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## A Study on the Future Direction of the Digital Signage Industry in Korea: A Big Data Network Analysis from 2008 to 2019

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### Abstract

*The use of digital signage in the public and commercial communication areas has been increasing in recent years. By integrating cutting-edge information technologies such as 5G, artificial intelligence, and the Internet of Things, digital signage continues to break apart from traditional outdoor advertising media. This study identified the problems facing the domestic digital signage industry by exploring and analyzing major issues related to digital signage and derived future development measures. Specifically, online documents were collected based on the digital signage-related keywords created over the past 12 years to conduct big data network analysis, and key topics were derived through visualization of the results. This study has great policy implications in that it excluded biased interpretations based on the viewpoints of companies or the government and, more objectively, suggested the direction of the digital signage industry's development in the domestic media market.*

**Keywords:** Digital Signage, Media Industry, OOH media, Outdoor Advertising, Media Strategy, Text Mining.

## 1. INTRODUCTION

Digital Signage, another name for digital outdoor media (or DOOH media: Digital Out-of-Home Media), is becoming a “fourth media” comparable to TV, Internet, and mobile phones in line with the intelligentization represented by ICT (Information & Communication Technology) convergence and artificial intelligence. [1] The Korea Communications Agency (2014) defined digital signage as an integrated system in which technologies, content, networks, devices, and equipment in various fields are connected and interconnected, not as a single independent medium or communication channel. In sum, the oldest form of advertising, “outdoor advertising,” is innovating through digital technology. [2] Digital signage is seen as a promising communication channel that will lead the media industry of the future. [3] Considering Korea's advanced information technology and content competitiveness, the nation's digital signage is expected to lead the world. [4] On the other hand, there is a concern that AI, big data, IoT, and cloud technologies are intervening in all industries and the convergence environment being created will deepen the competition within a limited market as they reduce media-to-media differentiation and increase their alternatives. [5][6][7] Indeed, innovative new

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media generated from rosy prospects often fail to predict market demand and generate revenue because of realistic gaps after entering the market. [8]

For digital signage to continue growing in the competitive domestic media market, it is necessary to objectively review the major issues related to digital signage and consider the direction of future development. In this context, this study sought to diagnose the present state of digital signage not from the perspective of a hardware, service provider or a policy leader, but through big data topic modeling of digital signage-related online documents published over the past 12 years.

## **2. RELATED WORKS**

The Korea Communications Agency (KCA) defined digital signage as a “comprehensive video, information, and advertising convergence service system” that allows two-way communication with users beyond simply displaying digital information. Digital signage is used not only for advertising but also as a means of implementing cultural contents. It also contributes to enhancing the dignity of the urban landscape. Lately, digital signage is called “smart signage,” as it integrates display devices, content, networks, and software solutions. [4] Specifically, digital signage is referred to as the “4th Industrial Revolution Technology” and actively collaborates with other industries such as artificial intelligence (AI), virtual reality (VR), augmented reality (AR), and the Internet of Things (IoT). [9]

According to Grand View Research (2019), the size of the global digital signage market is expected to nearly double from \$18.6 billion in 2018 to \$31.7 billion in 2025. [10] In fact, the global digital signage market is expected to grow steadily from 2017 to 2021 at 11.55% of the compound annual growth rate (CAGR). [11] The domestic digital signage market is also expanding, with an estimated market size of approximately 6 trillion won, domestic digital signage production inducement of 10 trillion won, value-added inducement of about 3 trillion won, and employment inducement of 70,000 people. [12][13] Samsung Electronics and LG Electronics are market leaders who account for about 40 percent of the global display market. Domestic companies are already leading the global digital signage market, as many Korean mid-sized companies are also discovering next-generation display services. [14]

Digital signage innovation is expected to drive the development of a variety of related areas, including advertising, content, culture, and technology. Recently, the South Korean government has been working to support and improve regulations for digital signage companies. The Korea Outdoor Advertising Center was the first in Korea to install a digital billboard for fundraising on the Olympic Expressway, in November 2019. [15] In addition, in December 2016, the Ministry of Public Administration and Security (MOSPA) selected COEX area of Gangnam-gu, Seoul as a free advertisement display zone, and the Gangnam-gu and its operators formed a consortium to install and operate a super-sized digital signage display. [16] In the recently developed free advertisement display zone, Gangnam Festival was held in September 2019 under the theme of “Where Dreams Come True, Gangnam,” featuring media art and creative performances. An abundance of cultural content was presented on 16 digital signage units in six locations within the Samsung subway station (COEX) free advertisement display zone. [17] In addition, through the implementation of a “regulatory reform sandbox,” the company is making policy efforts to create and provide infrastructure for innovative content and platform service development, such as restricting the use of digital signage bus advertisements, which was not possible under the current law. [18]

Although many policy efforts are being made to invigorate and innovate the digital signage market, the government is still having difficulty revitalizing the market and innovating the media because of regulatory coordination issues among multiple government-affiliated ministries. Specifically, digital signage is subject to overlapping regulations under the Outdoor Advertising Control Act, the Broadcasting Act, and Light Pollution Prevention Act. Therefore, it is challenging to adjust the position, regulatory domain, and authority of the departments concerned with the application of the law. [13] In addition, the government's push to include digital signage in the Outdoor Advertising Management Promotion Law is noted as the greatest limitation (Korea Economic Research Institute, 2016), considering it as a mere outdoor advertisement rather than a public smart media offering convergence service. In other words, changes in the legal system to keep up with the

pace of technological development, although urgently needed, are not being made. The Institute for Information & Communications Technology Planning and Evaluation also said that the 2017 ICT Technology Level Survey Report (2018) assessed that the domestic digital signage market lacks technology in related fields, except for displays, because of institutional constraints. [19] Laws and systems that fail to respond to changes are hindering the development of the digital signage industry and market growth. Therefore, the government should be fully aware of this situation and find a solution through institutional innovation that will allow industry and public values to coexist.

The media market environment is not an easy place to enjoy the global market growth of digital signage while expecting shared growth of the domestic digital signage industry simultaneously. First, although the size of the market is growing, competition among media in the limited domestic market is intensifying, making it necessary for digital signage to either emerge from the domestic market or to look abroad. Second, digital signage latecomers, including China, are catching up quickly in terms of technology, prompting local companies to seek innovation and aggressive marketing.

### **3. RESEARCH QUESTIONS**

This study is familiar with the major issues of digital signage-related technology and market, which were reviewed earlier through literature research, and attempts to answer the following research questions through online big data text mining.

1. What are the major issues related to digital signage in the domestic media market?
2. What future development strategies are needed to grow digital signage into a leading media in the domestic market?

### **4. EMPIRICAL ANALYSIS**

#### **1) Data collection**

This study uses big data text mining to explore major issues of digital signage in Korea. The data collection period was set from Jan. 1, 2008 to Nov. 30, 2019. In 2008, large companies such as Samsung Electronics, LG Electronics, and SK-telecom (SKT)—as well as advertising companies, including Cheil Worldwide—and online portal and telecommunications service companies applied for a number of patents related to digital signage and started new businesses. [20] In fact, according to the Korean Intellectual Property Office, the number of patent applications for digital signage in 2007 totaled 28 but doubled to 47 in 2008. For the data collection, we used search terms related to digital signage such as “digital signage,” “smart signage”, digital outdoor advertising”, “electronic signage”, and “electronic banner”. The range of the covered media included the portal site Naver (Blog, Cafe, News, Web Document, Knowledge IN), Daum (Blog, Cafe, News, Web Document), Google (Web Document, News, Facebook), and all published academic papers. The collection and filtering of the data used Textom, an online big data collection and analysis service (Textom, 2020).

#### **2) Method and procedure**

Prior to completing the online data collection and analysis, words or prepositions unrelated to the purpose of the research were removed from the collected data. Specifically, while using English translations, all expressions were collected and reformulated. For example, “digital signage” and “smart signage” were modified to “digitalsignage” and “smartsignage.” Moreover, duplicate documents derived from the same URL in the collected documents were removed before the final analysis. After repeatedly correcting data several

times, related keywords were extracted, and frequency analysis was conducted based on occurrences over 50 times. Then, a one-way mode symmetric matrix with the same row and column was derived according to the frequency of the co-exit. Afterward, we derived a one-way symmetric matrix with the same rows and columns, according to the frequency of appearance. Next, we used Ucinet 6.628 to analyze the link centrality index and identify the structure of the connections between the keywords. NetDraw was used to create a language network and visualize the analysis results. CONvergence of iterated CORrelations (CONCOR) analysis was applied to extract clusters formed by similar words.

### 3) Results

#### (1) Keyword frequency

In this study, 12,320 documents were compiled during the data collection period, including the aforementioned research keywords. Among these keywords, 72 keywords related to research topics were finally chosen based on the frequency of their appearance of more than 50 times. The words with the highest occurrence frequency were “Samsung” (1,149), “LG” (587), and “digital signage” (543), as large electronics companies were strongly connected to digital signage. Next, we could see words related to actual use or new technology such as “solution” (290), “installation” (251), “smart signage” (234), “Advantech” (221), and “TV” (212). The detailed frequency analysis results are shown in <Table 1>.

**Table 1. Frequency Analysis Results**

| Word Frequency Interval | Number of Words | Keywords  |
|-------------------------|-----------------|---|
| More than 1,000 times   | 1 word          | Samsung   |
| 999-500 times           | 2 words         | LG, digital signage   |
| 499-200 times           | 6 words         | solutions, installation, SmartSignage, AdvanTech, TV, UShop+  |
| 199-150 times           | 5 words         | advertising, display, launch, Samsung, SmartSignage, research   |
| 149-100 times           | 23 words        | DID, service, max., smart platform, introduction, LED, development, market, public, platform, digital signage, third quarter, video, smart, hold, easy, SaaS, LED Sign Korea, stand out, world, Tizen, extra-large, auction |
| 99-60 times             | 23 words        | Times, Helsinki, LG Digital Signage, series, digital, system, monitor, New York, HD, about, kiosk, airport, Istanbul, technology, sales, new, launch, open, commercial, innovation, LED Signage, smart, standalone          |
| 59-40 times             | 12 words        | global, customized, installation case, media, UHD, trends, COEX, video wall, electronic display, brand, design, model   |

#### (2) Degree of centrality analysis

The centrality analysis was conducted to quantify the link between the selected 72 keywords to identify the main keywords. The degree of centrality is an indicator that measures the strength of connections between nodes in a network. The larger the value of connection centrality, which is determined by the number of connected lines, the greater the influence within the network. Therefore, it can be regarded as a more important factor. [21] In the centrality analysis, the results of the key indicators of “degree centrality,” “closeness centrality,” “betweenness centrality,” and “eigenvector centrality” values for each of the top 25 words are shown in Table 2, and the words at the top were similar between each indicator.

Table 2. Centrality Analysis Results

| Rank | Word            | Degree Centrality | Word               | Closeness Centrality | Word               | Betweenness Centrality | Word                  | Eigenvector Centrality |
|------|-----------------|-------------------|--------------------|----------------------|--------------------|------------------------|-----------------------|------------------------|
| 1    | Samsung         | 0.122             | Samsung            | 30.603               | Samsung            | 14.064                 | Advantech             | 81.731                 |
| 2    | Advantech       | 0.047             | LG                 | 30.213               | LG                 | 12.873                 | display               | 80.993                 |
| 3    | solution        | 0.040             | solution           | 28.862               | Smart platform     | 4.834                  | TV                    | 80.414                 |
| 4    | display         | 0.037             | max.               | 28.862               | solution           | 4.615                  | Samsung               | 9.168                  |
| 5    | LG              | 0.037             | smart platform     | 28.862               | max.               | 4.497                  | LG                    | 7.756                  |
| 6    | TV              | 0.037             | service            | 27.843               | UShop+             | 3.797                  | Times                 | 4.502                  |
| 7    | smart platform  | 0.024             | stand out          | 27.843               | Advantech          | 3.735                  | smart signage         | 4.158                  |
| 8    | digital signage | 0.024             | technology         | 27.843               | service            | 2.755                  | world                 | 3.933                  |
| 9    | installation    | 0.023             | installation       | 27.734               | digital signage    | 2.174                  | UHD                   | 3.029                  |
| 10   | third quarter   | 0.022             | development        | 27.626               | installation       | 2.152                  | solution              | 3.026                  |
| 11   | LED             | 0.020             | Advantech          | 27.519               | Times              | 1.970                  | digital signage       | 2.617                  |
| 12   | about           | 0.019             | Digital signage    | 27.519               | stand out          | 1.813                  | Samsung smart signage | 2.359                  |
| 13   | Tizen           | 0.018             | Helsinki           | 27.519               | development        | 1.566                  | about                 | 2.340                  |
| 14   | Auction         | 0.018             | extra- large       | 27.413               | technology         | 1.554                  | auction               | 2.218                  |
| 15   | UShop+          | 0.018             | UShop+             | 27.308               | third quarter      | 1.430                  | commercial            | 2.118                  |
| 16   | airport         | 0.018             | Times              | 27.308               | Helsinki           | 1.420                  | video                 | 2.114                  |
| 17   | research        | 0.017             | commercial         | 27.308               | easy               | 1.339                  | platform              | 1.973                  |
| 18   | commercial      | 0.017             | easy               | 27.203               | commercial         | 1.339                  | DID                   | 1.952                  |
| 19   | world           | 0.016             | launch             | 27.203               | custom             | 1.110                  | installation          | 1.935                  |
| 20   | UHD             | 0.015             | smart signage      | 27.099               | smart signage      | 1.004                  | series                | 1.892                  |
| 21   | DID             | 0.015             | third quarter      | 26.996               | smart              | 0.973                  | third quarter         | 1.762                  |
| 22   | Times           | 0.015             | world              | 26.996               | extra large        | 0.926                  | service               | 1.726                  |
| 23   | Helsinki        | 0.014             | customized         | 26.996               | electronic display | 0.840                  | smart signage         | 1.504                  |
| 24   | series          | 0.014             | kiosk              | 26.792               | world              | 0.837                  | Helsinki              | 1.457                  |
| 25   | video           | 0.014             | electronic display | 26.792               | launch             | 0.800                  | launch                | 1.440                  |

### (3) Network analysis

CONCOR analysis was conducted for the period from 2008 to 2019 with the aim of visualizing relationships and patterns of major issues in the network and clustering them by similar words. This analysis is one of the structural isotropic analyses, in which correlation analyses of the co-existing matrix are performed repeatedly to create blocks of nodes, ultimately identifying the relationship between blocks. [22] Groups were labeled “Samsung/ Samsung Electronics”, “LG/ LG Electronics”, “Advertisement”, “Display Technology”, “Technology/ R & D”, “Global Launch” and “Solution/ Network Technology.” Therefore, it can be understood

that the core issues relating to the subject of digital signage for the past 12 years are summarized in the seven categories above. The visualization of the results obtained from CONCOR analysis using NetDraw for the purpose of understanding the specific connections of the groups is shown in Figure 1.

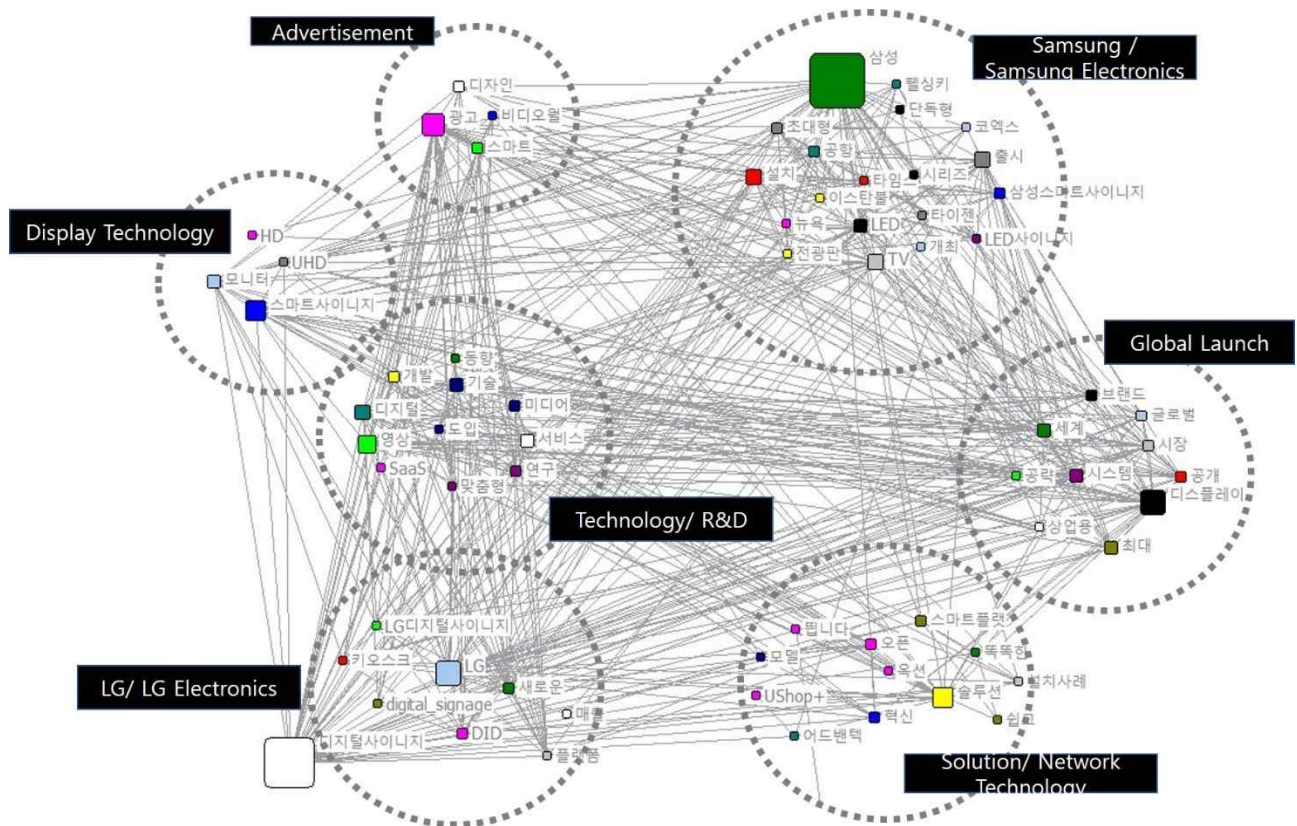


Figure 1. Visualization Result of the CONCOR Analysis

## 5. DISCUSSION AND CONCLUSION

This study has conducted topical analysis of online big data focusing on search terms related to digital signage for the past 12 years. As a result of the present research, seven issue groups were derived: “Samsung/ Samsung Electronics”, “LG/ LG Electronics”, “Advertisement”, “Display Technology”, “Technology/ R & D”, “Global Launch” and “Solution/ Network Technology”. What is interesting is that the groups related to “Samsung Electronics” and “LG Electronics”, the nation's leading and global electronics companies, formed the two core points of the network. These two groups were producing issues concerning other central points. In the case of Samsung Electronics, we could see that it is actively using the new term "smart signage" to create a new agenda in the media market. It is regrettable that only issues produced by the two flagship companies have surfaced, despite other conglomerates and many small and medium-sized enterprises focusing on digital signage-related businesses and research and development. Small and medium-sized companies need a differentiated marketing strategy that can find new agendas, break the framework of the current digital signage market, and create new businesses. On the one hand, more attention and support from the government will be needed to foster excellent SMEs and promote technological innovation.

Next, “display technology”, “solution”, “network technology”, and “technology/ research and development”

became another axis indicating that the major technologies related to digital signage were “display” and “solution/network.” However, it is unfortunate that the issues related to “content” and “content consumers,” who are the recipients of the content, have not been addressed because only technical aspects were emphasized. Finally, government or companies’ promotional activities such as seminars and events were not created on the agenda, despite the government’s active involvement in preparation for “industrial changes following the Fourth Industrial Revolution”. Nevertheless, it is encouraging that a related agenda has been created for the various efforts by companies and the government to move beyond Korea’s limited market and into the global market. Specifically, related expressions such as “global”, “brand,” and “world’s largest” were frequently mentioned. There were also issues related to “advertisements,” but their weight was not significant across the entire network compared to other agenda networks. Digital signage is not limited to advertising but is actively used as a tool for various public communication. The public domain has become a meaningful part of digital signage-related industries.

The success or failure of a business in a rapidly changing digital environment depends on innovation. The digital signage market — such as all-around screens, reinventing experiences, and personalized real-time communication — is becoming a testing ground for information technology. For the domestic digital signage sector to lead the global market, it is necessary to have more attempts and innovations than competitors. Based on the big data analysis results of this study, the two key points on the agenda of digital signage were “big companies” and “high-tech”. For the domestic digital signage to advance in the advertising/ media market in the future, issues related to “medium/ small business” and “consumer/ content” issues must be addressed more actively. For digital signage to mature into a cutting-edge media that can rival mobile media, players from various industries, including mid-sized and small businesses, must compete and collaborate. From now on, there will be a need for creative content development as well as continuous research and development on the consumer — the ultimate recipient of the message. This requires organic cooperation for industrial development in various fields such as industry, government, and university. We hope this research will help introduce policies to strengthen the competitiveness of digital signage in Korea.

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