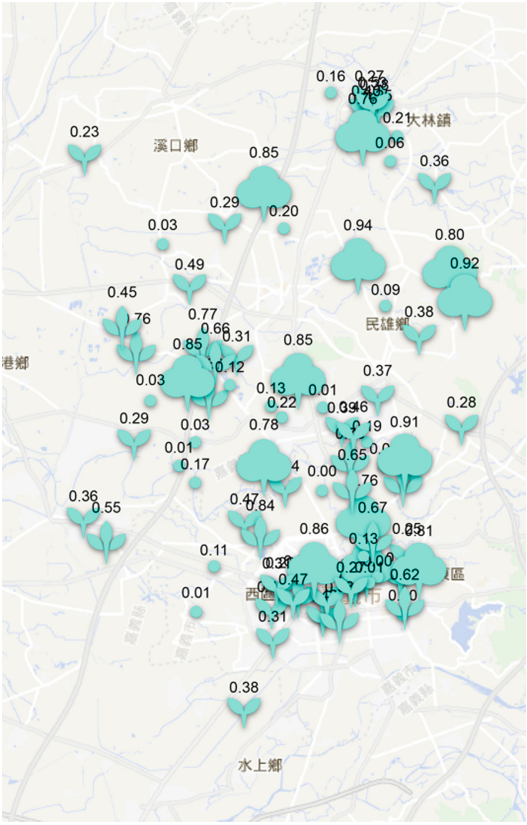

Fig. 1. Current status of the industrial activity of the Living Green tourism ecosystem. (Color figure online)

(b) **Maintain function:** Industrial connections are maintained by suggesting mutually beneficial groups. After identifying business locations and activity intensity between businesses, the Living Green system calculates the social connection index between businesses according to business attributes, geographical location, messages and sharing based on Gilbert's social connection computing model. The thickness of the line between points represents the level of industrial connection intensity. According to the level of industrial connection intensity, businesses are divided into five categories of mutually beneficial groups, namely green food, green transport, green attractions, green lodging and green leisure, and a resource-sharing cooperation model is achieved through industrial connections, as shown in Fig. 2. Figure 3 uses the green businesses in Chia-Yi, Taiwan, as an example. The green food category is characterized by local food, organic food and landscape restaurants; the green transport category focuses on environment-friendly transport modes, such as E-Bike, a public electric vehicle rental system; the green attractions category is represented by local sightseeing factories or eco-tourism attractions; the green lodging category features lodging recommendations; the green leisure category is represented by other leisure and entertainment activities.

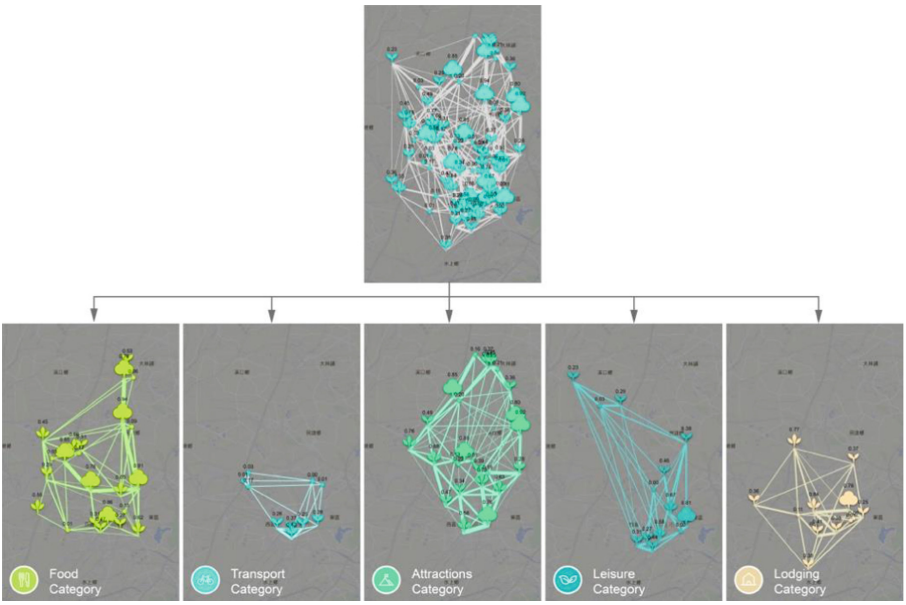

Fig. 2. Reciprocal attributes and categories of the Living Green tourism network. (Color figure online)

(c) **Enhance function:** To strengthen the connections between businesses, the study calculates industrial connection intensity based on current social behaviors on the industrial community platform, such as business attributes, geographical location, messages and sharing, and forms same-attribute networks with highly connected businesses to complete the construction of points and the connection of lines,

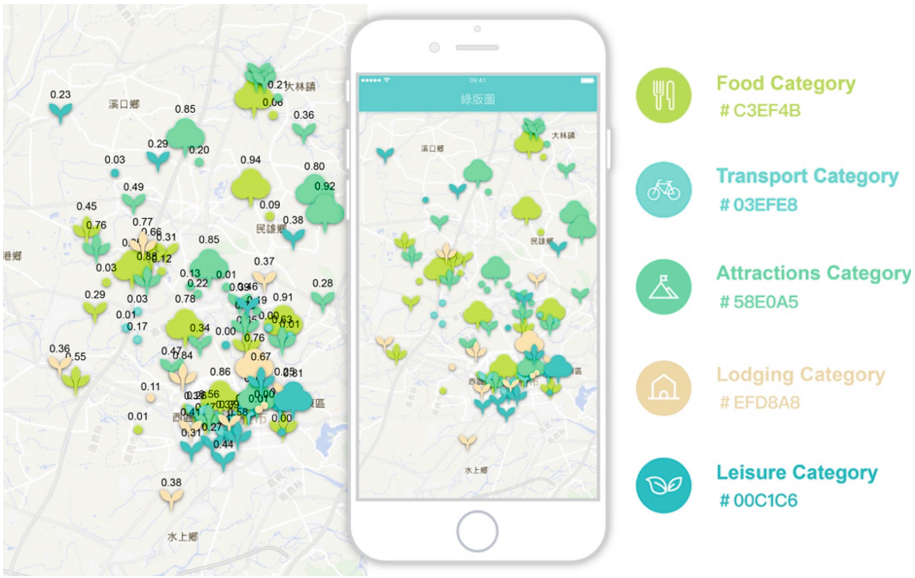

Fig. 3. Linking Living Green business categories. (Color figure online)

which lays a foundation for the integration of surfaces, namely establishing the Living Green ecosystem. In addition, to promote the benefits of the development of a smart tourism ecosystem, the study will provide tourists with the Living Green mobile app, whose smart travel itinerary recommendation mechanism will plan travel itineraries based on users' personal preferences and then promote the overall development of the Living Green tourism industry (Fig. 4).

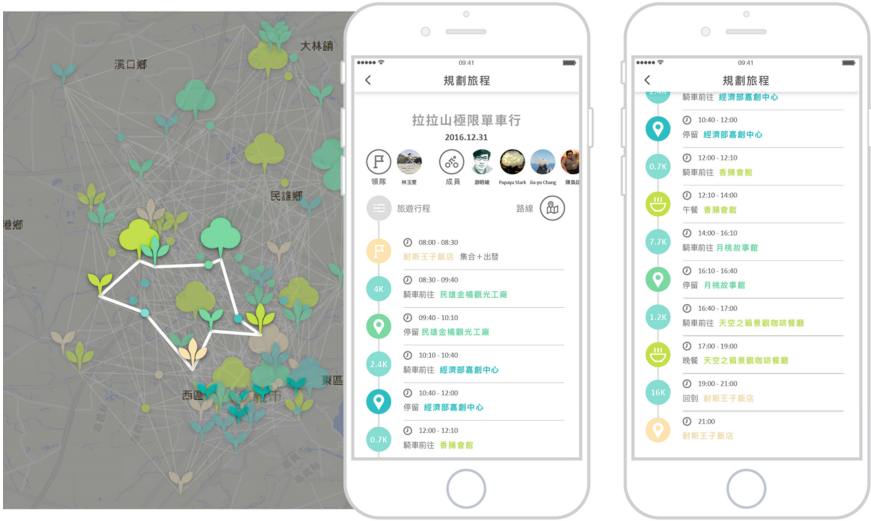

Fig. 4. Living Green mobile app - smart travel scheduler. (Color figure online)

3 Conclusion

Using the smart tourism ecosystem model as its framework as well as the strength of ties theory and the SNS social computing formula as a theoretical basis, this study establishes the Living Green tourism ecosystem to improve connections between businesses and the smart travel itinerary recommendation mechanism to promote the development of the entire industry. The Living Green tourism ecosystem has two major innovative features. (1) Visualizing industrial activity intensity and social connection intensity between businesses can not only help clearly understand the development of local businesses and assist in evaluating the effectiveness of industry development but also provide a reference for DMOs or relevant government agencies in terms of supporting the development of disadvantaged business segments. (2) The application of social media and social networks analysis helps implement the travel and tourism industry's development strategies. Based on businesses' social behaviors and interaction modes on social platforms, the tourism ecosystem calculates industrial connection intensity, uses it as an index for smart travel itinerary recommendations, and further enhances the overall promotion and development of the travel and tourism industry network. The Living Green mobile app supports the iOS system and is expected to be released in March 2018 on the App Store for interested users to download.

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