Keyword Analysis of Arboretums and Botanical Gardens Using Social Big Data

Hyun-Tak Shin¹, Sang-Jun Kim², and Jung-Won Sung^{3*}

¹Senior researcher, DMZ Botanic Garden, Korea National Arboretum, Yanggu 24564, Korea

²Post-doctoral associate, DMZ Botanic Garden, Korea National Arboretum, Yanggu 24564, Korea

³Assistant manager, Division of Planning and Operations, National Baekdudaegan Arboretum, Bongwha 35208, Korea

ABSTRACT

This study collects social big data used in various fields in the past 9 years and explains the patterns of major keywords of the arboretums and botanical gardens to use as the basic data to establish operational strategies for future arboretums and botanical gardens. A total of 6,245,278 cases of data were collected: 4,250,583 from blogs (68.1%), 1,843,677 from online cafes (29.5%), and 151,018 from knowledge search engine (2.4%). As a result of refining valid data, 1,223,162 cases were selected for analysis. We came up with keywords through big data, and used big data program Textom to derive keywords of arboretums and botanical gardens using text mining analysis. As a result, we identified keywords such as 'travel', 'picnic', 'children', 'festival', 'experience', 'Garden of Morning Calm', 'program', 'recreation forest', 'healing', and 'museum'. As a result of keyword analysis, we found that keywords such as 'healing', 'tree', 'experience', 'garden', and 'Garden of Morning Calm' received high public interest. We conducted word cloud analysis by extracting keywords with high frequency in total 6,245,278 titles on social media. The results showed that arboretums and botanical gardens were perceived as spaces for relaxation and leisure such as 'travel', 'picnic' and 'recreation', and that people had high interest in educational aspects with keywords such as 'experience' and 'field trip'. The demand for rest and leisure space, education, and things to see and enjoy in arboretums and botanical gardens increased than in the past. Therefore, there must be differentiation and specialization strategies such as plant collection strategies, exhibition planning and programs in establishing future operation strategies.

Keywords: Garden of Morning Calm, opinion mining, text mining analysis, trip

Introduction

The first space in South Korea created to test and exhibit plants was the test garden installed in Hongneung and Gwangneung to test and develop tree species for afforestation in 1922. This was the beginning of arboretums in Korea. Then in the 1960s, Korea's first private arboretum, Cheollipo Arboretum, was established by Carl Ferris Miller, followed by Seoul National University Gwanak Arboretum established by professor Chang Bok Lee, which gave rise to arboretums with modern functions and roles (Kang, 2012). Accordingly, Korea Forest Service perceived

the urgent need to establish a national arboretum to systematically preserve and study forest biospecies in Korea and lead interaction and cooperation among arboretums that are already established, ultimately expanding the Arboretum Division of the Jungbu Forestry Examination Site in Forestry Research Institute into an independent national arboretum in 1999 (Lee, 2008).

In the 2000s, which is the time in which the number of arboretums increased, 20 new public and private arboretums were established. Upon entering the era of \$10 thousand per capita income, establishing the Act on the Creation and Furtherance of Arboretums and Gardens, im-

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First author: Hyun-Tak Shin, twinshin@korea.kr, <https://orcid.org/0000-0002-7164-5338>

*Corresponding author: Jung-Won Sung, onsulove2036@hanmail.net, <https://orcid.org/0000-0001-8272-9695>

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plementing the five-day workweek policy and improving the leisure culture, the interest in and demand for arboretums and botanical gardens rapidly increased, raising the need for various analyses to establish effective operational strategies (Kang, 2012).

Meanwhile, many kinds of data using big data are now used in various fields such as society, economy, culture and arts, as the development of equipment and techniques such as opinion mining and text mining has enabled people to use multiple data that they could not process Choi and Choi, 2015). However, no trend analysis has been conducted thus far on how the social, economic and cultural interests in arboretums and botanical gardens have changed. In particular, among big data analysis, social big data analysis extracts information by collecting and classifying countless data from various paths of social media with real stories of producers or consumers, which is most efficient in determining thoughts, inconveniences, desires and behaviors of consumers (Lim and Park, 2015). In fact, many places are using social big data analysis to establish operational strategies, develop and publicize programs, and analyze user behavior. Therefore, this study is conducted to find the keyword patterns of arboretums and botanical gardens using social big data collected from blogs, cafes, knowledge search, etc. in the last 9 years, select the most relevant search words, and determine whether social, economic and cultural changes of arboretums and botanical gardens that occur real-time or will occur in the near future can be predicted in advance through sentiment analysis. Furthermore, we will trace the course of arboretums and botanical gardens and explain the patterns of change to use the results as the basic data to establish operational strategies for future arboretums and botanical gardens.

Research Methods

Theoretical considerations

Social big data

With the development of 5G information technology and increasing interest and attention in the internet, mobile platforms and social media, big data is used as a tool to solve

social problems in various fields such as society, economy, culture and arts. Many countries in the world are using big data, which performs a key role in determining the flow of the past and present through social media and predicting and solving future problems based on the ripple effect on the public and private sectors (Song, Song, and Cheon, 2015). Moreover, social media is used by firms as a channel for interaction and communication with researchers in addition to publicity, which results in improving the quality of innovation with swarm creativity (Chun, 2015). The Korean government is actively implementing use of big data in various fields to achieve creative economy, anticipating ripple effects such as efficiency in the administrative system and economic revitalization (Hong, 2014). Meanwhile, the results of social big data analysis are obtained by the producers searching keywords or related words in the document and analyzing their significance. Sentiment analysis such as opinion mining as well as text mining is performed, followed by statistics analysis and network analysis. This has the form of data that can increase reliability depending on age, gender and occupation (Chun, 2015). Longitudinal and cross-sectional studies that have been conducted were used effectively in determining the relationship between groups and individuals in terms of determined factors and variables, but are limited in analyzing the correlation of mutual information exchange that has been discussed in individual documents online (Song, Song, and Cheon, 2015). To make up for this deficiency, social media among big data analytics enables users to determine the views and thoughts of consumers based on abundant data, and when used along with offline complete enumeration survey, it would be possible to predict and cope with social, cultural and economic concerns that are currently causing problems based on reliable data.

Cases of using social big data

The development of rapidly changing information technology is expanding accessibility to social media in various channels such as internet and mobile. In particular, various users are producing a great amount of data on a real-time basis using internet or mobile-based smart devices, and it became possible to capture and analyze the trends of the

times in different fields through collection and analysis of data (Seo and Koh, 2014). This is used as a tool to more quickly approach technological development and customer needs by analyzing user consciousness, tendencies and emotions based on collected data and obtaining objective information (Chang, 2015). Moreover, social big data is used actively in various fields such as verification of diplomatic tools (Choi and Kim, 2016), image assessment (Hong and Oh, 2016), public relations strategies (Lee et al., 2015; Oh et al., 2015), analysis of stock prices (Kim et al., 2014), etc. In particular, opinion mining among sentimental analyses of text mining is used to determine the positive and negative perceptions and tendencies of users, come up with problems and improve them. Furthermore, a detailed analysis of collected data on social media shows a considerably high ratio of subjective opinions from individuals. Thus, compared to existing documents or publications, applying opinion mining will help obtain objective and rational data (Choi and Choi, 2015; Jang, 2013; Kim et al., 2014). Song, Noh, and Lee (2015) proposed a service model recommending cultural contents such as movies, plays and music according to individual tastes and sentiments using big data of social media. It is also used in various fields such as sentiment analysis on social issues (Kang et al., 2015), prediction of stock price fluctuations (Kim et al., 2014), fashion marketing with analysis on user opinions (Lee et al., 2014), etc.

Research content and methods

Content

We classified the keywords of arboretums and botanical gardens by the trends of times from 2010 to 2018, and conducted text mining, word cloud analysis, and sentiment analysis (Fig. 1). This study collected public opinions about big data on social media as the data and used the text mining technique. Moreover, we checked the main trends of arboretums and botanical gardens through keywords by year and determined the public awareness according to time. The process of big data analysis was carried out in four steps as shown in Fig. 1: data collection, data preprocessing, text mining, and sentiment analysis (opinion mining).

Fig. 1. Flow diagram of study process.

Methods

(1) Data collection

We used big data program Textom (<http://www.textom.co.kr>) to collect data for text mining analysis and word cloud analysis, and collected text data including keywords ‘arboretum’ and ‘botanical garden’ in the original texts of six social media such as Naver Blog, Café, Knowledge IN as well as Daum Blog, Café, and Instagram.

Data was collected for 9 years from 2008 to 2018, searching keywords of arboretums and botanical gardens. Moreover, we determined the user motivations for visit, purpose, and expectations about arboretums and botanical gardens. Social Matrix provides only documents (Docs) related to keywords that are to be analyzed via analytical engine comprised of text mining and natural language processing technique. Keywords are divided into related words and sentiment analysis. Related word analysis determines the trends and characteristics of users by extracting the most relevant word among those used in keywords. Sentiment analysis classifies subjective data such as opinions, attitudes and tendencies of online users about certain words according to their sentiment by categorizing the expressions into positive, negative and neutral (Lim and Park, 2015). Data provided on Social Matrix includes all original texts including keywords to analyze, and thus information that is not directly related to research is also likely to be

obtained as a result. Accordingly, we analyzed only the original text related to keywords we intend to analyze in this study by undergoing the filtering process of unnecessary endings such as parts of speech and affixes.

(2) Text mining analysis

We used big data program Textom to come up with keywords of arboretums and botanical gardens through big data and text mining analysis. To increase accuracy of collected data, we filtered the search words and excluded unnecessary parts of speech and affixes that are not related to this study. Frequency analysis is counting how many times the relevant search words appear in the collected news, which in this study was used to distinguish keywords and related search words. Moreover, we visually promoted understanding using word cloud (<http://wordcloud.kr>) to find out the singularities of keywords that are not derived in frequency analysis.

Results and Discussion

Results of data collection

Collected data is as shown in Fig. 2. There were total 6,245,278 cases of data collected by year from 2010 to June 2018. Big data program Textom can randomly sum-

marize and collect valid data excluding unreadable missing values that are not texts, such as images, photos, mathematical symbols, programming languages, etc. on social media during the selection period (Woo and Suh, 2017) and thus selected total 1,223,162 cases for analysis. The amount of data collected by year was the biggest in 2016 with 171,135 cases (14.0%), and the smallest in 2010 with 100,457 cases (8.2%). In particular, the collection period in 2018 was short, just 6 months, and thus we did not separately compare with the amount of data collected by year. Overall, social data showed a continuous increase.

Results of text mining analysis

We came up with high frequency keywords by year after data refining and selected keywords with reference to the word cloud, and as a result, 30 top frequency keywords are as shown in Table 1, Fig. 3 and Fig. 4. The result of analyzing social keywords of arboretums and botanical gardens by year showed that the keyword ‘garden’ constantly appeared since 2010. As the Anmyeondo International Flower Exhibition was held in 2009, presenting various things to see and enjoy, gardens began to receive public attention and were searched as a keyword on social media such as blogs, cafes, knowledge search, etc., In particular, the search rapidly increased by 1,445 cases compared to the previous year when the Suncheon Bay International

Fig. 2. Data collection from social media with keywords of arboretums and botanical gardens over years.

Table 1. Frequency of behavior-related keywords about arboretums and botanical gardens

2010		2011		2012	
Keyword	Frequency	Keyword	Frequency	Keyword	Frequency
Arboretum	30,569	Arboretum	32,568	Arboretum	33,580
Botanical garden	13,313	Botanical garden	13,019	Botanical garden	13,074
Garden of Morning Calm	9,111	Garden of Morning Calm	9,377	Garden of Morning Calm	10,237
Tree	4,004	Tree	4,280	Tree	4,447
Trip	3,166	Trip	3,425	Jeju Island	4,154
Rooms	2,893	Autumn	2,798	Trip	3,636
Course	2,644	Gapyeong	2,588	Walk	3,240
Garden	2,554	Picnic	2,499	Gapyeong	2,982
Autumn	2,304	Rooms	2,478	Autumn	2,958
Museum	2,129	Museum	2,365	Mountain	2,727
Gwangneung Arboretum	2,046	Course	2,239	Picnic	2,585
Picnic	2,045	Mulhyanggi Arboretum	2,217	Pension	2,463
Mulhyanggi Arboretum	2,027	Gwangneung Arboretum	2,172	Daegu Arboretum	2,450
Children	1,958	Daegu Arboretum	2,106	Festival	2,149
Scenery	1,907	Garden	1,844	Mulhyanggi Arboretum	2,120
Wildflowers	1,859	Weather	1,682	Gwangneung Arboretum	2,049
Daegu Arboretum	1,816	Children	1,674	Weather	1,982
Weather	1,515	Scenery	1,556	Garden	1,920
Beauty	1,321	Wildflowers	1,524	Course	1,916
Cheollipo Arboretum	1,258	Republic of Korea	1,524	Halla Arboretum	1,645
Pocheon	1,175	Halla Arboretum	1,407	Scenery	1,612
Admission fee	1,102	Pocheon	1,373	Cheollipo Arboretum	1,531
Halla Arboretum	1,073	Recreation forest	1,322	Rooms	1,476
National Arboretum	1,053	Hiking	1,216	Pocheon	1,469
Hiking	1,019	Cheollipo Arboretum	1,200	Children	1,458
Place	954	Gyeongnam	1,181	Museum	1,451
Natural Recreation Forest	943	Admission fee	1,180	Admission fee	1,399
Maple	911	Pyeonggang Botanical Garden	1,063	Festival	1,336
Pyeonggang Botanical Garden	904	Anmyeondo	1,021	Wildflowers	1,196
Experience	884	Experience	920	Experience	1,181
2013		2014		2015	
Keyword	Frequency	Keyword	Frequency	Keyword	Frequency
Arboretum	48,026	Arboretum	49,111	Arboretum	47,647
Botanical garden	16,166	Garden of Morning Calm	17,945	Garden of Morning Calm	19,282
Garden of Morning Calm	15,389	Botanical garden	15,699	Botanical garden	14,142
Tree	6,129	Tree	6,976	Tree	7,087
Trip	5,025	Trip	5,470	Trip	5,653
Autumn	4,713	Autumn	5,141	Autumn	5,586
Picnic	4,165	Picnic	4,941	Picnic	5,055
Festival	4,033	Recreation forest	3,976	Weather	4,027
Pension	3,612	Daegu Arboretum	3,880	Daegu Arboretum	3,738
Gwangneung Arboretum	3,392	Gwangneung Arboretum	3,734	Recreation forest	3,682
Garden	3,365	Weather	3,252	Gwangneung Arboretum	3,419
Daegu Arboretum	3,310	Mulhyanggi Arboretum	3,153	Garden	3,145
Mulhyanggi Arboretum	3,105	Garden	3,150	Rooms	3,091
Weather	3,097	Pocheon	2,769	Festival	2,995
Children	2,881	Camping ground	2,653	Halla Arboretum	2,741

Table 1. (continued)

2013		2014		2015	
Keyword	Frequency	Keyword	Frequency	Keyword	Frequency
Course	2,627	Admission fee	2,627	Admission fee	2,655
Scenery	2,209	Course	2,485	Children	2,636
Cheollipo Arboretum	2,111	Halla Arboretum	2,460	Walk	2,564
Admission fee	2,083	Rooms	2,454	Mulhyanggi Arboretum	2,316
Halla Arboretum	2,080	Cheollipo Arboretum	2,306	Course	2,316
Festival	1,999	Children	2,226	Restaurant	2,303
Museum	1,996	Walk	2,075	Nami Island	2,292
Pocheon	1,880	Festival	2,039	Experience Class	2,215
Experience	1,775	Zoo	2,031	Visiting experience learning	2,168
Walk	1,534	Museum	1,983	Scenery	2,009
Program	1,517	Scenery	1,921	Destination	2,003
Wildflowers	1,441	Bicycle	1,840	Cheollipo Arboretum	1,898
Recreation forest	1,412	Anmyeondo	1,811	Date	1,813
Jeju Island	1,397	Jade Garden	1,715	Summer	1,813
Jade Garden	1,388	Experience	1,642	Bicycle	1,772
2016		2017		2018	
Keyword	Frequency	Keyword	Frequency	Keyword	Frequency
Arboretum	48,566	Arboretum	47,514	Arboretum	23,568
Garden of Morning Calm	19,545	Garden of Morning Calm	15,953	Garden of Morning Calm	7,810
Botanical garden	14,267	Botanical garden	13,564	Botanical garden	7,394
Trip	7,326	Trip	7,426	Restaurant	4,268
Tree	7,147	Tree	6,564	Trip	3,820
Picnic	5,853	Autumn	5,353	Tree	3,340
Autumn	4,994	Picnic	5,261	Picnic	2,622
Weather	4,072	Restaurant	5,052	Function	2,439
Restagurant	3,904	Daegu Arboretum	3,997	Daegu Arboretum	1,959
Gwangneung Arboretum	3,884	Gwangneung Arboretum	3,751	Halla Arboretum	1,938
Daegu Arboretum	3,734	Garden	3,637	Gwangneung Arboretum	1,898
Garden	3,601	Weather	3,506	Weather	1,724
Pension	3,458	Pension	3,430	Garden	1,575
Children	3,251	Children	3,084	Festival	1,327
Recreation forest	3,231	Halla Arboretum	2,959	Walk	1,307
Course	2,884	Function	2,882	Fine dust	1,295
Museum	2,815	Walk	2,835	Course	1,198
Admission fee	2,750	Admission fee	2,686	Admission fee	1,148
Halla Arboretum	2,703	Festival	2,638	Cheollipo Arboretum	1,137
Walk	2,648	Course	2,549	Recreation forest	1,126
Pocheon	2,606	Recreation forest	2,443	Children	1,071
Mulhyanggi Arboretum	2,227	Parking	2,298	Parking	1,054
Nami Island	2,218	Rooms	2,195	Rooms	1,050
Date	2,157	Experience	2,135	Experience	1,047
Visiting experience learning	1,911	Mulhyanggi Arboretum	1,951	Hanbat Arboretum	1,032
Summer	1,902	Sejong	1,933	Cherry Blossom	1,031
Cheollipo Arboretum	1,886	Museum	1,911	Scenery	998
Theoretical education	1,869	Scenery	1,861	Mulhyanggi Arboretum	949
Light festival	1,866	Cheollipo Arboretum	1,831	National Arboretum	912
Destination	1,860	Program	1,821	Sejong	887

Fig. 3. Search trends of major keywords related to arboreturns and botanical gardens over years.

Garden Expo was held in 2013. With the designation of the first national garden in Korea in 2015, interest in gardens is expected to continuously increase.

As the keyword ‘healing’ first appeared in 2012, ‘travel’ and ‘healing’ tended to increase at the same time (Fig. 3). The word ‘healing’ which had been used only by a few people in the past, surpassed the craze of well-being that began since the early 2000s and became a big trend overall such as society, culture and economy (Oh, 2016). This trend spread out to various fields such as arboreturns and botanical gardens, temple stay and forest healing programs, and was even applied to tourism. Traveling for ‘healing’ implies that the pattern of travel in Korea is gradually changing from visual tourism focused on getting away from the city to realistic lifestyle tourism focused on relationship building such as direct experience and festivals. Considering the change in such trend, it is necessary to well reflect the rapidly changing trend of times by constantly monitoring individual tendencies that pursue ‘healing’ in arboreturns and botanical gardens through social media such as blogs, cafes, knowledge search, etc., and to develop and supply exhibition and education programs based on the intrinsic culture of the region.

Since 2013, public interest in ‘arboretum’ increased significantly, but that in ‘botanical garden’ seemed to have

declined. This suggests that the perception and interest have changed, regarding nature not as an object of learning but as an object to experience. Furthermore, keywords such as ‘tree’ and ‘experience’ related to ‘arboretum’ also showed high frequency, implying that national interest and demand have increased for education and experience programs held in arboreturns such as Gwangneung Forest bird exploring, professional exhibition garden interpretation, forest pre-natal program, summer forest camp, etc. In particular, the Happiness Promotion Program enables people that are underprivileged in terms of nature-related activities due to physical and financial difficulties to experience the diverse functions of forests, thereby expanding the base for educational services by increasing the scope of beneficiaries and operating customized education programs. Moreover, the O₂ Program boosts energy into military life by linking forest experience programs for Korean soldiers. As such, arboreturns and botanical gardens provide the right functions of forests in various fields, helping promote welfare for citizens.

In 2016, the keyword ‘Garden of Morning Calm’ showed the highest frequency, due to the publicity effect of filming location (movie title “The Letter”) and theme-based exhibition centers that capture visitors’ attention such as Starlight Garden Festival and Rose Festival, as well as high accessibility with its location in the outskirts of the city.

Results of word cloud analysis

We conducted word cloud analysis after data mining of texts in blogs, cafes, knowledge search, etc. with keywords of arboretums and botanical gardens. We extracted keywords with high frequency in the titles of total 6,245,278 cases, and bigger text indicates higher frequency (Fig. 4). As such, the public perceived arboretums and botanical gardens as spaces for rest and leisure such as ‘travel’, ‘picnic’ and ‘recreation’. We could also discover public interest in educational aspects through keywords such as ‘experience’ and ‘field trip’. Moreover, various things to see and enjoy in arboretums and botanical gardens were also mentioned, such as ‘zoo’, ‘museum’ and ‘festival’, indicating that arboretums and botanical gardens must develop differentiated

exhibition and education programs for each region and establish operational strategies that reflect customer needs.

Results of sentiment analysis

We intended to conduct opinion mining, which is a technique of sentiment analysis among the techniques used to analyze the meaning of online documents by users for social big data analysis, and determine the sentiments about arboretums and botanical gardens (Fig. 5). There were more positive expressions about arboretums, whereas negative expressions rarely appeared. There were 18,002 cases (89%) of positive keywords about arboretums by the public, such as ‘relaxing’, ‘healing’ and ‘comfortable’, indicating that arboretums were perceived positively by the public

Fig. 4. Word cloud made of keywords related to arboretums and botanical gardens.

Fig. 5. Sentiment analysis for arboretums (A) and botanic gardens (B).

as a rest area that provide mental comfort away from exhausting daily life. On the other hand, there were 2,155 cases (11%) of negative keywords about the high entrance fees and the management state of arboretums that fall short of the fees, such as ‘expensive’, ‘disappointing’ and ‘damaged’. As a result of analysis by year, the ratio of negative keywords increased by 4% in 2011 compared to the previous year, which is the increase in the negative keyword ‘inadequate’ about facility and operation (Fig. 6). Recently, the ratio of positive keywords increased such as ‘relaxing’ along with the positive keyword ‘substantial’ about aesthetic satisfaction as well as experience programs and exhibitions. Overall, regarding sentiment words about arboretums, admission fees vary depending on the host and the purpose of foundation and thus may not be adequate for description. However, considering the public view about the management state, arboretums and botanical gardens must inspect their sites and establish management plans to preserve the forest resources and improve the image as a place for exhibitions and education among the public.

There were 10,197 cases (91%) of positive keywords by the public about botanical gardens, some of them about the landscape of botanical gardens such as ‘pretty’, ‘fabulous’ and ‘marvelous’, as well as ‘unique’ for novel attempts like a maze park or jungle adventure. On the other hand, there were 1,055 cases (9%) of negative keywords such as ‘inadequate’ and ‘boring’ due to dull compositions and insufficient amenities, as well as negative keyword ‘damaged’

due to poor management (Fig. 5). As a result of analysis by year, there was a keyword ‘awful’ in 2011 in terms of operation, due to noise from remodeling and decreased satisfaction (Fig. 6). Lack of things to see and enjoy compared to the size of the venue led to dissatisfaction about high admission fees, giving rise to new negative keywords such as ‘nothing to see’, ‘cannot see’ and ‘disappointing’. On the other hand, the increase of positive keywords such as ‘pretty’ and ‘fabulous’ related to festivals and events as well as natural landscapes was used as a tool to promote positive awareness about botanical gardens. The public seems to prefer dynamic elements such as various games, experiences and recreation away from the simple form of exhibitions and viewing of landscape elements. Therefore, botanical gardens must develop and publicize various events, exhibitions and education programs using plants of forest resources, and strive to provide desirable forest services for the public.

Conclusion

This study was conducted to determine whether social, economic and cultural changes of arboretums and botanical gardens can be predicted using social big data collected from blogs, cafes, knowledge search, etc. in the last 9 years. Moreover, we traced the courses of arboretums and botanical gardens and explained the patterns of change to use

Fig. 6. Changes in the distribution of sentiment analysis for arboretums (A) and botanic gardens(B) over years.

as the basic data to establish operational strategies for future arboretums and botanical gardens. As a result of refining collected data, total 1,223,162 cases were selected for analysis. By year, there were 171,135 cases in 2016 (14.0%) and 100,457 cases in 2010 (8.2%), and social data tended to increase constantly. This indicates that users are showing more interest due to the publicity effect of various things to see and enjoy through education/experience programs and exhibitions planned and carried out in arboretums and botanical gardens, along with the increasing base of consumers using Naver and Daum Blog, Café, Knowledge IN and Instagram. The keywords identified included 'arboretum', 'healing', 'travel', 'experience', 'Garden of Morning Calm' and 'festival'. This implied that arboretums and botanical gardens had been merely perceived by the public as place to watch or observe, but are now perceived as a place to experience nature up close with various plants and programs such as customized forest interpretation and healing for different age groups and participants.

The keyword analysis results of arboretums and botanical gardens using social big data can be summarized as follows. First, as interest in 'healing' expanded to various fields including arboretums and botanical gardens, the form of travel in Korea changed from visible tourism focused on getting away from the city to realistic lifestyle tourism focused on relationship building such as direct experience, festivals, temple stay and forest healing programs. Arboretums and botanical gardens must strive to publicize the importance of conservation through education and exhibitions about the precious values, effects and uses of forest resources beyond providing just experiences and festivals. Second, public interest in 'tree' and 'experience' related to 'arboretum' also increased, which resulted in high national interest and demand such as having their own trees, air purifying plants, and plants that reduce particulate matter. Third, 'gardens' are showing various things to see and enjoy through national gardens and garden flower exhibitions, implying that the garden culture is spreading out according to function and space, such as development of plantation techniques for traditional Korean gardens, garden shows using Korean native plants, and tools to improve backward regions. Fourth, public interest in the keyword 'Garden of Morning Calm' increased through unique ex-

hibitions and events such as Starlight Garden Festival, light festival and nightscape. This is due to the interest in events and exhibitions held in the Garden of Morning Calm at night, along with the trend of opening amusement parks, historic sites and parks at night. The results of word cloud and sentiment analysis showed that public awareness about arboretums and botanical gardens showed high positivity. This is because there is a higher demand for rest and leisure space, education and things to see and enjoy in arboretums and botanical gardens compared to the past. Thus, it is necessary to come up with a future-oriented and long-term operation roadmap for arboretums and botanical gardens to meet such demand.

Arboretums and botanical gardens must establish facilities and infrastructures so that users can feel that they are convenient and safe. They must also develop programs based on the life cycle or families by seeking diversification through program development and research, and develop and operate differentiated forest interpretation and education programs between arboretums and botanical gardens. Based on the above, it is necessary to induce constant public participation through publicity and marketing to promote awareness as a space for cultural life that provides nature-related experience and education on the value of nature. Therefore, there must be differentiation and specialization strategies such as plant collection, exhibition planning, and development of education and experience programs in establishing future operational strategies for arboretums and botanical gardens.

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