Network analysis of Korean pop music creators - A comparison of the top 100 song creators in 2010 and 2020

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Abstract

Korean popular music, known as K-pop, is an important genre that has developed the Korean wave into a transnational cultural phenomenon. The creation of popular music takes place through various collaborative networks such as composers, lyricists, arrangers, singers, producers, and agencies, and the nature of the music content varies depending on how the network functions. In this respect, the analysis of the network of connection structures for pop creators is of academic significance in that it can capture the trends of K-pop on a small scale and Korean wave on a large scale. This study conducted a network analysis of music creators by collecting data from the 2010 and 2020 Top 100 music charts, which collect and aggregate the scores of most music platforms in Korea. As a result of the analysis, the network size in 2020 was larger than in 2010, but its density and degree of connectedness decreased. Although the collaborative intensity decreased in 2020 compared to 2010, many singers participated in creative work such as composition and lyrics, and the part where the proportion of pop songs increased and foreign creators participated was positive. However, consistent the power-law distributions observed in other music markets, there was a phenomenon of commercial success and industry influence being concentrated among creators with high network centrality.

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KEY WORDS: K-pop, Korean wave, music network, creator network, network analysis, commercial performance

1. Introduction

Korean pop music constitutes the basis of K-pop, a distinctive cultural phenomenon that emerged from Korea's unique integration of traditional and Western musical elements (Jin, 2024; Lee & Zhang, 2021). The sustained innovation and production of creative musical content are imperative for the widespread popularity of Korean pop music and K-pop. However, because popular music as a cultural industry operates in a complex, dynamic, and uncertain organizational environment, producers in the cultural industry must cooperate with each other through continuous feedback (Faulkner & Anderson, 1987).

Even if producers in the cultural industry do not know consumers' tastes in advance, and even if they know past tastes, the future is still uncertain, making uncertainty one of the greatest characteristics of the cultural industry (Hirsch, 2018; Caves, 2000). The creation of popular music with such uncertain cultural industry characteristics takes place through various collaborative networks, including composers, lyricists, arrangers, singers, producers, and agencies, and determines what musical content is produced depending

on how these collaborative networks function. In other words, popular music as a cultural industry can be seen as a collaborative connection in which producers divide their labor and interact in their respective specialties to overcome uncertainty (Hirsch, 2018).

In such an uncertain cultural industry, the question of how people network and create products becomes very important. Because by capturing this connection structure, the strategies of producers in response to uncertain and dynamic changes in consumer tastes can be identified, and the behavior of collaboration can be identified. Network analysis of the collaborative structure of these creators in popular music can provide various implications about how many connections are taking place in Korean pop music, what themes are at the center of Korean pop music, how different creators are collaborating, and whether these connections are expanding or shrinking over time. Through network analysis of Korean pop music, creators who collaborate will be able to understand the path steps and openness to access other creators, who will be able to understand whether these path steps increase or decrease over time, and how the "narrow world" in popular music affects the success and creativity of popular music.

Creativity comes from unfamiliarity and diversity, not familiarity, and diversity can be the basis for Korean popular music to continue to produce creative and innovative products. Therefore, the analysis of the connection structure network for Korean pop music creation is expected to show what the pop music creation network, consisting of lyrics, compositions, arrangements, singers, and agencies, looks like through the network analysis of Korean pop music, and to provide clues as to which subjects form the network through the centrality analysis. This may have implications in terms of the openness of the creation structure of popular music, and when the connection efficiency between various creation nodes is analyzed in combination with the factor of the box office of popular music, it is expected that the creation network structure is related to the box office. Therefore, identifying the network centrality and connection of Korean pop music, which is the basis of K-pop, through the analysis of the creator network of Korean pop music will help to plan and produce popular music by providing clues as to which creator nodes are the center of popular music's success, and will have academic significance in that it can examine network changes and correlations with content diversity through changes in the creator network of Korean pop music.

2. Literature Review

2.1 Network Analysis Theory The subway map is a good example of conveying the meaning of the network by ignoring the complex information or distance that exists on the ground and enhancing only the minimum information necessary to use the subway. In other words, it is not the distance from the starting point to the destination that is important, but the way in which it is connected. These laws of networks govern not only subways, but everyday life. Castells defined that all societies are culturally created structures and are organizations of people in production, consumption, reproduction, experience and power relationships that express meaningful communication with the code of culture about the social structure of the network (Castells, 2009). In network analysis to understand this structure, centrality analysis is an analytical method to examine whether a particular actor in the network occupies a distinctly central position compared to other actors, and can be a method to measure the importance or reputation of each actor within the network (Wasserman & Faust, 1994; Bae & Park, 2014).

The theory of small world network measures the distance between any two people in the United States, finds that the number of people passing through the center is within six steps, and the social network is tightly connected, so it is a space filled with strings that connect an individual to another person who is geographically and socially distant (Milgram, 1967). Using this narrow world network theory, a study of which networks create artistic and economic creativity by analyzing the networks of co-production personnel involved in the production process of Broadway music shows the highest success when the narrow world network index is in the middle (Uzzi & Spiro, 2005). In a study of the "narrow world" network in the Korean film industry, the path length in the production team network was short and the cluster coefficient was high when creative achievements occurred, such as submitting to and winning awards at international film festivals (Lee Se-in, 2012).

In addition to centrality or the narrow world network, there are the concepts of a "hub" and a "connector" that describe the center of the network. A hub refers to a node that is located at the center of the network

because it has multiple links as a wheel axis or centripetal point, while a connector differs from a hub in that it is a person who is connected to other people of various classes and is responsible for connecting them (Choi Young, 2019). In other words, a hub serves as the center of a large number of connections, but its influence may be limited to one group, while connectors are only connected to a small number of people, but can play a role in connecting different groups. The more complex and diverse the nodes, the more important these connectors become, and these connectors secure network capital by connecting groups that are not directly connected to each other.

2.2 Analysis of the network structure of popular music A music feature is a collaboration between one artist and another artist, and songs released in various forms such as instrumental or vocal collaboration are marked as "featuring". For example, if "G-Dragon" participates in the form of singing and rapping on the song "Palette" by IU, a famous Korean singer, the title will be marked as "Feat. G-DRAGON". This is different from the collaboration that takes place between two artists. These features are often achieved through close relationships between artists, composers, lyricists and agencies, and there are also many collaborations between artists of different genres. A study that examined whether different artists collaborating through such musical features increased a song's popularity found that songs that featured other artists were more likely to be in the Billboard Top 10 than songs that did not feature other artists (Ordanini et al., 2018). Furthermore, the study found that the greater the difference between genres, the greater the likelihood of being at the top of the chart, and the proportion of these featured songs in the Billboard Hot 100 has increased over the past 20 years.

There is also a study that analyzed network structure and influence in popular music in terms of "cover" rather than "feature" (Otega, 2021). A cover song is an arrangement of an existing song by another singer and represents the popularity of the song or original artist, so the cover for a particular singer or song can also be said to be an indicator of the song's influence. The study extracted more than 106,000 artists and 855,000 cover versions to draw a network graph. The study found that the number of cover songs has gradually decreased over time since the 1950s, with different genres being the most important factor in cover songs between artists, and language being the second most important factor. Jazz and pop/rock were the most influential music genres revealed by the cover.

Just as the power law distribution replaces the average and normal distribution in the network world, the same phenomenon occurs in the market share of popular music. Haampland (2017) describes this phenomenon as the concentration of wealth and fame among successful artists. After analyzing 50 years of data from the Billboard charts, he found that cumulative gains, such as specific albums and artists' reputations, cause this imbalance, and the power function law is implemented in the form of better album sales for famous artists.

A study that used network analysis to predict the popularity of artists in music streaming services examined whether artists affect their popularity when they upload information and song information to music streaming platforms, and predicted box office artists by identifying the network structure of the relationship between artists based on images, videos, and audio that artists upload to social media (Matsumoto et al., 2020).

Other studies using network theory in relation to music include analysis of similarities between classical music (Rolla et al., 2021), user activation, participation, and collaboration based on music genres (O'shea, 2020), collaboration through social network analysis between composers (McAndrew & Everett, 2015), analysis of networks between music creators (Watson, 2012), and research analyzing international music exchange networks (Moon et al., 2010).

One of the representative studies in Korea is a study that analyzed the network structure and fluctuations of Korean pop music creators (Kim & Kim, 2014). In this study, the network analysis of lyricists, composers, arrangers, and singers who are producers of popular music analyzed the collaboration structure by dividing it into times. In addition, the changes in the network were examined along with the changes in time, and the structural changes of the Korean pop music creation network in each period were examined by performing centrality analysis, narrow world network analysis, and ERGM (External Random Graph Model) analysis. As a result of the study, it was found that the number of creations increased over time, and the connection

among creators was distributed among a small number of creators due to changes in the specialization and genre of creators, and the role of intermediaries decreased, while the efficiency of the connection also decreased. In addition, it discovered the form of a narrow world network in the Korean pop music creation network and found that this narrow world network index increased over time, and it was found that the phenomenon of cooperation among creators with the same attribute also increased over time. However, this study has the advantage of conducting a time-series study with a total of 28 years of data from 1985 to 2012, but due to the nature of data collection over a vast period of time when the means of listening to music have changed, the music box composed of record data, Hanteo chart, and melon data as a sound source was integrated and composed. From 2005 to 2014, only data within a specific platform called Melon were used to investigate the changes in the creator network. Considering that since 2010, record sales have been mainly conducted by K-pop idol groups, there is a concern that the difference between the K-pop idol-centered network and the general music-centered network will be divided if the music and record data are integrated and aggregated.

Therefore, in this study, we collected data based on the annual top 100 data of the Circle Chart sound source. The Circle Chart was created in 2010 with the consensus that Korea also needs official music charts such as the Billboard Chart in the U.S. and the Oricon Chart in Japan. Produced by the Korea Music Contents Association and sponsored by the Ministry of Culture, Sports and Tourism of Korea, it has been recognized for its public credibility. The data was collected based on the annual top 100 data of music in the circle chart, and the top 100 music creators network in 2010 and the top 100 music creators network in 2020 were compared and analyzed to track changes over time. Through this comparative analysis, we tried to see whether the collaboration between K-pop music creators continued to increase, and how K-pop, which has become more popular around the world, and the structure of songwriting and composer collaboration changed.

Recent studies have examined the relationship between network position and performance outcomes in creative industries. Uzzi & Spiro (2005) found that network centrality correlates with both artistic and commercial success in Broadway productions, while studies by Cattani & Ferriani (2008) demonstrated that optimal performance occurs at intermediate levels of network embeddedness. These findings suggest that network analysis can provide insights into the commercial implications of collaborative structures, supporting the need to examine performance outcomes alongside structural network characteristics.

3. Research questions

Based on the literature review, the following research questions were formulated.

RQ1: What is the Korean pop music network like in 2010, and what is the network size, density, and connection level? Also, who is the creator who ranks high in the center of the network?

RQ2: What does the Korean pop music network look like in 2020, and what is the network size, density, and connection level? Also, who is the creator who ranks high in the network center?

RQ3: What are the changes in network size, density, and connectedness in the Korean pop music creator network in 2010 and 2020, and what changes did the creators with the highest network centrality show?

4. Methods: Dataset & Analysis

The method of aggregating the data of all songs released to understand the Korean pop music creator network is not practically possible, and it is not suitable in that the highly influential music that many members of the public listen to is underestimated. If network analysis is conducted mainly on popular songs, the question remains how much the entire creator network is reflected, but there is an advantage of being able to look at the creator network that creates popular music in that it is the most listened to music in that era and the network analysis of its creators. Therefore, this study analyzed the data of lyricists, composers, arrangers, and singers through the Korea Music Copyright Association and Google Search

by using the data of popular songs in 2010 and 2020, when the annual top 100 of the circle chart, which collects more than 97% of Korean pop music's Melon, Genie, FLO, Vibe, and Bugs,.

First, songs and artists were identified based on the song data of the top 100 digital music sources in 2010 and 2020, which were released on the Gaon Chart (www.gaonchart.co.kr), the predecessor of the Circle Chart, and lyricists, composers, and arrangers were written by song using the Korean Music Copyright Association's (www.kcomca.or.kr) work search function. Up to eight creators (teams) with more than one artist, lyricist, composer, and arrangement are listed. Through pre-analysis, we compared the method of identifying the connection form in the form of song-singer, singer-composer, composer-composer, and song-composer, and the method of identifying the connection form in the form of song-writing, and decided that it was more suitable for this study to understand the network structure around song. This is because popular songs are a form in which singers, lyricists, composers, and arrangements gather to work on songs. In addition, if the singer listed on the Gaon Chart participated in the song work, it was intended to change the name of the singer registered with the Copyright Association to examine the network composition for each role.

The analysis method also selected the Python networkX package in consideration of the convenience of analysis and the possibility of expanding future research after comparing the UCINET, NodeXL, and Python nextworkX packages through prior research. The Python networkX package is a Python language-based package-type software for calculating and studying the structure, function, and dynamics of complex networks, equipped with standard graph theory and statistical physics functions, supports the implementation of various typical forms of graph and synthetic networks, is easy to change into various forms, and features large-scale analysis is possible (Platt, 2019). Through the Python networkX package, network graphs of K-pop creations or networks in 2010 and 2020 were organized and compared, and changes in network size, density, and connection degree were examined.

5. Results

5.1 K-pop network analysis in 2010 A network analysis was performed on 99 songs, excluding one pop song, out of 100 songs included in the annual Gaon chart top 100 in 2010. With song, singer, lyricist, composer, and arranger as nodes, the unidirectional network of song-singer, song-composer, song-composer, and song-arranger was graphically constructed. Graphs such as Figure 1 and Figure 2 were constructed, consisting of a total of 335 nodes and 381 edges. The network size was 335, the network density was 0.0068, and the degree of connection was 2.27.

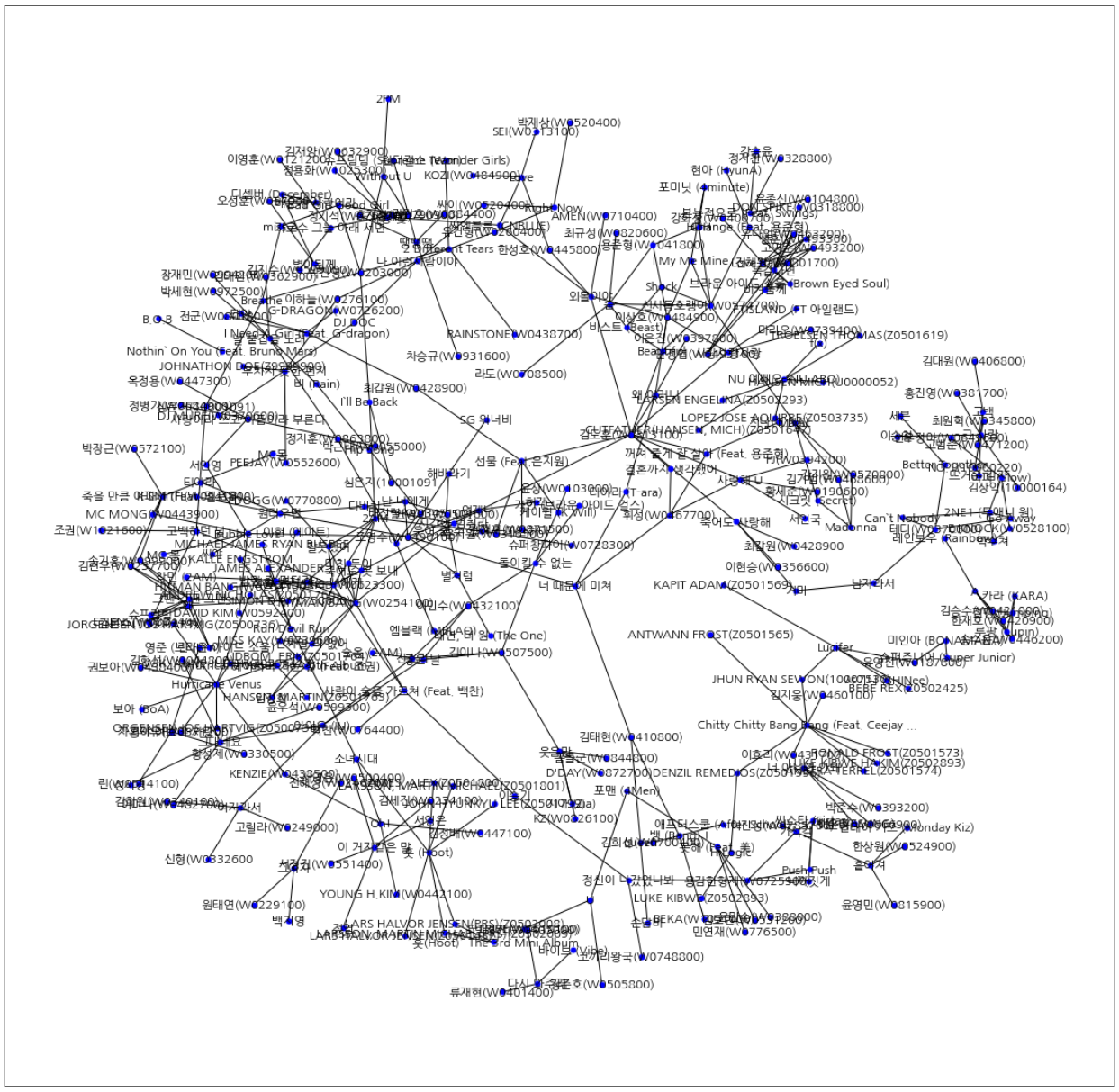

Figure 1: Network graph of K-pop in 2010

In the graph of Figure 2, in which each node is divided into professional groups such as singers, composers, lyricists, and arrangers, the clustering of lyricists, composers, and arrangers was remarkable. This is because singers, including idol groups, do not match the songwriting, composition, and arrangement nodes registered by the Copyright Society, but lyricists, composers, and arrangers tend to cross each other's job groups. Psy, Wheesung, Jo Kwon, and Lee Hyo-ri, who are singers and work on songs, played a role in connecting these jobs.

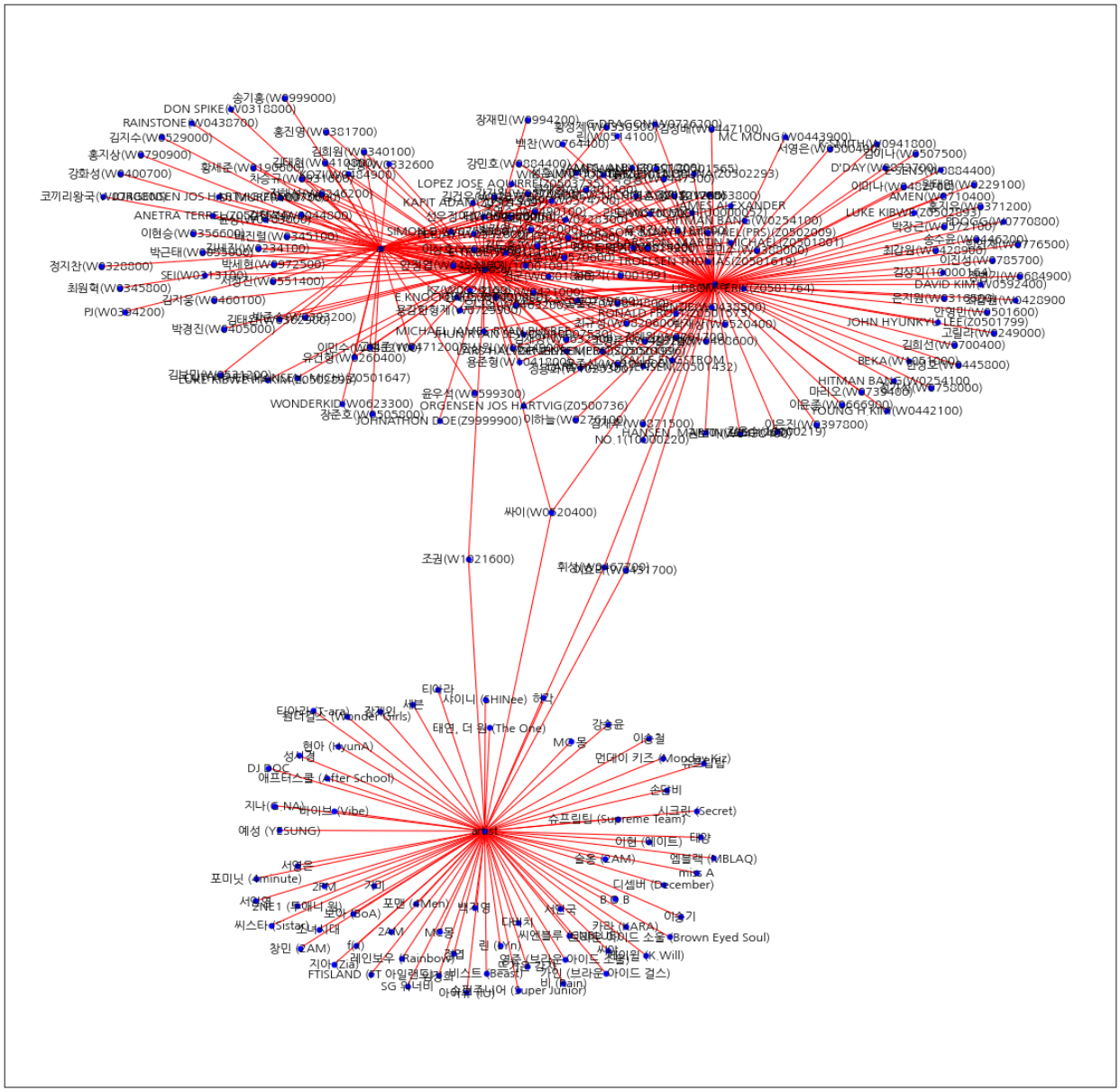

Figure 2: Network graph of K-pop in 2010 (Profession)

In the analysis of the centrality of the Korean pop music network in 2010, Kim Do-hoon had the highest centrality as a person, excluding the song, followed by Bang Si-hyuk (also known as HITMAN BANG) in second place, Wonder Kid in third place, Shinsa-dong Horang in fourth place, and Cho Young-soo in fifth place. In terms of songs, Hurricane Venus and Lee Hyo-ri's Chitty Chitty Bang Bang had the highest centrality, which may be due to the fact that many lyricists, composers, and arrangers were involved.

Node	Centrality
Kim Do-hoon (W0313100)	0.0299
HITMAN BANG (W0254100)	0.0269
Hurricane Venus	0.0269
WONDERKID (W0623300)	0.0269
Chitty Chitty Bang Bang	0.0239
Shinsa-dong Horang (W0574700)	0.0209

Node	Centrality
Cho Young-soo (W0490100)	0.0209
Hoot	0.0209
2AM	0.0179
Love Ballad	0.0179
NU ABO	0.0179
Back then, back then, back then	0.0179
If it's the same	0.0179
Why	0.0179
Lee Sang-ho (W0484900)	0.0179

Table 1: Analysis of K-pop centrality in 2010

5.2 K-pop network analysis in 2020 A network analysis was performed on 86 songs, excluding 14 pop songs out of 100 songs included in the annual Circle Chart Top 100 in 2020. Only one pop song was included in the annual top 100 in 2010, while the proportion of pop songs increased significantly in 2020. A graph as shown in Figure 3 was composed of a total of 382 nodes and 387 edges. Although the network is composed of fewer songs compared to 2010, the total number of nodes and edges increased due to the tendency of a large number of lyricists and composers to participate in song work. The network size was 382, an increase from 2010, the network density was 0.0053, a decrease from 2010, and the degree of connection was 2.02.

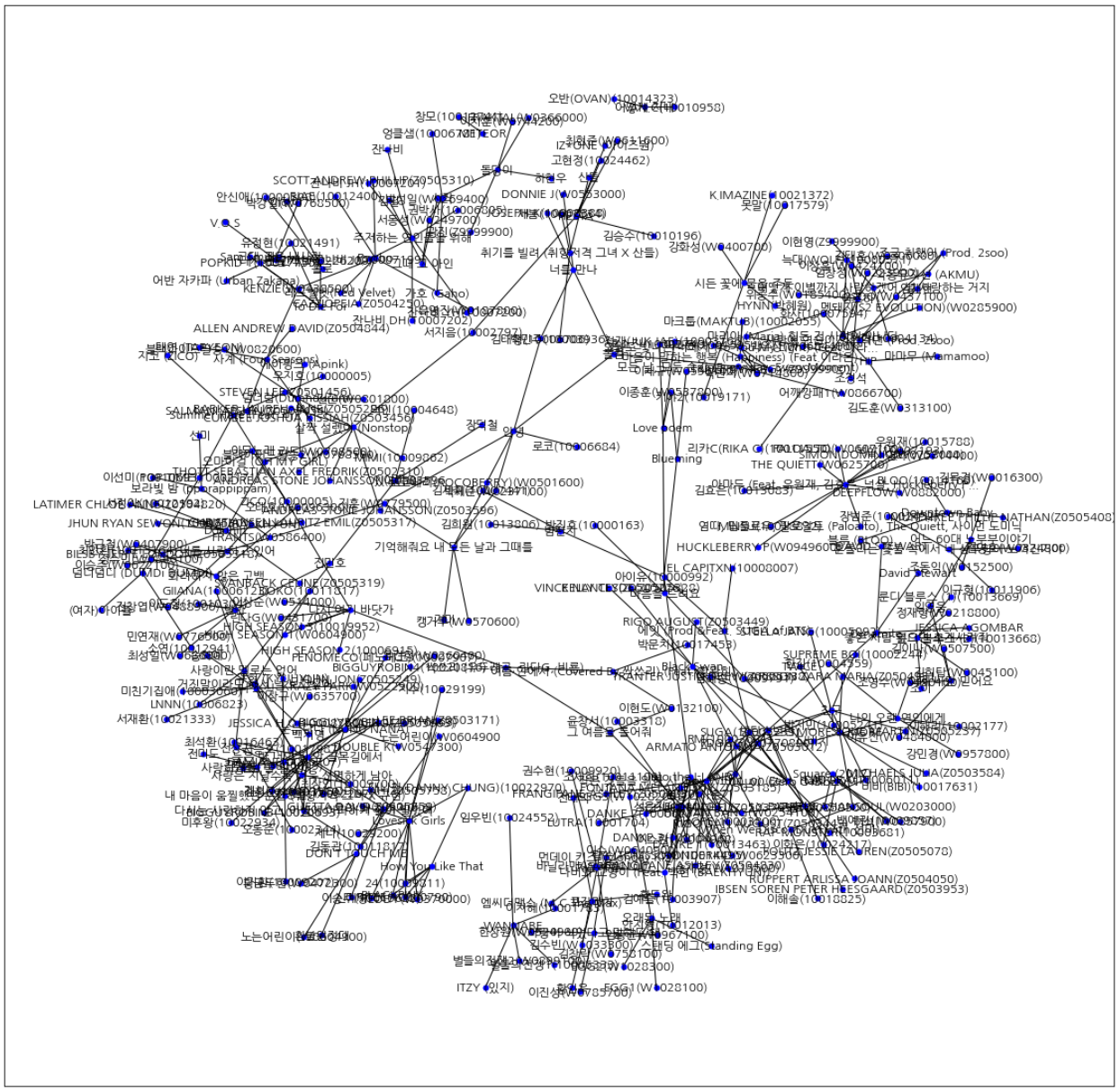

Figure 3: Network graph of K-pop in 2020

As in 2010, the cluster of lyricists, composers, and arrangers was noticeable in the graph of Figure 4, which was divided into professional groups such as composers, lyricists, and arrangers, but compared to 2010, the number of singers who participated in writing and composing work increased significantly. In particular, more singers such as IU, Zico, Jang Beom-jun, Hwasa and Marktup participated in the song work.

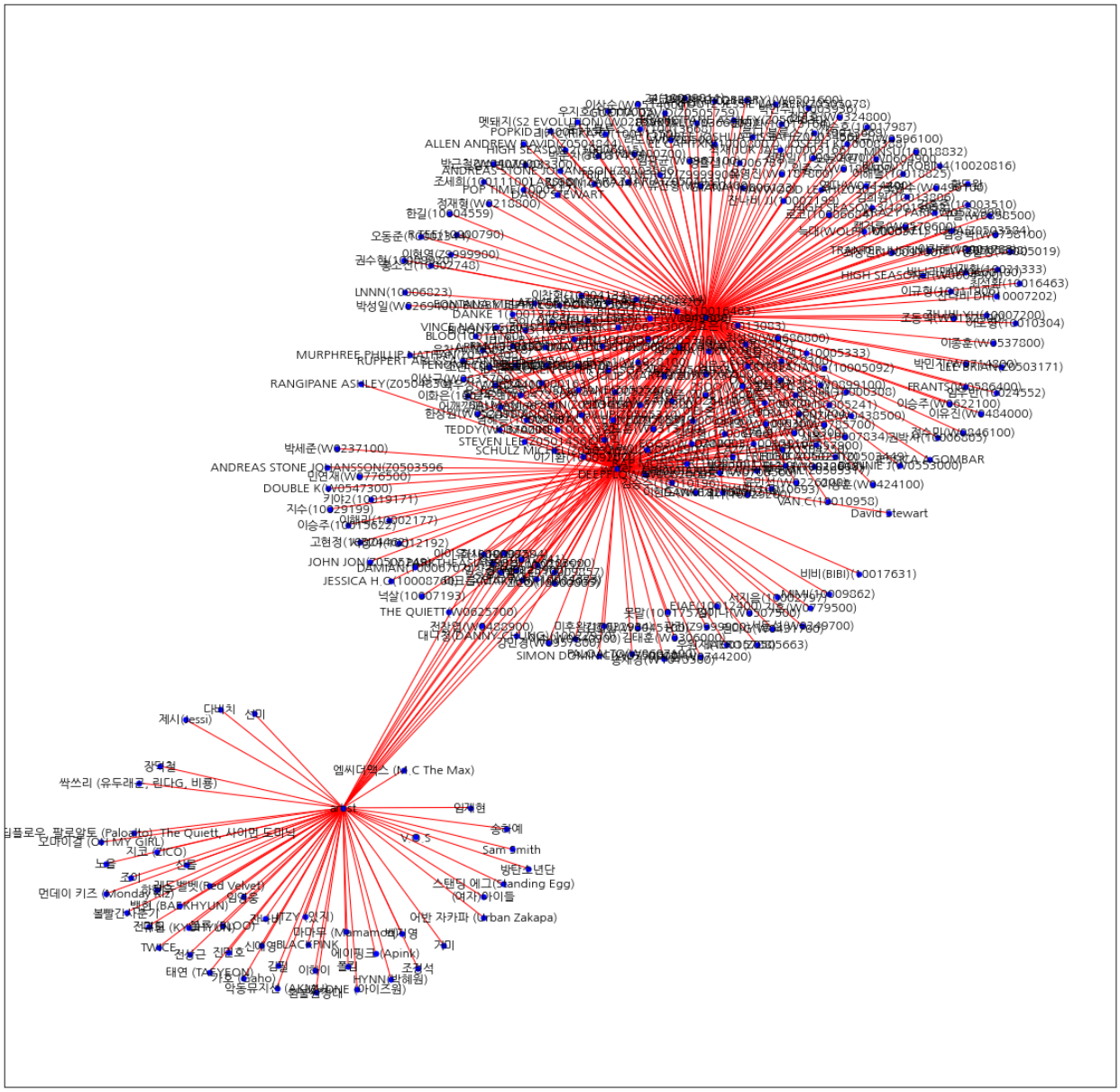

Figure 4: Network graph of K-pop in 2020 (Profession)

In the analysis of the centrality of the Korean popular music network in 2020, Bang Si-hyuk showed the highest centrality, followed by Schulz Michel in second place, BTS member Suga in third place, IU in fourth place, and Danke 1 in fifth place. In terms of songs, Into the I-LAND, Poetry for Small Things, ON, etc. showed the highest centrality, as a large number of lyricists, songwriters and arrangers participated, and many of BTS' songs entered the charts.

Node	Centrality
HITMAN BANG (W0254100)	0.0549
Into the I-LAND	0.0547
Boy With Luv (Feat. Halsey)	0.0531
ON	0.0526
BTS	0.0524
Spring Day	0.0522

Node	Centrality
SCHULZ MICHEL(Z0503765)	0.0519
Filter	0.0517
SUGA(10005239)	0.0515
eight (Prod.&Feat. SUGA of BTS)	0.0494
IU (10000992)	0.0492
DANKE1 (10013463)	0.0488
DANKE2 (10006214)	0.0488
DANKE3 (10015816)	0.0488
Lee seuran (10004968)	0.0488
PDOGG (W0770800)	0.0472
RM (10003681)	0.0436
Friend	0.0421
Black Swan	0.0418

Table 2: Analysis of K-pop centrality in 2020

5.3 2010 vs 2020 Network comparison analysis As shown in Table 3, the number of pop songs increased significantly from 1 to 14 in 2020 compared to 2010, and the network analysis was performed with fewer songs compared to 2010. However, more singers, lyricists, composers, and arrangers participated, and the number of nodes and edges increased further, making the network larger. However, the density of the network decreased slightly compared to 2010, and the degree of connectivity also decreased slightly, indicating that the connectivity in 2020 was lower than in 2010. Overall, the density of the creator's network was not high, but it was concentrated in a few nodes. In 2010, the centrality of Kim Do-hoon, Bang Si-hyuk, Wonder Kid, Sinsa-dong Horang, and Cho Young-soo was high, and in 2020, the centrality of Bang Si-hyuk, BTS, Schulz Michel, Suga, IU, and Danke 1 was high. The centrality of the top nodes was also more than double that of 2010, indicating that the overall network density decreased in 2020 compared to 2010, while the centrality of the top nodes increased. A network analysis of the data by occupational group reveals that in 2020, a greater number of singers were directly involved in the writing, composing, and arranging of songs in comparison to 2010. This finding indicates an increase in network connectivity between lyricists and songwriters. This phenomenon is indicative of the evolving nature of artistic roles within the contemporary K-pop industry, where conventional boundaries between performance and composition are progressively dissipating.

Sort	2010	2020	Change
Node	335	382	Increase
Edge	381	387	Increase
Network Density	0.0068	0.0053	Decrease
Degree of connectivity	2.2746	2.0261	Decrease

Table 3: Network comparison 2010 vs. 2020

Through a comparative analysis of the network of Korean pop creators in 2010 and 2020, it was possible to determine which creators formed a popular music network at that time. It is noteworthy that Bang Si-hyuk, who was ranked second in the center of the network in 2010, has played a central role in Korean pop songs for more than 10 years, and is now ranked first in 2020. The BTS produced by Bang Si-hyuk and the creators who participated in their songs are also ranked first in 2020. The preponderance of HYBE-affiliated creators in prominent positions within the network underscores the profound influence of Korea's oligopolistic entertainment industry structure on network formation and collaboration patterns. This corporate concentration is indicative of the strategic role of major entertainment companies in shaping the creative networks of Korean popular music. Furthermore, IU, who had been ranked 50th among singers

on the network center in 2010, ascended to the top position in the category of creators who contributed to the writing and composition process in 2020. It was also found that the proportion of pop songs has increased in 2020 compared to 2010, and collaboration has increased significantly, with many more creators participating in the production of songs. However, the overall network density has decreased and the center of the top ranks has increased, which means that the concentration of certain creators has increased even though the overall network connection has weakened. In other words, from the perspective of collaborative intensity, the network connectivity patterns indicate a decrease in collaborative cohesion in 2020 compared to 2010, despite an increase in market openness to international participants. On the other hand, it can be seen that the participation of foreign creators in K-pop has increased significantly, and in 2010 there were no foreign creators in the top 100, while in 2020 there were 23 international creators from 8 countries in the top 100. In other words, the proportion of foreign creators participating in the creation of K-pop in Korean pop music has increased significantly, representing a fundamental shift toward global production networks.

6. Conclusion

In order to analyze the creator network of Korean popular music, this study conducted a network analysis centered on the song node of each of the 100 popular songs in 2010 and 2020. The song work is a unidirectional network that cannot be considered to have a specific direction, and it formed an inter-node network among all the artists, composers, lyricists, and arrangers who participated in the song. As a result of the study, the size of the Korean popular music network in 2020 was larger than in 2010, but the network density and connection degree decreased, and the participation of foreign creators in addition to domestic creators increased significantly. In the network world, a power law distribution appears instead of an average or normal distribution, and wealth and honor are concentrated in famous artists on the Billboard chart (Haampland, 2017), which was confirmed in this study analyzing the creator network of Korean popular music. The creator network of Korean popular music was no exception to the phenomenon observed in existing network studies, and it seems to be a matter of concern that the degree of diversity and openness underlying creativity has decreased in 2020 compared to 2010. However, the fact that many singers participate in creative work such as composition and lyrics, the proportion of pop songs has increased, and the participation of foreign creators has increased is a positive part in terms of diversity and openness. In addition, there have been several attempts to analyze the success of BTSs, but it was an opportunity to look at the existence and role of producer HITMAN BANG, who has been ranked first and second in the Korean pop music network for 10 years in 2010 and 2020.

This study is significant in that it examines the creator network of Korean popular music through a network analysis methodology and examines changes in the network density, center, and connection through comparative studies of the creator network in 2010 and 2020. Network analysis has the advantage of being able to grasp the strategies of creators in response to changes in consumer tastes by grasping the connection structure of the network among creators in an uncertain cultural industry, and to understand which creators are at the center of the network and the degree of openness and connection of the network. However, the specificity of a particular year may have had a great influence on this study, as it only compared data for two years, 2010 and 2020, without considering the limitations of the creator network analysis, which is limited to 100 popular songs per year and changes over time. In addition, the data may be biased due to the popularity of certain artists such as BTS and IU, and there is also a side that the characteristics of each node cannot be clearly expressed in network analysis. In addition, nodes for agencies and distributors, which play an important role in the production of popular songs, should be added, and it seems necessary to include pop songs as well as popular songs when predicting an increase in the domestic market share of foreign music in the future. However, this study has the value of being one of the few network analysis data for domestic pop music creators, and can be said to be valuable as a preliminary study for time series analysis research through broader data collection in the future.

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