A Study on the User Demand Forecasting and Improvement Plan of Gimpo City Library Service

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ABSTRACT

With accommodation of a population of many young people and families due to Hangang River New Town Housing Project and development of railway station spheres, a need is increasing to improve the quality of public libraries service for Gimpo citizens and to establish more libraries. This study thus analyzed the book lending data of Gimpo City libraries, and the city's libraries-related social media big data in an effort to forecast the users, and thus to propose four library service improvement measures. First, in terms of book gathering and book development policy plans, a proposal was made to expand good books for children and youth, and to expand general original-language books related to learning of English, and English books for children. Second, in terms of the establishment of additional libraries or specialization strategy, a proposal was made to establish exclusive children's libraries or English libraries, and to establish library specialization strategy with a focus on children and English themes. Third, in terms of library culture programs, a proposal was made to provide library culture programs in relation to children education and to expand weekend library culture programs. Fourth, in terms of library facilities, considering the convenience of parking facilities, a proposal was made to establish libraries near apartment complexes.

1. Introduction

Gimpo City has been recognized as one of the most dynamic and highly promising cities with an explosive influx of population induced by the Hangang River New Town Housing Project and development of railway station spheres. Also, as the population of young generations and families living in Gimpo City has been increased, Gimpo citizens' demand for qualitative improvement

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of library services and establishment of more libraries has been on the rise.

In addition, applying Gimpo City's over the 20-year period (1984-2004) average annual population growth rate of 4.9% calculated from the Population Statistical Yearbook of Gimpo City to the population of 590,000 in 2020 predicted by the '2020 Gimpo City Basic Plan,' the population of Gimpo City in 2024 is expected to be about 630,000, which is equivalent to a 14.7% increase. That is, in 2024, the number of Gimpo citizens receiving services from one library in Gimpo City is expected to be 75,000, highly exceeding the national average of 49,692.

Accordingly, in order to practically expand libraries, Gimpo City has planned to build more than five public and small libraries by 2024, including the Pungmu Library built in 2019. Consequently, libraries in Gimpo City need to qualitatively improve the services they currently provide and understand the actual demands of users which should be reflected in the planning and operation of the new libraries.

Thus, this study analyzed the book lending data of Gimpo City libraries and the social media big data related to Gimpo City's libraries in an effort to forecast the users demands and propose library service improvement measures based on the forecast. Specifically, this study analyzed the book checkout pattern by year, age and gender, using the big data (user and checkout data) of Gimpo City libraries, and identified the preferences of the library users in Gimpo City by performing keyword network analysis based on the name and author data of the most borrowed adult and children's books. Moreover. improvement measures for user services that can be applied to libraries in Gimpo City were derived through network analysis on library-related keywords extracted from Naver Cafes or social media sources related to Gimpo City libraries.

This study is not only expected to improve the current services provided by libraries in Gimpo City, but also to provide fundamental data for the planning and operation of new libraries to be established in Gimpo City. Furthermore, applying the improvement measures proposed through big data analysis in this study to the actual sites will make a great contribution to satisfying the needs of library users in Gimpo City and improving the level of satisfaction with library services.

2. Previous Studies

Since the emergence of big data as one of the core technologies in the era of the Fourth Industrial Revolution, big data analysis has been actively used in research and industrial sites of many different fields with various tools such as R and NetMiner developed for the analysis. Studies related to the utilization of library big data have also been conducted in the domestic library and information science sector and the details are as follows.

In the early stage, studies discussing the necessity and application of big data for the library sector were conducted. First, Lee (2013) demonstrated that library big data can provide fundamental data crucial for the qualitative improvement of information services provided by libraries. As practical measures for utilizing library big data, Lee suggested the establishment of library policy, community support, development of information resource and establishment of customized information service direction. In other words, Lee underlined that the use of library big data analysis results by researchers

in order to understand the needs of users and apply the user's demands to the establishment of library policies, community supports, development of information resources and establishment of customized information service direction will serve an important role in improving the quality of library services.

In addition, Lee, Kim, and Kim (2015b) argued that checkout patterns and use-behaviors of users can be analyzed through analysis platforms based on big data. They suggested that, in addition to assisting the librarians, it can be used in various areas such as establishing marketing plans to increase satisfaction with libraries and developing new services for users. In particular, they emphasized the importance of developing a mobile book recommendation service based on big data analysis as one of the most necessary services to be developed based on library big data.

Later, in the study illustrating examples of library big data analysis platforms, Lee, Kim, and Kim (2015a) asserted the importance of the use of big data in the library sector, considering the use of big data as helpful in satisfying various needs of users. In fact, they showed a case of analysis platform that the Korea Institute of Science and Technology Information was developing after construction. The platform, as a library big data analysis platform, can be used to collect, process, store and analyze library big data via cloud computing environment as well as assisting librarians, recommending books and supporting R-based statistics.

Recently, research has been conducted on the National Sejong Library, as a study analyzing the status of users and book checkouts by using big data logs (user information, checkout information, service usage information) of a specific library. Kim, Baek, and Oh (2018) analyzed the user information and book checkout status of adult users by using the big data logs of the National Sejong Library to identify the characteristics of each adult user group, proposing an efficient operation plan for the library based on the characteristics. In the same year, Baek et al. (2018) examined the status of children and youth services at the National Sejong Library by analyzing the status of children's book checkouts and participation in cultural programs, focusing on the children and youth services provided by the National Sejong Library. Furthermore, based on the findings, they proposed improvement measures for the children and youth services at the National Sejong Library.

As such, it can be said that studies conducted in the domestic library and information science sector in relation to the use of library big data can broadly be divided into three categories. First, in the early stage, studies suggesting the necessity and application of big data in the library sector were conducted. Second, after the early stage, studies presenting cases of platforms practically constructed to analyze library big data were carried out. Third, in recent years, studies have been conducted to find ways to improve library services by understanding the needs of users of a specific library based on big data analysis of the specific library. This study differs from previous studies in that it performed keyword network analysis based on SNS data as well as library users and loan data.

It is obvious that the use of library big data is a useful way to find practical measures to improve library operation and user satisfaction. Therefore, it is anticipated that the domestic sector of library and information science needs to carry out various studies applying library big data (e.g. user information, checkout information, service usage information) to more diverse areas. Furthermore, it is deemed necessary to satisfy user demands and improve the quality of library services in Korea

by reflecting results obtained from a library big data analysis in the policies and services at the actual sites of libraries.

3. Research Design and Methodology

3.1 Research Process

For the purpose of this study, the book checkout patterns, as well as the network of most borrowed books and their authors, were analyzed by utilizing the library big data (user and book checkout data) of Gimpo City. In addition, user demands were predicted by analyzing the social media related to Gimpo City, and improvement measures based on the demands were proposed. Details of research process and contents are as shown in Fig. 1.

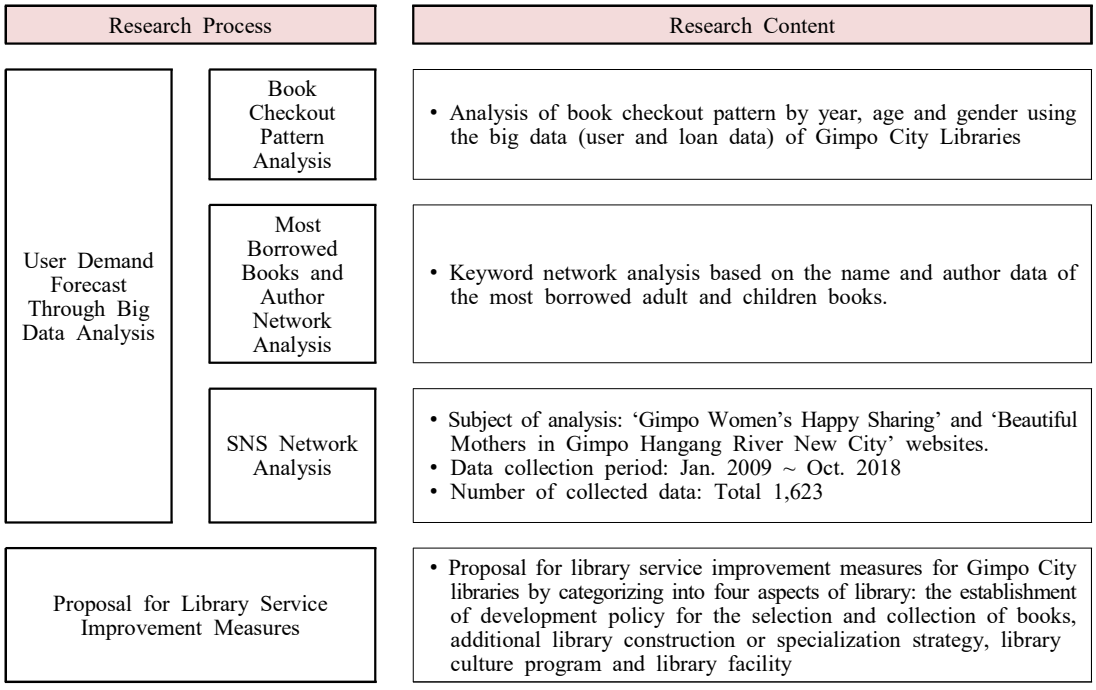

Fig. 1. Research Design Diagram

3.2 Data Collection and Analysis Method

In this study, users and checkout data of Gimpo City libraries were used to analyze the book checkout patterns. In addition, in order to analyze library-related social media big data, the Naver Cafe websites of 'Gimpo Women's Happy Sharing' and 'Beautiful Mothers in Gimpo Hangang River New City' were selected. The data collection period was from January 2009 to October

2018, and the data were collected by setting 'Library' as the search keyword in Naver Cafes related to Gimpo, such as Gimpo Women's Happy Sharing' and 'Beautiful Mothers in Gimpo Hangang River New City' and collecting information related to Gimpo libraries. As a result of the data collection, a total of 1,623 data were collected of which 1,093 and 530 data, respectively, were from 'Gimpo Women's Happy Sharing' and 'Beautiful Mothers in Gimpo Hangang River New City'.

Morpheme analysis was conducted on the data preprocessing related to the network analysis through Python KonLPy module by using the programming language and Python Selenium module, and only nouns were extracted via the morpheme analysis. The collected data were divided into two groups according to the data collection period - data collected from 2009 ~ 2013 and 2014 ~ 2018 - for data analysis. Keywords for each period were extracted and visualized by word-clouding.

4. User Demand Forecast by Library Big Data Analysis

In this study, big data analysis was conducted by broadly dividing it into two perspectives. First, user demand was predicted by analyzing the big data (user and checkout data) of Gimpo City libraries. In other words, the book checkout pattern by year, age and gender was analyzed using the big data of Gimpo City libraries, and the preferences of the library users in Gimpo City were identified by performing keyword network analysis based on the name and author data of most borrowed adult and children books. The findings from the analysis are expected to make a great contribution to predicting users' demands that can be reflected in the improvement of the user services provided by Gimpo City libraries.

Second, the direction of user service improvement measures was derived by analyzing social media big data related to Gimpo City libraries. That is, improvement measures for user services that can be applied to libraries in Gimpo City were deduced through network analysis on library-related keywords extracted from Naver Cafes related to Gimpo City libraries. This is anticipated to help to increase the level of user satisfaction with the services provided by Gimpo City libraries.

4.1 Checkout Pattern Analysis

In order to predict the future user demands of Gimpo City libraries, user preferences were investigated by analyzing book checkout patterns based on the big data of Gimpo City libraries. The investigation findings were then examined by year, age, and gender. In this study, book checkout data between 2016 and 2018 from Gochon · Yanggok · Jungbong · Tongjin libraries were collected and the collected data were used to analyze the checkout patterns of Gimpo City libraries.

4.1.1 Checkout Pattern by Year

The checkout pattern by year was studied per topic and age group, and the details are as follows.

1) Book checkout pattern by year per topic

The result of analyzing the checkout patterns of Gimpo City libraries by year and per topic from 2016 to 2018, showed that literature (45.6%), social science (13.1%), history (8.4%) and natural science (8.2%) books were checked out in 2016 whereas literature (46.7%), social science (12.7%), natural science (8.8%) and history (8.6%) books were borrowed in 2017. Similarly, it was analyzed that literature (45.9%), social science (13.0%), natural science (9.5%) and history (9.0%) were checked out in 2018. According to the comprehensive result, it can be found that the top topic of books borrowed from Gimpo City libraries for the 3 years is literature (46.1%), followed by social science (12.9%), natural science (8.9%) and history (8.7%).

It is noteworthy that the checkout rate for literature was 46.1%, accounting for a high proportion. Nonetheless, it may not be of much significance as the most frequent topic of books borrowed in public libraries is also literature (Choi, Bae, & Nam, 2011), and Gimpo City libraries can be just following the trend. However, the checkout rate of books with literary themes in Gimpo City Libraries was almost 50%, showing an overly biased preference for literary subjects over others. Therefore, it seems necessary for Gimpo City libraries to make efforts to enable users to cultivate the habit of reading through experiences of reading books with various subjects. The operation of various reading culture programs (e.g. book concert for humanities, meeting with authors of sociology books) focusing on topics other than literature can be one example of a concrete action plan.

Table 1. Number and Ratio of Book Lending of Gimpo City Libraries by Year per Topic

	2016	2017	2018	Total
General	42,126 (4.3%)	40,460 (4.1%)	44,390 (4.0%)	126,976 (4.1%)
Philosophy	43,737 (4.5%)	39,170 (4.0%)	39,539 (3.6%)	122,446 (4.0%)
Religion	21,322 (2.2%)	17,786 (1.8%)	20,034 (1.8%)	59,142 (1.9%)
Social Science	128,667 (13.1%)	125,205 (12.7%)	143,212 (13.0%)	397,084 (12.9%)
Natural Science	80,602 (8.2%)	86,644 (8.8%)	104,980 (9.5%)	272,226 (8.9%)
Technology Science	66,505 (6.8%)	64,356 (6.5%)	72,133 (6.5%)	202,994 (6.6%)
Arts	31,966 (3.3%)	27,299 (2.8%)	29,000 (2.6%)	88,265 (2.9%)
Language	35,726 (3.6%)	39,485 (4.0%)	45,600 (4.1%)	120,811 (3.9%)
Literature	446,841 (45.6%)	460,772 (46.7%)	507,482 (45.9%)	1,415,095 (46.1%)
History	82,486 (8.4%)	84,873 (8.6%)	99,328 (9.0%)	266,687 (8.7%)
Total (Ratio)	979,978 (100.0%)	986,050 (100.0%)	1,105,698 (100.0%)	3,071,726 (100.0%)

2) Book checkout pattern by year per age group

In order to examine the books checked out from Gimpo City libraries between 2016 and 2018 by year in terms of age group, the collected data were categorized into different age groups of preschoolers (under 8 years old), elementary school students (8-13 years old), middle school students (14-16 years old), high school students (17-19 years old) and adults (20 years old or above). In 2016, it was found that books were checked out by adults (80.9%), middle school students (12.0%), middle school students (4.2%), high school students (1.7%) and preschoolers (1.2%) in the given order, whereas adults (81.5%), elementary school students (11.9%), middle school students (2.9%), preschoolers (2.1%) and high school students (1.5%) checked out more books in the given order in 2017. Similarly, in 2018, the age group borrowing the greatest number of books was found to be in the adults (81.7%), followed by elementary school students (12.5%), preschoolers (2.3%), middle school students (2.0%) and high school students (1.5%). According to the comprehensive results, it can be observed that adults (81.4%) checked out the greatest number of books during the three years, followed by elementary school students (12.2%), middle school students (3.0%), preschoolers (1.9%) and high school students (1.6%).

Thus, active measures need to be devised to increase the checkout rate of preschoolers, elementary, middle, and high school students. As a matter of fact, Gimpo City libraries have set the youth as a specialization strategy target for long-term libraries, operating the Youth Resource Center, Youth Steering Committee, and Youth Reading Culture Program. However, considering the characteristics of Gimpo City, which has a high population influx composed of young people and families, it is deemed necessary to set the specialization strategy target of public libraries to children or construct additional children-only libraries.

Table 2. Number and Ratio of Book Lending of Gimpo City Libraries by Year per Age group

	2016	2017	2018	Total
Preschoolers (Under 8 years old)	11,345 (1.2%)	20,372 (2.1%)	24,989 (2.3%)	56,706 (1.9%)
Elementary School Students (8~13 years old)	117,352 (12.0%)	115,156 (11.9%)	136,557 (12.5%)	369,065 (12.2%)
Middle School Students (14~16 years old)	41,239 (4.2%)	28,132 (2.9%)	21,738 (2.0%)	91,109 (3.0%)
High School Students (17~19 years old)	17,099 (1.7%)	14,550 (1.5%)	16,058 (1.5%)	47,707 (1.6%)
Adults (20 years old or above)	792,297 (80.9%)	786,578 (81.5%)	891,291 (81.7%)	2,470,166 (81.4%)
Total (Ratio)	979,332 (100.0%)	964,788 (100.0%)	1,090,633 (100.0%)	3,034,753 (100.0%)

4.1.2 Checkout Pattern by Age

The checkout pattern by age were studied per day of the week, and the details are as follows.

1) Checkout pattern by age per day of the week

As a result of analyzing the checkout pattern by age in terms of a day of the week, it was found that more books were generally checked out by adults (81.4%), elementary school students (12.2%), middle school students (3.0%), preschoolers (1.9%) and high school students (1.6%), in the given order, though out the week. In fact, more books were checked out on weekends regardless of the age of users. From Monday to Sunday, the age group borrowing the most books was adults, followed by elementary school students,

This indicates that families or parents bringing their children to libraries on weekends form the majority of users who visit libraries. Therefore, it seems necessary for Gimpo City libraries to expand their weekend library culture programs in which both the children and parents can participate, targeting the families who visit libraries to borrow books on weekends.

Table 3. Number and Ratio of Book Lending of Gimpo City Libraries by Age per Day of the Week

	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Total
Preschoolers (Under 8 years old)	12,198 (2.0%)	5,042 (1.6%)	7,722 (1.7%)	6,613 (1.9%)	6,316 (1.6%)	5,985 (1.6%)	12,830 (2.2%)	56,706 (1.9%)
Elementary School Students (8~13 years old)	91,180 (15.3%)	30,884 (10.0%)	45,974 (10.4%)	39,368 (11.2%)	40,403 (10.2%)	35,499 (9.8%)	85,757 (14.9%)	369,065 (12.2%)
Middle School Students (14~16 years old)	27,904 (4.7%)	6,837 (2.2%)	10,029 (2.3%)	8,209 (2.3%)	9,065 (2.3%)	7,002 (1.9%)	22,063 (3.8%)	91,109 (3.0%)
High School Students (17~19 years old)	10,471 (1.8%)	3,990 (1.3%)	6,898 (1.6%)	5,113 (1.5%)	5,643 (1.4%)	5,225 (1.4%)	10,368 (1.8%)	47,708 (1.6%)
Adults (20 years old or above)	453,974 (76.2%)	263,146 (84.9%)	371,779 (84.0%)	291,364 (83.1%)	336,297 (84.6%)	309,650 (85.2%)	443,986 (77.2%)	2,470,196 (81.4%)
Total (Ratio)	595,727 (100.0%)	309,899 (100.0%)	442,402 (100.0%)	350,667 (100.0%)	397,724 (100.0%)	363,361 (100.0%)	575,004 (100.0%)	3,034,784 (100.0%)

2) Book checkout pattern by age per topic

The result of investigating the book lending patterns of Gimpo City libraries by age and per topic showed that adults (81.4%) have the highest rate of checkouts for overall topics, ranging from general to history, followed by elementary school students (12.2%). On the other hand, the checkout rate of preschoolers (1.9%), middle school students (3.0%) and high school students (1.6%) was found to be 3% or less, showing a similar checkout ratio. In addition, adults, compared to other age groups, were observed to read relatively various topics, ranging from general to history, while elementary, middle, and high school students were found to have a biased reading habit leaned towards the literature.

Consequently, it is deemed imperative that Gimpo City libraries need to plan and operate reading programs encouraging the students to read books with various, yet age-appropriate topics. It is expected to help students to cultivate proper reading habits and stray away from unbalanced reading.

Table 4. Number and Ratio of Book Lending of Gimpo City Libraries by Age per Topic

	General	Philosophy	Religion	Social Science	Natural Science	Technology Science	Arts	Language	Literature	History	Total
Preschoolers (Under 8 years old)	1,754 (1.4%)	802 (0.7%)	644 (1.1%)	7,628 (2.0%)	6,224 (2.3%)	2,009 (1.0%)	931 (1.1%)	3,100 (2.6%)	30,628 (2.2%)	2,989 (1.1%)	56,709 (1.9%)
Elementary School Students (8~13 years old)	15,157 (12.0%)	8,150 (6.8%)	6,618 (11.4%)	34,191 (8.8%)	46,131 (17.1%)	14,137 (7.1%)	6,702 (7.8%)	16,956 (14.2%)	182,559 (13.0%)	38,470 (14.6%)	369,071 (12.2%)
Middle School Students (14~16 years old)	3,395 (2.7%)	2,350 (1.9%)	1,093 (1.9%)	8,359 (2.1%)	9,050 (3.4%)	3,896 (1.9%)	1,894 (2.2%)	3,996 (3.3%)	47,313 (3.4%)	9,763 (3.7%)	91,109 (3.0%)
High School Students (17~19 years old)	1,447 (1.1%)	2,556 (2.1%)	651 (1.1%)	6,506 (1.7%)	4,725 (1.8%)	3,464 (1.7%)	1,703 (2.0%)	1,607 (1.3%)	21,424 (1.5%)	3,625 (1.4%)	47,708 (1.6%)
Adults (20 years old or above)	104,085 (82.7%)	106,757 (88.5%)	49,208 (84.5%)	333,619 (85.5%)	203,794 (75.5%)	176,460 (88.2%)	75,125 (87.0%)	93,870 (78.5%)	1,118,428 (79.9%)	208,856 (79.2%)	2,470,202 (81.4%)
Total (Ratio)	125,838 (100.0%)	120,615 (100.0%)	58,214 (100.0%)	390,303 (100.0%)	269,924 (100.0%)	199,966 (100.0%)	86,355 (100.0%)	119,529 (100.0%)	1,400,352 (100.0%)	263,703 (100.0%)	3,034,799 (100.0%)

4.1.3 Checkout Pattern by Gender

The checkout pattern by gender was examined in terms of topics and age groups, and the details are as follows.

1) Checkout pattern by gender per topic

Analyzing the checkout patterns of Gimpo City libraries by gender and per topic from 2016 to 2018, the top five topics with the highest checkout rate were observed to be literature, social science, natural science, history, and technology science, regardless of the gender. On the other hand, out of the ten topics, the least and second least favored topic by both genders were found to be arts and religion. The topics showing a difference between the genders were the topics ranked between the 6th and 8th, or middle to lower ranks. In fact, men found to prefer general, philosophy, and language in the given order whereas women showed their preference in the order of language, general, and philosophy.

In other words, the book checkout pattern by gender was found to have no distinctive characteristics. However, it seems essential for Gimpo City libraries to make efforts to increase users' interest in topics with a low checkout rate, such as arts and religion, for both men and women. Especially for arts, it is highly anticipated that users' interest in arts can be increased by implementing art therapy programs, which is an actual exemplary case of combining reading and arts, integrating reading therapy and art therapy into one.

Table 5. Number and Ratio of Book Lending of Gimpo City Libraries by Gender per Topic

	Male		Female		Total	
General	54,541	(4.6%)	65,009	(3.7%)	119,550	(4.1%)
Philosophy	50,521	(4.3%)	60,940	(3.5%)	111,461	(3.8%)
Religion	24,431	(2.1%)	30,137	(1.7%)	54,568	(1.9%)
Social Science	166,476	(14.2%)	210,412	(12.0%)	376,888	(12.9%)
Natural Science	110,040	(9.4%)	152,344	(8.7%)	262,384	(9.0%)
Technology Science	72,273	(6.2%)	118,607	(6.8%)	190,880	(6.5%)
Arts	36,135	(3.1%)	44,574	(2.5%)	80,709	(2.8%)
Language	48,840	(4.2%)	68,101	(3.9%)	116,941	(4.0%)
Literature	501,764	(42.7%)	853,590	(48.8%)	1,355,354	(46.4%)
History	109,401	(9.3%)	145,161	(8.3%)	254,562	(8.7%)
Total (Ratio)	1,174,422	(100.0%)	1,748,875	(100.0%)	2,923,297	(100.0%)

2) Book checkout pattern by gender per age group

The result of studying the checkout patterns of Gimpo City libraries by gender and per age group from 2016 to 2018 showed that the top three age groups with the highest checkout rate respectively were adults, elementary school students and middle school students. The low-ranking age groups ranked on the 4th and 5th respectively were preschoolers and high school students for men, and high school students and preschoolers for their counterparts. Similar to the checkout pattern by gender per topic discussed earlier, the checkout pattern by gender per age group did not show any remarkable difference between men and women.

Table 6. Number and Ratio of Book Lending of Gimpo City Libraries by Gender per Age Group

	Male		Female		Total	
Preschoolers (Under 8 years old)	30,563	(2.7%)	25,172	(1.4%)	55,735	(1.9%)
Elementary School Students (8~13 years old)	163,865	(14.3%)	197,935	(11.4%)	361,800	(12.5%)
Middle School Students (14~16 years old)	37,874	(3.3%)	50,358	(2.9%)	88,232	(3.1%)
High School Students (17~19 years old)	20,251	(1.8%)	25,995	(1.5%)	46,246	(1.6%)
Adults (20 years old or above)	896,216	(78.0%)	1,438,230	(82.8%)	2,334,446	(80.9%)
Total (Ratio)	1,148,769	(100.0%)	1,737,690	(100.0%)	2,886,459	(100.0%)

4.2 Most Borrowed Books and Social Media Analysis

Keyword analysis was performed using the data on the name and author of books borrowed by users of Gimpo City libraries between 2016 and 2018. Specifically, keyword analysis on the most borrowed books and authors were conducted by dividing the books into children's and adults' books and suggested the network via word-clouding.

4.2.1 Analysis Results of Most Borrowed Books

The network of most borrowed books was analyzed by dividing the books into adult and children's books, and the details are as follows. First, the most borrowed adult book was "Along with the Gods", and most borrowed books were found to have the characteristics of containing keywords related to 'Science', 'Philosophy', 'Art', or 'Religion' in their name, containing keywords related to 'Real Estate' or 'Child' in their name or be a full-length novel in the case of famous movie-based movies. In addition, it was found that the adult users of Gimpo City libraries tend to borrow more books related to science, philosophy, art, religion, real estate, and children's education. Therefore, it seems necessary for Gimpo City libraries to reflect the findings in the library operation and secure relevant adult books.

Table 7. Ranking of Keywords for Names of Most Borrowed Adult Books

Rank	Keyword	Rank	Keyword	Rank	Keyword	Rank	Keyword
1	With Got	11	Afterlife Episode	21	Origami	31	Religion mystery
2	I am	12	For Wide	22	The definition of villainess	32	Late Night Mirage
3	Mythical Episode	13	Wide and shallow	23	Julietta's Dress	33	Don't come to the flower shop
4	Emperor's only daughter	14	Shallow knowledge	24	Courage to be disliked	34	The queen
5	Reminiscence Adonis	15	Wendy's Flower Shop	25	Intellectual conversation	35	Put yourself in anther's shoe.
6	Elementary	16	Secrete	26	For conversation	36	Apocrypha
7	The queen of the world	17	Moon marks	27	Knowledge Philosophy	37	Reason
8	Sigrid	18	7 Years	28	Philosophy Science	38	Sapiens
9	Beatrice	19	Vegetarian	29	Science Arts	39	Real Estates
10	Long novel	20	From Mom	30	Arts Religion	40	Kids

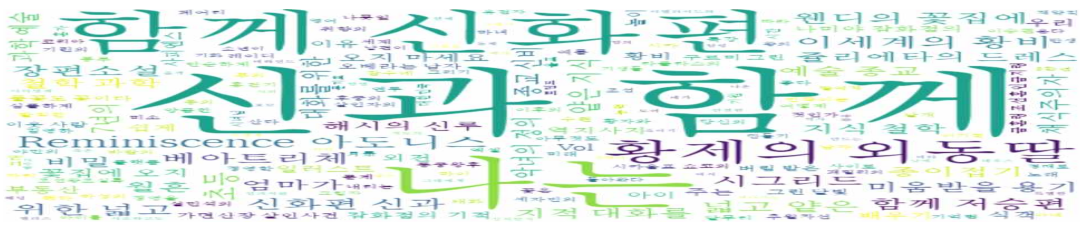

Fig. 2. Word Cloud of Names of Most Borrowed Adult Books

Second, the most-borrowed children's books were the 'poor family' and 'survival' series, and most-borrowed children's books had the characteristics of being a part of certain series or containing the keywords of 'Maple Story' or 'cookie' in their name. In addition, it was found that young users of Gimpo City libraries tend to borrow books related to cooking, science, games, and history. Therefore, Gimpo City libraries should reflect the findings in the library operation and secure relevant children's books. Also, it seems imperative to plan and operate reading culture programs encouraging young users, who will lead the country in the future, to read books with various topics without leaning towards a specific topic for reading.

Table 8. Ranking of Keywords for Names of Most Borrowed Children's Books

Rank	Keyword	Rank	Keyword	Rank	Keyword	Rank	Keyword
1	Poor Family	11	Cookie Run Adventure	21	Tales Runner Job Experience	31	Cheap Charlie
2	Surviving	12	Adventure of Cookies	22	RPG Comic	32	Game
3	Comic Maple Story	13	Cookies exciting	23	Try working	33	Korean History
4	Maple Story Offline	14	Exciting Word Tour	24	Surviving in the world	34	That's right
5	Offline RPG	15	Battle	25	Invention	35	Secret
6	Magic Thousand-Character	16	treasure hunt	26	treasure hunt by the era	36	Accident
7	Best Inventor Tomorrow	17	Cookie Run	27	Family saving	37	Butt Detective
8	Best Scientists Tomorrow	18	Cooking Star	28	Find it	38	Science
9	Cookie Run Survival	19	Emergency Escape Number 1	29	people	39	Escape
10	Survival Masterplan	20	scientific common sense	30	Cookie Run Chinese Character Rung	40	Catching up

Fig. 3. Word Cloud of Names of Most Borrowed Children's Books

4.2.2 Analysis Results of Authors of Most Borrowed Books

The network of authors of most borrowed books was analyzed by dividing their books into adults and children's books, and the details are as follows. The name of Korean author whose books had the highest number of checkouts for adult books was 'Yoon Seul,' and that of the international author was 'Higashino.' As a result of identifying the characteristics of the top authors of adult books, it was analyzed that the name of authors of the books was included in the top keywords. In fact, the adult users of Gimpo City libraries were observed to have a tendency to borrow books written by 'Yoon Seul' and 'Higashino.' As such, Gimpo City libraries should reflect the findings in the library operation and secure relevant adult books.

Table 9. Ranking of Keywords for Names of Most Borrowed Adults Books

Rank	Keyword	Rank	Keyword	Rank	Keyword	Rank	Keyword
1	Hagashino	11	Cahe Habin	21	Woo Jihae	31	MJ
2	Yoon Seul	12	Chae Boss	22	Will Bright	32	Kim Jiwoo
3	Ju Homin	13	MaCherie	23	Moon Eungsuk	33	Jeon Eungjung
4	Choi Suhyun	14	Kim Jisuh	24	Fredrick	34	Jung Munee
5	Nam Haein	15	Ju Haeon	25	Cheon Jihae	35	On Haram
6	Yoon Esoo	16	Yu Bal	26	Jung Yuna	36	Jung Kyunghwa
7	Shiya	17	Ryu Jaehyun	27	Heo Youngman	37	Lee Kijoo
8	Im Suhrim	18	Kishimi	28	Kang Full	38	Choi Eunyoung
9	Jung Yujung	19	Yu Simin	29	Jung Yeonju	39	Kobayashi
10	Hangang River	20	Jo Sungrae	30	Yoo In	40	Bang Eunsun

Fig. 4. Word Cloud of Names of Authors of Most Borrowed Adult Books

Second, the name of authors of most-borrowed children's books was 'Teddy Bear Co.' and the name of author whose children's picture books had the highest number of checkouts was 'Hong Jonghyun' and 'Ryu Suyong.' As a result of identifying the characteristics of the top authors of children's books, it was analyzed that the name of authors of the books was included in the top keywords. In addition, it was found that the young users of Gimpo City libraries prefer children's books coming in series and have a tendency to borrow books written by 'Teddy Bear Co.' 'Hong

Jonghyun' and 'Ryu Suyong.' Therefore, Gimpo City libraries should reflect the findings in the library operation and secure relevant children's books. In addition, it is necessary to implement reading culture programs, such as meeting with the author and book concert, to incite the interest of young users, who are at the ages of cultivating their own reading habit, in various topics of reading.

Table 10. Ranking of Keywords for Names of Most Borrowed Children's Books

Rank	Keyword	Rank	Keyword	Rank	Keyword	Rank	Keyword
1	Teddy Bear	11	All that story	21	Ryu Giwoon	31	Lee Seunghee
2	Hong Junghyn	12	Lee Taeyoung	22	Lee Bongki	32	Jung Sekho
3	Ryu Suhyung	13	Jo Jaeho	23	Storybox	33	Kim Junghwa
4	Song Dohsu	14	Hong Geobook	24	Kim Taeyong	34	Cereal
5	Han Hyungdong	15	Milky Way	25	Kim Sungjae	35	Kim Juwon
6	Kim Kanghyun	16	Aristo	26	Trol	36	Kimg Kyungah
7	Kang Kyungho	17	Story	27	Silky Shoes	37	Choi Jaehoon
8	Kim Kisu	18	Edu Comic	28	Picture Tree	38	Lee Kangsook
9	Jo Juhee	19	Cha Hyunjin	29	Comic Com	39	Studio
10	Seo Jungeun	20	Sweet Factory	30	Park Saejun	40	Kwon Chanho

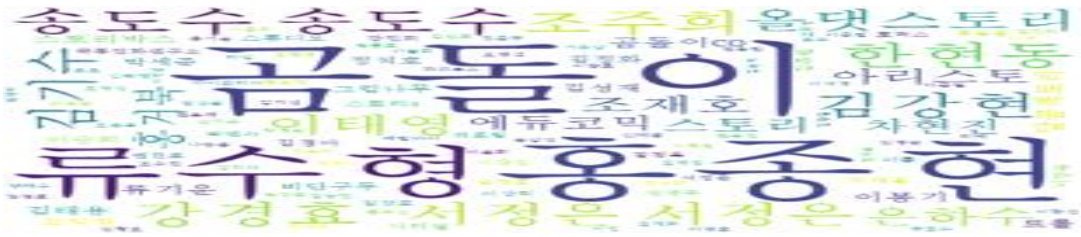

Fig. 5. Word Cloud of Names of Authors of Most Borrowed Children's Books

4.3 Gimpo City Library Social Media Network Analysis

4.3.1 World Cloud Analysis Result

With the analysis subjects of 'Gimpo Women's Happy Sharing' and 'Beautiful Mothers in Hangang River New City' websites, data related to Gimpo City libraries were collected, and the word cloud of collected data was analyzed by dividing the data collection period into 2009 to 2013 and 2013 to 2018.

First, the word cloud analysis conducted for the period between 2009 and 2013 identified 'Library', 'Gimpo', 'Children', 'Tongjin Library', 'Jungbong Library', 'Yanggok Library', 'Hour', 'English', 'Municipal Library', 'Study', 'Kids', 'Program' and 'Toddler' as the main keywords. 'Library',

'Tongjin Library', 'Jungbong Library', 'Yanggok Library' and 'Hour' were found to be the main keywords related to libraries. Similarly, 'Children' 'Kids' and 'Toddlers' were found to be the most representing keywords for kids and 'English,' and 'Program' were analyzed to be other main keywords.

Table 11. Ranking of Keywords for 2009 ~ 2013 Top Search Results

Rank	Keyword	Rank	Keyword	Rank	Keyword	Rank	Keyword	Rank	Keyword
1	Library	11	Now	21	Jeongdo	31	Bus	41	Immediately
2	Children	12	Study	22	School	32	Class	42	Kids
3	Gimpo	13	Near	23	Thinking	33	10K KRW	43	Apartment
4	Tongjin Library	14	Janggi-dong	24	Return	34	Afternoon	44	Prepare
5	Jungbong Library	15	Kids	25	Elementary School	35	Education	45	Tomorrow
6	Yanggok Library	16	We	26	Free of Charge	36	Mud Ball	46	Us
7	Hour	17	Program	27	Mom	37	Library Where	47	Report
8	English	18	Son	28	Reading	38	Living Room	48	Event
9	Today	19	Parenting	29	Kindergarten	39	Recommendation	49	Loan
10	Municipal Library	20	Use	30	Photo	40	Rent	50	Sawoo-dong

Fig. 6. Word Cloud of Search Results in 2009 ~ 2013

Table 12. Ranking of Keywords for 2014 ~ 2018 Top Search Results

Rank	Keyword	Rank	Keyword	Rank	Keyword	Rank	Keyword	Rank	Keyword
1	Library	11	Near	21	Jeongdo	31	Complex	41	Weekend
2	Children	12	Apartment	22	Baby	32	Bookstore	42	Recent
3	Gimpo	13	Recommendation	23	Children-only Library	33	One	43	Moving Hose
4	Yanggok Library	14	English	24	English Library	34	Nearby Library	44	Book
5	Study	15	Where	25	Once	35	Son	45	Loan
6	Jungbong Library	16	Tongjin Library	26	Yang-dong	36	Different	46	Gurae-dong
7	Today	17	Parking	27	Library Where	37	Report	47	When
8	Janggi-don	18	Rent	28	Now	38	Mom	48	School Library
9	Use	19	10K KRW	29	Thinking	39	Stand	49	Use
10	Hour	20	Return	30	Park	40	Phone	50	Us

Fig. 7. Word Cloud of Search Results in 2014 ~ 2018

4.3.2 Network Analysis Result

According to the network analysis results, the main keywords from 2009 ~ 2013 included a municipal library, kindergarten, toddler, bus, elementary school, education, kids, school and program whereas those found from 2014 ~ 2018 were to be English library, children-only library, nearby library, weekend, parking and park.

As an implication deduced from the results, it can be observed that the interest the parents have in ‘English library’ and ‘Children-only library’ for their children have been increased and the number of users visiting libraries on ‘weekends’ has been on the rise. In addition, with the keyword ‘parking,’ it can be understood that many users bring their car to visit libraries, and the keyword ‘park’ suggests that users prefer libraries having a nearby park.

Moreover, during the entire data collection period from 2009 to 2018, Gimpo, library, Yanggok library, Jungbong library, Tongjin library, study, English, Rent, Mom, Children, Apartment, Hour, Today and Recommendation were identified as a keyword.

The keywords of ‘Mom’ and ‘Children’ indicate that many mothers visit libraries with their kids, and the keyword ‘recommendation’ can be perceived as the users’ willingness to receive recommendations for books and library programs from librarians. Also, the keyword ‘Apartment’ suggests that the local residents living in an apartment prefer local libraries near their apartments.

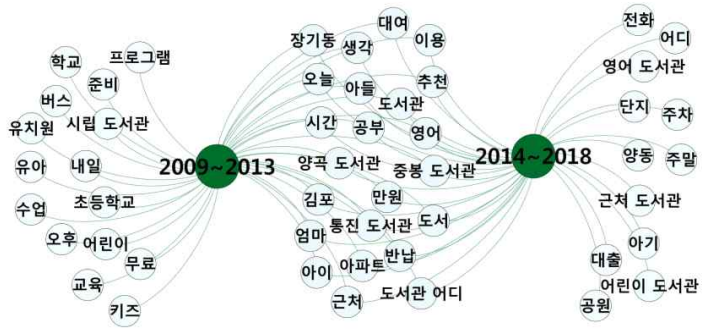

Fig. 8. Network Analysis Results

5. Library Service Improvement Measures for Future

In this study, the main keywords related to Gimpo City libraries were extracted from social media Naver Cafes and big data (user and checkout data) of Gimpo City libraries for network analysis. Reflecting on the results, user service improvement measures for Gimpo City libraries were presented in the aspects of establishment of development policy for the selection and collection of books, establishment of additional libraries or specialization strategies, library culture programs, and library facilities. The details are as follows.

First, as a result of analyzing the social media network of Gimpo City libraries, English libraries and children-only libraries were identified as the main keyword in 2014-2018. As such, it can be interpreted as the users of Gimpo City libraries have a high level of interest in English education and look forward to receiving library services related to English learning. Therefore, this study suggests that Gimpo City libraries should secure and expand good books for children and youth, as a part of the establishment of development policy for the selection and collection of books, particularly focusing on original books in English related to English learning and English books for children.

Moreover, the results from analyzing checkout data of Gimpo City libraries revealed a trend of overly biased checkout trend of books. Consequently, Gimpo City libraries should supplement resources with various topics other than literature for the purpose of establishing development policy for the selection and collection of books and devise measures to encourage the users to enjoy reading various topics, rather than leaning forwards to literary resources.

Second, according to the analysis results on the checkout pattern of Gimpo City libraries, the checkout rate of elementary, middle, and high school students was significantly low compared to that of the adults, and the needs to strengthen the library services for the former groups were

clearly identified. In addition, the social media network analysis results demonstrated the demands of users for English libraries and children-only libraries. Therefore, it is highly recommended for Gimpo City libraries to establish children-only libraries or English libraries and set the library specialization strategy target to kids and English themes, considering the characteristics of Gimpo City having a tremendous population influx of young generations and families, from the perspective of establishing additional libraries or specialization strategies.

Third, the results of analyzing library big data (user and checkout data) of Gimpo City libraries demonstrated that the number of users on a day of the week was the greatest on weekends, and identified 'mom,' 'children' and 'weekend' as the main keywords by the social media network analysis. Thus, from the library culture program aspect, Gimpo City libraries should provide library culture programs related to children's education, implement culture programs in which both the mothers and children can participate and expand the library culture programs held on weekends.

Fourth, the results of examining the social media network of Gimpo City libraries showed 'Parking,' 'Park' and 'Apartment' as the main keywords. In fact, Gimpo City has planned to build more than five public and small libraries by 2024, including the Pungmu Library built in 2019. Consequently, it is highly advisable that Gimpo City libraries to consider the convenience of parking facility and construct parks near libraries for the aspect of library facilities. It is also recommended to build libraries near apartment complexes.

However, since this study selected Naver Cafes, of which married women account for the majority of the users, as the analysis subjects, it has the drawbacks of limiting the keywords to those related to children education, such as English books, English libraries, children-only libraries, and library culture programs.

Nonetheless, it is highly anticipated that the application of the library service improvement measures deduced by the big data analysis in this study to the mid-to-long-term development plan of libraries can make a great contribution to the improvement of the overall service quality of Gimpo City libraries, while increasing the level of satisfaction among the users.

6. Conclusion and Suggestion

The large influx of population into Gimpo City driven by Hangang River New Town Housing Project, development of railway station spheres and other changes is expected to continue increasing, and the need to increase the number of public libraries in Gimpo City is also growing to reflect the changing and inflowing population of Gimpo City. Indeed, '2020 Gimpo City Basic Plan' announced that the number of libraries in Gimpo City will increase to a total of 12 libraries or one library per 50,000 Gimpo citizens, considering the size of neighborhood and population, as a part of the cultural and physical education facility plan.

Accordingly, this study predicted user demands and deduced improvement measures for library services by conducting big data analysis using the checkout data of Gimpo City libraries and social media related to the libraries.

The big context of the findings of this study is that the checkout rate for books with literary

themes was 46.1%, accounting for a significant part of the total. Nonetheless, it may not be of much significance as the most frequent topic of books borrowed in public libraries is also literature (Choi, Bae, & Nam, 2011), and Gimpo City libraries can be just following the trend. However, the checkout rate of books with literary themes in Gimpo City Libraries was almost 50%, showing an overly biased preference for literary subjects over others.

Therefore, it seems necessary for Gimpo City libraries to make efforts to enable users to cultivate the habit of reading through experiences of reading books with various subjects. The operation of various reading culture programs (e.g. book concert for humanities, meeting with authors of sociology books) focusing on topics other than literature can be one example of a concrete action plan. In particular, Gimpo City libraries need to devise measures to encourage students, who are at the age of building their own reading habit, to cultivate proper reading habits and stray away from unbalanced reading.

Another thread of the findings is the observed significant number of user demands reflecting the characteristics of Gimpo City which has a large influx of population composed of young generations and families. In other words, the majority of library users visited libraries as a family or parents visiting libraries with their children. Therefore, it seems necessary for Gimpo City libraries to expand their weekend library culture programs in which both the children and parents can participate, targeting the families who visit libraries to borrow books on weekends.

Moreover, elementary school students showed the highest checkout rate after adults and lots of interest in English learning. Therefore, Gimpo City libraries should set the specialization strategy target of public libraries to kids and English, similar to the Youth Resource Center and Youth Reading Culture Program currently under operation or establish children-only libraries and English libraries.

This study is not only expected to improve the current services provided by libraries in Gimpo City, but also to provide fundamental data for the planning and operation of new libraries to be established in Gimpo City. Furthermore, applying the improvement measures proposed through big data analysis in this study to the actual sites will make a great contribution to satisfying the needs of library users in Gimpo City and improving the level of satisfaction with library services.

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