

A Study on the Perception and Context of Sportswear Brand Collaboration through Big Data Analysis

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Abstract

Recently, brand collaboration is attracting the attention of the industry as one of the strategies for brand differentiation. It is a marketing activity in which two or more brands of the same kind or different kinds create new brands together to target consumers, and it has developed into a form of productive collaboration that combines and creates new values beyond the level of mutual complementation between individual brands, and is being attempted in many fields. The sportswear industry is also recovering as it has passed the COVID-19 pandemic and has shifted to endemics. This study is to understand consumers' perceptions of sports collaboration brands on social media and provide basic data to related industries. Social media channels are Naver and Google sites. Naver channels collected data from blogs and news sections, Google channels collected data from news and Facebook sections, and used Textom version 6.0, a big data analysis solution, for data collection. The collection period was collected from May 11, 2023, during the transition from the COVID-19 pandemic to the end of the pandemic, to June 30, 2024. The collected data are 2,667 blogs and 761 news on Naver channels. They are 222 news and 41 Facebook on Google channels. The collected data was converted into standardized data through preprocessing. TF and TF-IDF were analyzed through text mining. Sixty keywords were extracted in consideration of the frequency of keywords and the importance in the sentence. Semantic matrix and Concore analysis were performed on the extracted keywords. Big data analysis programs such as Textom and Ucinet were used for big data analysis, and NetDraw was used for visualization. As a result of text mining analysis, 'collaboration' showed the highest frequency with 4,860 times in relation to TF. Next, brand(3,835), sports(1,934), product(1,442), 'X'(1,125), global(1,116), release(1,064), and Nike(937), were shown in the highest order. In terms of TF-IDF, 'Nike' was the highest at 2153. Next, Puma(1,996), product(1,731), 'X'(1,659), collection(1,516), Golf(1,494), and release(1,476) were found to be high. As a result, 60 keywords were extracted and the centrality was analyzed through semantic matrix analysis. Finally, through CONCOR analysis, they were clustered into marketing strategy cluster, 'sports brand cluster', 'recommendation cluster', and 'Nike cluster'. For the results of these four cluster analysis, basic practical data were presented based on the main interest, perception, and context of 'sports brand collaboration' of consumers.

Keywords: Sports Brand, Collaboration, Big Data Analysis, Text Mining, Semantic Network Analysis, CONCOR Analysis

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1. Introduction

Modern people are enjoying the usefulness of universal technology due to the development of science and technology and mass media, but they tend to prefer their own creative and unique products and differentiated products as the level of life they pursue increases. Therefore, it is becoming increasingly difficult for companies to build and maintain strong brands. In line with this trend of social change, companies are trying to interact with each other in various fields and try to create new value through products. Companies are paying attention to collaboration for mutual exchange and value creation [1]. The dictionary definition of collaboration means 'working together' and 'collaborating together', which means co-appearance, contest, collaboration, and collaboration [2].

Collaboration is a marketing strategy and management technique that companies or brands often use to maintain brand sustainability by combining images of each other to create new works. Successful collaboration can re-establish the brand identity and expand the market, and with this opportunity, new customers can be secured along with existing customers, so that brand image and value can be increased and mid- to long-term profit improvement can be achieved [3]. Collaboration is actively taking place in various industries, and it is a phenomenon that is particularly active in the fashion industry. Collaboration in the fashion industry can be divided into three types as follows. First, there is a type of collaboration between fashion brands of various characteristics located in the fashion industry. Second, there is a type of collaboration between fashion brands and brands in other industries. Finally, there is a collaboration between fashion brands and individual artists [4].

Collaboration is also an important brand solution in sports companies. In the case of Nike, Nike Plus, which is based on a breakthrough idea that combines sports brand and digital technology, has been unusually evaluated through the combination with Apple, which has not previously collaborated with other brands. In addition, the sportswear brand Adidas is actively utilizing various collaborations with homogeneous and heterogeneous industries, famous designers, etc. [5]. In recent years, Puma, a global sports brand, has collaborated with Soundshop Balansa, a subculture editorial shop, and collaboration products of Lecoq Sportive, a sports brand developed by Descent Korea, and designer brand Bmuet have been released. In addition, a collaboration product with FILA and the Museum visitor was released, and a Puma XO product was released in collaboration between Puma and Canadian world-renowned musician Weeknd.

The industry's interest and investment in sports brand collaboration has led to academic research results over the past decade. As of 2024, about 20 RISS search results have been searched. Research trends on this can be divided into three main categories. First, it is a case study of sports brand collaboration [6]. Second, it is a study on the causal analysis of related variables according to the type of sports brand collaboration [7-8]. Third, it is a study applying an in-depth interview technique or big data analysis on sports brand collaboration [9].

As such, research on the collaboration of sportswear brands is also being accumulated in academia due to the interest and investment of the industry. This study aims to conduct big data analysis on sportswear brands. As previously suggested, prior research on big data has been conducted. However, since the previous study limited five brands and was a study before the COVID-19 pandemic, it is judged that research at the time of the end of the pandemic is necessary.

As such, collaboration has been attempted in various sportswear brands, and this study collects and analyzes big data related to collaboration of sportswear brands created in social media until recently, starting from May 2023, when COVID-19 pandemic was converted to Endemics, to understand public perception, important keywords, issues, meanings, and contexts. The purpose of this study is to provide basic data on the

collaboration industry and research of sportswear brands.

2. Research method

2.1 Data collection and analysis method

Keywords for data collection for this study were 'sports brand collaboration'. Naver and Google were selected as collection channels. Naver channel collected data from blog and news sections, Google channel collected data from news and Facebook sections, and Textom version 6.0 was used for data collection, which is a big data analysis solution. The collection period was collected from May 11, 2023, during the transition from the COVID-19 pandemic to the endemic, to June 30, 2024. The collected data are 2,667 blogs and 761 news on Naver channel. News 222 and Facebook 41 on Google Channel. Keyword extraction was limited to 60 in consideration of the frequency of appearance, and data collection information is shown in Table 1.

Table 1. Analyze data information

Item	Content
Collection period	Naver(Blogs, News) , Google(News, Facebook)
Collection channel(collection unit)	May 11, 2023 - June 30, 2024(monthly basis)
Search word(60item)	Sports Brand Collaboration
Collection tools/ Analysis / Visualization tool	TEXTOM / Ucinet 6.0 NetDraw

2.2. Analytical procedure

In this study, data were collected and analyzed using Textom, and the collected data were converted into standardized data by removing unnecessary words, adverbs, and conjunctions. Next, the refined data were analyzed using text mining techniques to calculate the frequency of words, and keywords related to sports brand collaboration were derived. Then, a matrix was created using the derived keywords, and a CONvergence of iterated CORrelations(CONCOR) analysis was conducted using the Ucinet 6.0 program to derive clusters with similar characteristics to network centrality. Network visualization and CONCOR analysis were performed using Netdraw function [10].

3. Results

3.1. Text mining analysis

In big data analysis, text mining is based on natural language processing technology to extract meaningful information and knowledge from large-scale text data [11]. In this study, we analyzed TF and TF-IDF through text mining. TF refers to the frequency of extracted words, while TF-IDF is the product of the inverse of keyword frequency (TF) and document frequency (IDF), indicating how important a word is in a specific document.

The results of the text mining analysis are as follows. First, the top 10 keywords based on keyword occurrence frequency were 'collaboration' with the highest frequency of 4,860 times. Next were brand(3,835), sports(1,934), product(1,442), 'X'(meaning collaboration; 1,125), global(1,116), release(1,064), Nike(937), fashion(895), and collection(890). Next, the top 10 keywords based on TF-IDF were 'Nike' with the highest

value of 2,153. The next were Puma(1,996), product(1,731), 'X'(1,659), collection(1,516), Golf(1,494), release(1,476), sports(1,934), global(1,419), and fashion(1,419). The specific results text mining are shown in Table 2.

Table 2. Text mining analysis results

No	Word	TF	TF-IDF	No	Word	TF	TF-IDF
1	Collaboration	4860	315	31	Provide	314	751
2	Brand	3835	806	32	Sneakers	305	836
3	Sports	1934	1422	33	Purchase	296	773
4	Product	1442	1731	34	Sweatshirt	288	893
5	X	1125	1659	35	Designer	280	756
6	Global	1116	1419	36	Make public	268	706
7	Release	1064	1476	37	Model	268	755
8	Nike	937	2153	38	Nike kids	263	844
9	Fashion	895	1419	39	Open	257	746
10	Collection	890	1516	40	Fashion brand	254	671
11	Sports brand	810	1183	41	FILA	253	881
12	Puma	672	1996	42	Domestic	250	674
13	Design	659	1184	43	Club	246	782
14	Clothing	588	1096	44	News	244	683
15	Exercise	570	1210	45	Street	241	717
16	Shoes	570	1274	46	Air Force	240	736
17	Process of event	568	1105	47	Celebration	233	661
18	Golf	503	1494	48	The United States of America	228	659
19	Recommendation	501	990	49	Japan	226	701
20	Store	459	1185	50	Culture	225	643
21	Style	444	961	51	Pop-up store	225	667
22	Adidas	439	1221	52	Marketing	224	689
23	Sportswear	425	883	53	Jordan	220	679
24	Popularity	419	926	54	Release	219	653
25	Reebok	381	1136	55	Introduction	219	606
26	T-shirt	373	967	56	Information	218	608
27	Collaboration brand	367	824	57	Season	215	618
28	Item	323	810	58	Life style	207	593
29	Line	321	897	59	Color	207	613
30	Game	315	915	60	Sale	205	605

3.2. Semantic network analysis and CONCOR analysis

Through text mining, we extracted 60 keywords through TF and TF-IDF results and performed 1-mode matrix analysis to convert them into matrices. These analysis results were performed by semantic network analysis and visualization using the Ucinet6 program. Keywords based on frequency of occurrence are important keywords, but they can be overestimated or underestimated due to their low frequency of occurrence. To do this, three centrality analyses were conducted. The three centrality analyses analyzed connection centrality, proximity centrality, and mediation centrality. Specific results of centrality analysis are shown in Table 3.

The three centrality analysis results are as follows. First, the collaboration (.132) showed the highest degree centrality, followed by brand (.103), product (.052), sports (.047), Nike (.045), global (.039), X(.037), release (.033), and collection (.030). Next, the collaboration, brand, product, sports, global, shoes, exercise, clothing,

store, recommendation, design, sportswear, provide, information keywords closeness centrality represented a value of '1', and the betweenness centrality represented a value of '.195' and a high betweenness centrality. As in TF, the most centralized keyword is 'collaboration'. Considering the three centralities, the top five important keywords are 'collaboration', 'brand', 'product', 'sports', and 'global'. Specific results are shown in Table 3. Next, to visualize the network, we generated network data with Ucinet 6.0 and visualized it using Netdraw as shown in Figure 1. Ucinet 6.0 and Netdraw are software that visualizes and represents inter-word networks, visually showing the strength of connections between key words and the role of specific words throughout the network.

Table 3 Centrality analysis results

No	Word	Degree	Closeness	Betweenness	No	Word	Degree	Closeness	Betweenness
1	Collaboration	.132	1	.195	31	Provide	.014	1	.195
2	Brand	.103	1	.195	32	Sneakers	.012	.952	.036
3	Sports	.047	1	.195	33	Purchase	.009	.983	.074
4	Product	.052	1	.195	34	Sweatshirt	.018	.747	.073
5	X	.037	.983	.074	35	Designer	.010	.952	.054
6	Global	.039	1	.195	36	Make public	.008	.983	.074
7	Release	.033	.983	.074	37	Model	.007	.967	.042
8	Nike	.045	.983	.184	38	Nike kids	.018	.602	.006
9	Fashion	.028	.983	.074	39	Open	.008	.952	.030
10	Collection	.030	.983	.074	40	Fashion brand	.008	.967	.060
11	Sports brand	.026	.983	.074	41	FILA	.010	.843	.095
12	Puma	.024	.922	.006	42	Domestic	.007	.967	.042
13	Design	.019	1	.195	43	Club	.009	.967	.060
14	Clothing	.025	1	.195	44	News	.009	.967	.042
15	Exercise	.027	1	.195	45	Street	.010	.937	.025
16	Shoes	.028	1	.195	46	Air Force	.015	.843	.122
17	Process of event	.015	.967	.061	47	Celebration	.006	.967	.042
18	Golf	.014	.908	.004	48	USA	.007	.952	.030
19	Recommendation	.021	1	.195	49	Japan	.007	.922	.006
20	Store	.025	1	.195	50	Culture	.006	.952	.030
21	Style	.014	.983	.074	51	Pop-up store	.007	.967	.060
22	Adidas	.015	.983	.164	52	Marketing	.005	.952	.041
23	Sportswear	.018	1	.195	53	Jordan	.012	.855	.118
24	Popularity	.013	.983	.074	54	Release	.008	.952	.041
25	Reebok	.012	.952	.047	55	Introduction	.007	.967	.042
26	T-shirt	.012	.967	.061	56	Information	.008	1	.195
27	Collaboration brand	.010	.983	.074	57	Season	.006	.967	.059
28	Item	.010	.983	.074	58	Life style	.006	.937	.016
29	Line	.008	.967	.060	59	Color	.006	.983	.074
30	Game	.006	.894	.015	60	Sale	.005	.967	.042

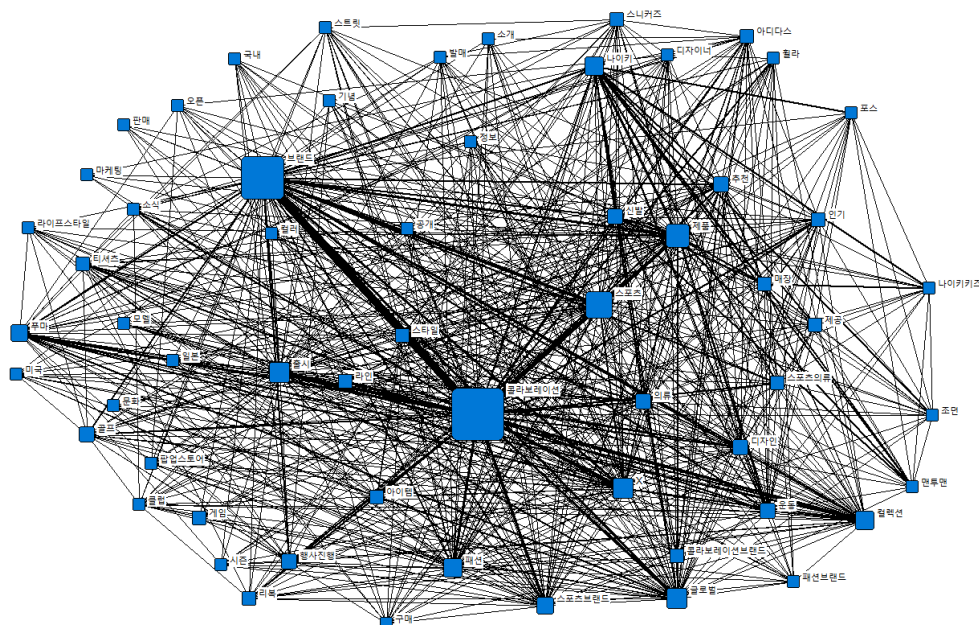


Figure 1. Result of network visualization

Next, a CONVERGENCE of iteration (CONCOR) analysis was performed on the extracted 50 words. A method of finding similar groups at the appropriate level through iterative correlation analysis is structural equivalence analysis [12]. In other words, by clustering a large network into several small networks, it is easy to grasp the contextual meaning of each keyword [13]. In this study, a semantic network was constructed based on the top 60 keywords and the number of truncated clusters was determined by referring to the dendrogram of the CONCOR analysis [14]. As a result of this semantic network analysis and CONCOR analysis, four clusters were formed.

The first is a marketing strategy cluster with keywords such as 'Collaboration', 'Fashion', 'Design', 'Process of Event', 'Golf', 'Style', 'Adidas', 'Popularity', 'Item', 'Line', 'Game', 'Purchase', etc. The second is a Sports brand cluster with keywords 'Make public', 'X', 'FILA', 'Sports brand', 'Sneakers', 'Open', 'News', 'Pop-up store', 'Release', 'Puma', 'Reebok', 'Street', 'Designer', 'Collection', 'Club', 'T-shirt'. The third is a recommendation cluster with keywords 'Sports Clothing', 'Recommendation', 'Clothing', and 'Product'. The fourth is a Nike cluster with keywords 'Shoes', 'Sweatshirt', 'Nike Kids', 'Store', 'Exercise', 'Air Force', 'Jordan', 'Nike', and 'Provide'. As a result, it is shown in Figure 2 and Table 4

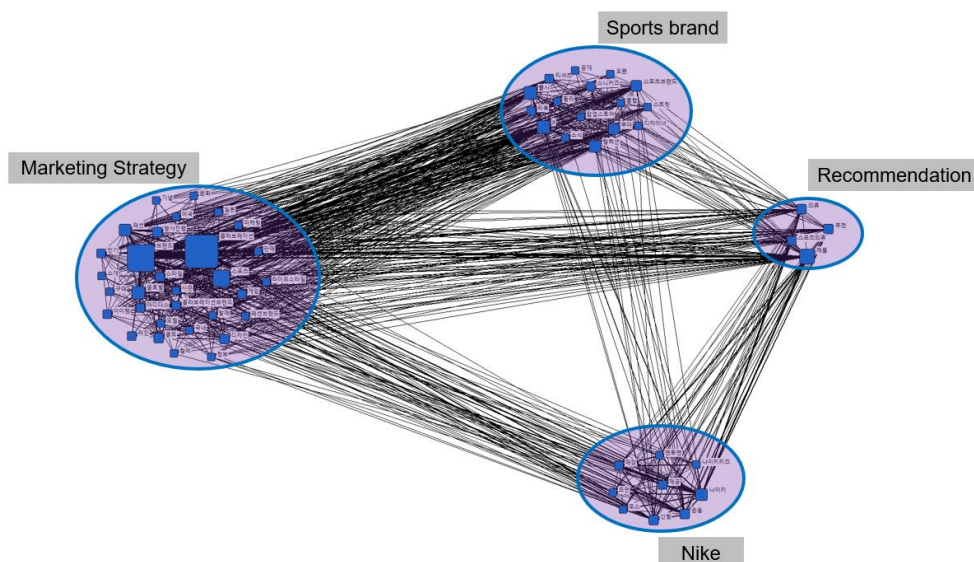


Figure 2. CONCOR analysis results

Table 4. Result of categorization

Cluster	Keyword
Marketing strategy	Collaboration, Fashion, Design, Process of Event, Golf, Style, Adidas, Popularity, Collaboration Brand, Item, Line, Game, Purchase, Model, Fashion brand, Domestic, Celebration, USA, Japan, Culture, Marketing, Release, Introduction, Information, Season, Life Style, Color, Sale, Brand, Sports, Global
Sports brand	X, Make Public, FILA, Sports Brand, Sneakers, Open, News, Pop-Up Store, Release, Puma, Reebok, Street, Designer, Collection, Club, T-shirt
Recommendation	Sports Clothing, Recommendation, Clothing, Product
Nike	Shoes, Sweatshirt, Nike Kids, Store, Exercise, Air Force, Jordan, Nike, Provide

4. Conclusion

As a result of text mining analysis, high-frequency keywords such as 'collaboration', 'brand', and 'sports' were identified. When excluding these high-frequency keywords, other keywords such as 'product', 'X', 'global', 'release', 'Nike', 'fashion', and 'collection' also showed high frequency. From the TF-IDF perspective, 'Nike', 'Puma', 'Product', 'X', 'collection', 'golf', 'release', 'sports', and 'global' were ranked highest. Based on this, 60 keywords with high frequency of appearance were extracted, and a semantic network analysis was performed to confirm three centralities (degree, closeness, and betweenness). When summarizing the three centrality analysis results, 'collaboration', 'brand', 'product', 'sports', and 'global' showed high centrality. Next, as a result of CONCOR analysis, clustering was shown into four clusters.

First, the marketing strategy cluster focuses on collaborations with various brands and sports brands. It showcases the product's characteristics, such as design, style, and line. Additionally, it includes information on product launches, sales, and events related to culture and lifestyle. This suggests that collaborations in sportswear products are recognized as an effective marketing strategy. Accordingly, collaboration was mainly between similar industries, but in recent years, collaborations between completely different species are also increasing. In order to lead a more successful collaboration, a strategy that can create synergy between

collaborator and collaboratee is needed.

Second, the sports brand cluster centers around sportswear brands, including collaborations with fashion designers, limited edition sneaker launches through pop-up stores, and street fashion collections. Many sportswear brands have successfully collaborated with fashion designers. They are expected to continue collaborating with diverse fields like art, culture, and the environment to appeal to consumers. The collaboration's Big Bang occurred when Supreme and Louis Vuitton joined hands. Palas Skateboard and Polo Ralph Lauren also joined forces. This is the second collaboration in the fashion scene. It is about the combination of street fashion brands and luxury house brands. This has developed further, leading to collaboration between luxury fashion brands and brands. A typical example is the collaboration between Gucci and Balenciaga, Fendi and Versace [15].

Third, the recommendation strategy cluster deals with product recommendations. It might include strategies considering the collaboration product's characteristics and target customers. For instance, recommending a Puma-Balansa collaboration to customers interested in subculture. It could also include strategies based on product popularity, sales volume, season, or specific event schedules.

Fourth, the Nike cluster focuses on the sportswear brand Nike. Its specific inclusion suggests high public interest in Nike's collaboration products. Products like shoes, sweatshirts, Nike Kids, Air Force, and Jordan are likely receiving attention. Consumers are interested in purchasing channels for Nike products. Therefore, integrated marketing communication strategies are crucial for collaboration products to enhance information and purchase convenience for consumers.

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