



A Trend Analysis of Changes in Housework due to Technological Innovation and Family Change*

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Abstract

Purpose – This study attempted to analyze news big data in order to examine the trend of change in housework due to technological innovation and family changes.

Research design, data, and methodology – News big data was collected from *Bigkinds* for the purpose of trend analysis. A total of 8,270 articles containing 'housework' were extracted from news articles between January 1, 1990 and December 31, 2021. 11 general daily newspapers and 8 business newspapers were selected and were analyzed by dividing them into five-year units.

Result – The change of trends in housework that appeared through news big data analysis can be summarized as below. First, the tendency to regard housework as work of women or housewives is gradually weakening. Instead, the centrality of connection with double income is increasing. Second, there is a tendency to strengthen the institutional approach to evaluation of the productivity of housework. Third, the possibility of market substitution for housework is expanding.

Conclusion – In the era of the 4th industrial revolution, examining the impact of technological innovation and family change on housework not only enables the prospect of an industry, but also provides implications for policies related to housework. In addition, this study is differentiated in that it contributed to expand the field of housework research previously limited to analyzing survey data.

Keywords: Housework, Changes in Housework, Technological Innovation, Family Change, Productivity of Housework, Market Substitution for Housework

JEL Classification Code: D10, D12, D13.

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1. Introduction

Housework is an unpaid activity performed by family members and aims to satisfy the needs of family members (Kim & Lee, 2015). The family is the place where everyone's daily life takes place, and it is a unit of life where the daily care, nurture, education, and protection of family members are carried out. Housework makes the daily life of family members possible and is performed repeatedly every day. Someone has to perform housework in order to maintain the daily life of family members. Our daily lives are possible today thanks to housework that has been repeatedly performed by someone every day.

The first academic approach to the discussion of productivity on household work, which is unpaid work, was from Reid (1934)'s theory of household production. He viewed housework as domestic production and named it household production. Household production is an unpaid activity performed by and for family members. It is performed by purchasing goods from the market. This activity can be replaced by hiring services if all matters such as income, market conditions and personal preference are allowed. There are two important points in this definition. First, it defines housework as 'production', and secondly, it defines that housework can be incorporated into the social production process in the market by clarifying the 'substitutability' of housework. This definition is meaningful in that it provides an academic basis for considering housework as productive labor and suggests the possibility of substituting goods and services in the market. Afterwards, Becker (1965) developed a discussion on the productivity of housework with the time allocation theory. Reid (1934)'s theory of household production and Becker (1965)'s time distribution theory can be said to be the basis for discussing the productivity of housework from an economic point of view.

The most important concept in the academic discussion on housework is the productivity of housework. Although housework creates utility value by producing household products to satisfy the needs of family members, the value of domestic labor is not recognized in reality and is performed without remuneration in individual households, so the characteristic of productivity is emphasized. The productivity of housework is also explained by market substitutability. This is because, if unpaid housework in individual households is purchased and replaced with market goods and services, the value of the replaced goods and services becomes the productive value of housework.

As the structure and values of the family change and technology advances, the possibility of market substitution for housework has increased. Lee (2021) explained the factors affecting the distribution between housework and consumption by dividing them into family values, technological development, and macro-environmental factors. Values such as the perception of gender roles and the division of housework act as factors influencing the decision-making between household work and consumption. Also, as technology and industries develop, the time distribution between housework and consumption may change. Advances in technology can be a factor in reducing the value of individual housework time and thereby increasing women's labor participation. Although there is controversy as to whether home appliances developed thanks to technological advances have the effect of reducing housework time, it is true that consumption of various products and services that help housework efficiently has increased with the advancement of technology. The recent technological innovation of the 4th industrial revolution and changes in family structure and values are accelerating changes in household work and consumption behavior at home. In addition, the burden of housework has increased as family members spend more time at home due to the spread of COVID-19. This environmental change is also affecting the pattern of housework. Families are responding to the changes in the environment by choosing whether to satisfy the needs of family members by performing housework, or to purchase products and services that can replace housework in the market.

The purpose of this study is to examine the change trends in housework due to technological innovation and family changes. This study focuses on changes in family values and industrial technology among the three factors mentioned by Lee (2021), and attempts to identify trends in household work. To this end, we intend to examine the impact of changes in the family and technology on housework, and to analyze the trends in housework changes through news big data analysis. Because news reflects social changes and issues as a whole, news big data analysis is an appropriate source to show trends in social change for keywords or topics.

2. Literature Review

2.1. Effect of family change on housework

The most remarkable change in the family that affects housework is the increase in the number of dual-income families due to the increase in women's employment. The female labor force participation rate steadily increased from

39.3% in 1970 to 53.5% in 2019 (Statistics Korea, 2022b). The increase in women's participation in economic activities led to an increase in dual-income household rate, which recorded 46% in 2019 (Statistics Korea, 2022a). Women's participation in economic activities and the increase in dual-income households cause changes in the male subsistence model. The change from the male subsistence model to the two-person earner model is a factor that causes changes in the division of household roles such as support, child rearing, and education. In other words, as the gender division of labor system of the 'male breadwinner-female caregiver' model is no longer valid, there is a problem that there is no one responsible for caring at home.

This change can be captured through gender role attitude. According to the results of a survey by the National Statistical Office from 2004 to 2019, the proportion of people who oppose the traditional gender roles of men and women, 'men at work, and women at home', is steadily increasing across all age groups (table 1). Overall, the younger age group has a higher rate of opposition to traditional gender roles. Compared to 2004, the proportion of opposition to traditional gender roles is significantly increasing, especially among the middle-aged generation in their 30s and older. As the age increased, the proportion of opposition to traditional gender role decreased, but it is worth nothing that, as of 2019, more than half of all were opposed to the gender role of 'man at work, woman at home' (Lee, 2021).

Table 1: Proportion of People Opposing Traditional Gender Roles among Age Groups

Age group	Proportion of opposition to gender roles for 'men at work, women at home'				
	2004	2009	2014	2019	Compared to 2004
10's	77.3	78.2	79.3	87.9	10.6
20's	70.5	73.0	77.0	85.7	15.2
30's	57.8	62.0	68.4	81.6	23.8
40's	52.6	57.1	63.2	73.6	21.0
50's	47.6	51.8	57.6	67.2	19.6
60's and over	36.4	45.3	49.2	57.1	20.7

Source: Statistics Korea. (2020).

As the dichotomous gender role of 'man at work, woman at home' became weakened, the perception that housework is the exclusive property of woman is gradually fading. Attitudes toward housework among gender are changing in the direction of 'couples should share housework equally'. According to the Statistics Korea social survey conducted in 2008 and 2018 (Statistics Korea, 2018), the proportion in favor of 'housework should be shared fairly' increased from 32.4% to 59.1%, while the proportion in favor of 'the wife should lead' decreased from 66.5% to 38.4%. It indicates that the attitudes toward housework is gradually changing from 'women-led' to 'couples share equally'.

Meanwhile, the increase in single-person households is one of the changes in the family structure that leads changes in housework. According to Statistics Korea data, the proportion of single-person households was only 15.5% in 2000, but increased to 31.7% in 2020 (KOSIS, 2021). The increase in the number of single-person households poses social challenges, as society becomes responsible for housework and care which previously have been done domestically. Single-person households are at a disadvantage in that they have to do all the housework by themselves. Although the amount of housework to be done is smaller than that of a multi-person household, the types and needs of household work to be performed are not reduced even if they live alone. It is often inefficient to do all the housework by themselves, and economies of scale cannot be expected. For this reason, single-person households have a greater desire to replace housework by purchasing products and services from the market that will relieve the burden of housework (Lee et al., 2022). In fact, it was found that single-person households are generally willing to continue to use housekeeping services in terms of saving time and money and professional management of housekeeping. This can also be confirmed in data from 'Single-person household consumption behavior' (Jeong & Oh, 2020). As discussed above, the increase in dual-income households and single-person households acts as a major factor in changes in family structure that cause changes in housework.

2.2. Effect of technology change on housework

Housework is greatly affected by technological advances. It is said that one of the ten major events in the field of technological engineering since the 20th century is 'a home appliance, a solution that reduces housework' (Science All, 2010). With the development of science and technology, it became possible to develop home appliances that reduce housework. Washing machines and vacuum cleaners are representative household appliances that have dramatically reduced the burden of housework.

The washing machine has been evaluated as "the washing machine has changed the world more than the Internet" in that it has dramatically shortened the housework time and made it possible for women to enter the labor market. This is what economist Chang said in his book *23 Things They Don't Tell You about Capitalism* (Chang, 2011). Home appliances such as washing machines made easier for women to enter the labor market, which has revolutionized their lifestyle. The Internet has drastically changed the way people spend their leisure time, he explains, but it has not changed society as a whole as much as washing machines. In fact, according to the announcement of the US Rural Electrification Program Administration in the 1940s, after the introduction of the electric washing machine in 1908, the time it takes to wash 17 kg of laundry has decreased from 4 hours to 41 minutes (Samsung Newsroom, 2016). With the advent of washing machines, housework hours have been dramatically reduced compared to the past.

The vacuum cleaner is one of the household appliances that has made a big difference in the time and method of housework. In the 21st century, vacuum cleaner technology has continuously developed, leading to the commercialization of a robot vacuum cleaner that cleans itself without the use of human power. In general, robot vacuum cleaners are partially modified in structure and equipped with artificial intelligence programs, and home appliance companies around the world are developing and launching robot cleaners. In particular, robot vacuum cleaners, along with dishwashers and clothes dryers, are 'three new household appliances' that dramatically reduce the burden of housework.

The spread of intelligent information technology in the 4th industrial revolution causes innovative changes in the field of housework and care. With artificial intelligence technology based on the Internet of Things and Big Data, home appliances are connected to each other and can be controlled not only inside the house but also outside the house. Home appliances, equipped with the technology of the 4th industrial revolution, will enable innovation that not only reduces the time spent on housework, but also changes the way housework is performed. The innovation of the 4th industrial revolution will enable the management of home appliances beyond the limits of time and space, and will provide customized services through artificial intelligence. The impact of the Fourth Industrial Revolution can also be identified through delivery platforms and digital care (Lee et al., 2022).

2.3. The Use of Big Data Analysis on Housework

Previous studies examining changes in housework tended to focus mainly on housework hours (Bianchi et al., 2000; Chang, 2020; Kim & Chin, 2016; Sayer, 2010). These studies focused on the difference in housework hours according to gender from a gender perspective. However, this approach has limitations in understanding the comprehensive aspects of housework. Since housework is related to technological development and social change, it is necessary to approach it from a comprehensive perspective.

Various data can be used to approach changes in housework as a whole. For example, Lee (2021) analyzed the trend of changes in housework using literature data such as research reports and newspaper articles. Literature analysis using secondary data helps to understand the trend of change, but there is a tendency to deal with small number of discourses on housework due to the limited number of data used. As a way overcome these limitations, big data analysis, which has recently been in the spotlight, can be used.

Big data is distinguished from other data in terms of data volume, velocity, and variety (Lamba & Singh, 2017). The 3 V's of big data helps solve the problem of data bias, and research. Using analysis of big data is on the rise as there are many other advantages.

Various data, including structured data as well as unstructured data, can be used for big data analysis. News articles are a type of unstructured data, major channels for forming social discourse, and are significant in that they show how certain issues are set on a social agenda. However, in the past, the analysis results were limited because content analysis, which relied on manual work for news articles, was used (Park, 2016). By using big data analysis, a large amount of news articles can be analyzed, so it is possible to comprehensively examine the discourse changes in news articles on housework.

Methods for analyzing big data include several network analysis techniques such as centrality analysis, density analysis, and subgroup analysis. Among them, centrality analysis helps to grasp the role of keywords in news articles and the relationship between keywords (Cho & Ahn, 2016), and is mainly used for news big data analysis due to these characteristics. In addition, since analyzing news big data in a time series can compare the trend of changes in social discourse in specific issues (Han, 2018), this study attempts to analyze housework trends using this method.

3. Methodology

3.1. Data Collection

News big data was collected from *Bigkinds* for trend analysis. The Korea Press Foundation supports the news big data service by establishing domestic news databases such as general daily newspapers, business newspapers, regional daily newspapers, and broadcasting companies through *Bigkinds* to promote access to news big data analysis. After selecting 11 general daily newspapers and 8 business newspapers from *Bigkinds*, new articles were extracted to include the articles from the search of term “housework”. As a result, a total of 8,270 news articles were extracted from January 1, 1990 to December 31, 2021.

Table 2: The Press that Extracted News Articles

	List of newspapers
General Daily Newspapers	Chosun Ilbo, Dong-A Ilbo, Hankook Ilbo, Hankyoreh, Joongang Ilbo, Kukmin Daily, Kyunghyang Shinmun, Munhwa Ilbo, Naeil Shinmun, Segye Times, Seoul Shinmun
Business Newspapers	Aju Business Daily, Asia Business Daily, Financial News, Herald Business, Korea Economic Daily, Maeil Business, Money Today, Seoul Economy

3.2. Analysis Method

Trend analysis was conducted by the following procedure. First, by using the keywords trend analysis of *Bigkinds*, it was examined that the trend of change in the number of news articles containing the keyword ‘housework’. By looking at the number of news articles each year, it helped to get a rough idea of how much attention the keyword was getting.

Second, the extracted news articles were divided into five-year units and it was analyzed that the importance of keywords in the news articles and their relationship with other keywords using centrality analysis method. The centrality analysis method is a kind of network analysis and is mainly used for trend analysis (Cho & Ahn, 2016; Kim, 2018; Kim & Han, 2020) because it is useful for examining changes in social discourse implied in news articles. In centrality analysis, centrality can be measured by degree centrality, closeness centrality, betweenness centrality, and eigenvector centrality. The degree centrality indicates the number of all edges connected to a node, and the closeness centrality is measured based on the distance between nodes. The betweenness centrality shows the degree to which a node is located between other nodes, and eigenvector centrality is a centrality that reflects the centrality of other nodes. News articles provided by *Bigkinds* include various information such as media companies, contributors, titles, people, and locations. Among them, centrality analysis was performed using character extraction keywords weighted according to the text rank algorithm of *Bigkinds*.

Table 3: Analysis Method and Tool

Analysis Method	Analysis Tool
Keywords Trend	Service Provided by <i>Bigkinds</i>
Centrality Analysis	Gephi 0.9.2

4. Results

4.1. Number of News Articles by Year

The number of news articles containing the keyword was less than 200, except in 2001, 2002, 2005, and 2006. However, the number of news articles increased rapidly after 2010, and in 2015, the annual number of news articles exceeded 500. Although the number of news articles decreased to 405 in 2020, it is still a lot compared to before, and it can be seen that the keyword ‘housework’ received relatively more attention from news articles after 2010.

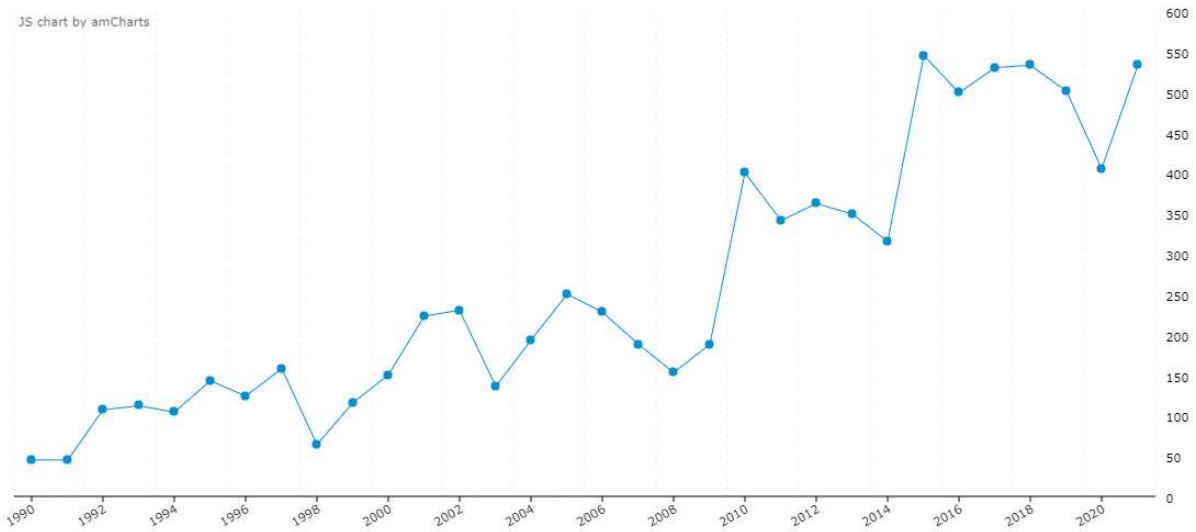


Figure 1: Number of News Articles by Year

4.2. The Importance of Keywords in News Articles

4.2.1. Results from 1990 to 1994

Table 4 to 10 show the results of centrality analysis. Top 20 keywords are sorted according to the degree centrality. Table 4 shows that keywords such as ‘women’, and Republic of Korea’ were ranked at the top 20 of degree centrality from 1990 to 1994. Other centrality figures of these keywords were also high, indicating that the keywords play an important role in news articles. In addition, it was confirmed that keywords such as ‘women’ and ‘housewives’, which mainly engage in housework, and keywords related to evaluate the value of housework such as ‘gift tax’, ‘inheritance’ and ‘division of property’, were in the top 20 keywords of degree centrality.

Table 4: Centrality of Keywords during 1990-1994

Keywords	Degree Centrality	Closeness Centrality	Betweenness Centrality	Eigenvector Centrality
Housework	504	0.465	0.336	1.000
women	455	0.416	0.154	0.675
Republic of Korea	364	0.411	0.125	0.599
Seoul	268	0.401	0.085	0.505
Gift tax	250	0.372	0.046	0.368
Housewives	181	0.386	0.067	0.359
Forum	180	0.378	0.038	0.350
Spouse	176	0.368	0.031	0.323
Inheritance tax	151	0.358	0.024	0.257
Alimony	144	0.366	0.025	0.282
Minister office	143	0.373	0.027	0.297
Respondent	136	0.361	0.021	0.259
Nursery	134	0.367	0.026	0.255
Female student	131	0.358	0.022	0.215
National Tax Service	116	0.346	0.018	0.170
Women’s community	100	0.362	0.016	0.241
Seoul Family Court	99	0.333	0.007	0.187
The United States	97	0.359	0.023	0.181

Division of property	96	0.340	0.010	0.195
Real-name financial transaction system	94	0.345	0.012	0.163

4.2.2. Results from 1995 to 1999

During this period, the keyword ‘time data’ newly emerged due to the construction of time use survey by the Statistics Korea. As international comparisons of time data become possible, the centrality figures of state-related keywords such as ‘the United States’, ‘Germany’, ‘Japan’, and ‘developed countries’ were relatively high.

Table 5: Centrality of Keywords during 1995-1999

Keywords	Degree Centrality	Closeness Centrality	Betweenness Centrality	Eigenvector Centrality
Republic of Korea	642	0.418	0.151	1.000
Housework	467	0.458	0.281	0.973
Dual income	378	0.386	0.058	0.589
The United States	355	0.397	0.078	0.569
Women	329	0.403	0.074	0.618
Germany	299	0.373	0.044	0.432
Japan	297	0.386	0.056	0.473
Housewives	262	0.394	0.060	0.494
Syndrome	212	0.350	0.032	0.226
Children	202	0.378	0.035	0.357
Time data	192	0.378	0.032	0.375
Seoul	190	0.385	0.053	0.365
Report	188	0.365	0.025	0.320
Full-time housewife	162	0.375	0.025	0.362
Washer	161	0.358	0.024	0.240
Policy for Women	143	0.347	0.019	0.177
Worker	138	0.364	0.020	0.243
Developed country	127	0.369	0.016	0.285
Unemployment rate	127	0.351	0.013	0.198
Public official	121	0.340	0.015	0.171

4.2.3. Results from 2000 to 2004

In 2000~2004, the centrality figures of the ‘Ministry of Gender Equality’ established in 2001 was high. And psychological and pathological keywords such as ‘burden’, ‘syndrome’, and ‘depression’ appeared as the top 20 keywords.

Table 6: Centrality of Keywords during 2000-2004

Keywords	Degree Centrality	Closeness Centrality	Betweenness Centrality	Eigenvector Centrality
Housework	921	0.481	0.353	1.000
Republic of Korea	604	0.423	0.113	0.647
Seoul	580	0.417	0.103	0.570
Ministry of Gender Equality	499	0.394	0.059	0.485
Women	446	0.415	0.084	0.505
The United States	353	0.394	0.060	0.332
Full-time housewife	252	0.390	0.027	0.351
Children	250	0.383	0.036	0.280
Housewives	228	0.391	0.035	0.308
Time data	216	0.387	0.027	0.283
Dual income	205	0.384	0.022	0.282

Respondent	203	0.372	0.017	0.248
People	185	0.391	0.035	0.255
Burden	157	0.354	0.012	0.162
Syndrome	154	0.366	0.015	0.183
Worker	154	0.368	0.014	0.205
Depression	151	0.360	0.013	0.165
Japan	149	0.364	0.019	0.165
Washer	133	0.358	0.014	0.132
Spouse	132	0.361	0.010	0.187

4.2.4. Results from 2005 to 2009

As Shown in Table 5, health-related keyword ‘arthritis’ emerged and keywords such as ‘holiday syndrome’ and ‘aftereffect’ appeared from 2005 to 2009.

Table 7: Centrality of Keywords during 2005-2009

Keywords	Degree Centrality	Closeness Centrality	Betweenness Centrality	Eigenvector Centrality
Housework	900	0.476	0.347	1.000
Republic of Korea	677	0.429	0.145	0.701
The United States	457	0.404	0.083	0.482
Dual income	330	0.389	0.040	0.383
Time data	318	0.400	0.049	0.413
Seoul	315	0.395	0.062	0.347
Stretching	266	0.367	0.029	0.238
Arthritis	240	0.368	0.032	0.210
Respondent	236	0.371	0.022	0.282
Japan	235	0.372	0.032	0.241
Women	228	0.391	0.046	0.286
Full-time housewife	212	0.372	0.020	0.268
Statistics Korea	209	0.376	0.019	0.291
Housewives	205	0.394	0.038	0.314
Office Worker	205	0.374	0.022	0.268
Child	201	0.384	0.033	0.258
Holiday syndrome	192	0.379	0.017	0.278
Woker	175	0.374	0.022	0.224
Syndrome	173	0.370	0.019	0.231
aftereffect	151	0.352	0.014	0.164

4.2.5. Results from 2010 to 2014

From 2010 to 2014, the degree centrality ranking of health-related keywords rode, and a new pathological keyword called ‘carpal tunnel syndrome’ was added.

Table 8: Centrality of Keywords during 2010-2014

Keywords	Degree Centrality	Closeness Centrality	Betweenness Centrality	Eigenvector Centrality
Housework	1011	0.477	0.320	1.000
Republic of Korea	754	0.422	0.112	0.683
Time data	501	0.410	0.059	0.551
Arthritis	466	0.374	0.041	0.345
Housewives	462	0.398	0.057	0.460
Worker	453	0.377	0.048	0.311

Syndrome	396	0.385	0.035	0.384
Dual income	388	0.386	0.038	0.374
The United States	364	0.389	0.042	0.366
Spouse	319	0.377	0.026	0.311
Women	297	0.406	0.049	0.369
Stretching	295	0.373	0.022	0.280
Carpal tunnel syndrome	282	0.362	0.018	0.259
Holiday syndrome	265	0.375	0.021	0.280
Office worker	260	0.384	0.024	0.303
Seoul	254	0.384	0.034	0.264
Division of property	251	0.361	0.019	0.209
Respondent	248	0.368	0.013	0.273
China	244	0.368	0.024	0.210
Job	236	0.372	0.020	0.234

4.2.6. Results from 2015 to 2019

In the mid-to-late 2010s, the centrality figures of the keywords ‘parental leave’ and ‘working mom’ were found to be high. And a ‘dryer’, one of the three-new home appliances, was included in the list.

Table 9: Centrality of Keywords during 2015-2019

Keywords	Degree Centrality	Closeness Centrality	Betweenness Centrality	Eigenvector Centrality
Housework	1546	0.479	0.306	1.000
Republic of Korea	950	0.429	0.106	0.640
Time data	760	0.413	0.064	0.536
Worker	650	0.392	0.054	0.378
Seoul	612	0.408	0.063	0.428
Syndrome	486	0.379	0.032	0.300
Dual income	449	0.393	0.030	0.367
Job	444	0.392	0.030	0.337
Spouse	410	0.382	0.023	0.300
Holiday syndrome	388	0.370	0.021	0.239
The United States	386	0.395	0.038	0.290
Japan	363	0.382	0.028	0.252
Statistics Korea	348	0.383	0.018	0.305
Women	315	0.404	0.033	0.322
Parental leave	309	0.379	0.017	0.256
Stretching	289	0.370	0.016	0.202
Working mom	282	0.378	0.017	0.240
Carpal tunnel syndrome	271	0.361	0.015	0.166
GPD	250	0.361	0.016	0.151
Dryer	242	0.363	0.014	0.154

4.2.7. Results from 2020 to 2021

Since 2020, keywords reflecting environmental changes such as ‘COVID-19’, ‘work from home’, and ‘online’ have been at the top 20 due to the influence of COVID-19. Along with this, in addition to the three-new home appliances ‘robot vacuum’ and ‘dishwasher’, various home appliances such as ‘washer’ and ‘refrigerator’ were included in the list.

Table 10: Centrality of Keywords during 2020-2021

Keywords	Degree Centrality	Closeness Centrality	Betweenness Centrality	Eigenvector Centrality
COVID-19	591	0.432	0.162	0.950
Housework	558	0.468	0.305	1.000
Worker	540	0.399	0.113	0.695
Seoul	364	0.400	0.079	0.589
The United States	251	0.392	0.063	0.407
Republic of Korea	234	0.411	0.076	0.506
Work from home	177	0.387	0.031	0.368
Robot vacuum	176	0.362	0.026	0.258
Time data	173	0.402	0.047	0.424
Washer	150	0.371	0.025	0.279
Office Worker	145	0.374	0.018	0.311
Dishwasher	145	0.366	0.022	0.254
Online	143	0.379	0.025	0.308
Basic income	140	0.368	0.022	0.238
Ten thousand	136	0.371	0.028	0.229
Refrigerator	131	0.373	0.024	0.236
Children	124	0.380	0.030	0.265
GDP	121	0.345	0.020	0.145
Job	119	0.379	0.019	0.301
Dual income	116	0.378	0.015	0.297

As a result of the analysis, from 1990 to 1994, ‘women’ and ‘housewives’ who were mainly in charge of housework took the top positions. Keywords related to housework value evaluation such as ‘gift tax’, ‘inheritance tax’, ‘alimony’, and ‘spouse’ also appeared. From 1995 to 1999, the National Statistical Office life time survey started, and ‘time data’ appeared anew. As international comparisons made possible through the construction of time data, Korea, the United States, Germany, and Japan occupy the top position in connection centrality. Also, ‘double-income’ appeared as a high level of connection centrality, and the term ‘full-time housewife’ also started to be mentioned, which can be compared to the previous period where only women or housewives appeared as words related to housework. It is understood as the result of paying attention to the burden of housework for dual-income families and the value of housework for full-time housewives. During this period, ‘washing machine’ first appeared as a word related to housework, heralding the growth of the home appliance market. From 2000 to 2004, ‘women’s department’, newly established in 2001, was a keyword with high connection centrality, and ‘full-time housewife’ emerged as a high level of connection centrality. In addition, pathological words such as ‘syndrome’ and ‘depression’ appeared. From 2005 to 2009, keywords related to ‘US’, ‘Korea’, ‘double-earning’, and ‘time data’ ranked highly in connection centrality. In addition, pathological phenomena related to housework such as ‘arthritis’ and ‘holiday syndrome’ were added. Between 2010 and 2014, as ‘carpal tunnel syndrome’ was added, interest in health problems caused by housework continued. It can be seen that during this period, as ‘property division’ appeared anew, housework value evaluation received attention again. Between 2015 and 2019, new keywords such as ‘parental leave’ and ‘working mother’ appeared in addition to ‘dual-earning’. It is also noteworthy that the dryer appeared as a new home appliance while keywords related to domestic workers such as ‘worker’ and ‘job’ rose to the high place in connection centrality. In 2020-2021, it is remarkable that home appliances such as ‘robot vacuum cleaner’, ‘dishwasher’, and ‘washing machine’ emerged as a new keyword with a high central connection. It reflects that the environmental changes like ‘COVID-19’ and ‘work from home’ led to the need for home appliances that reduce the burden of housework.

5. Conclusions

This study attempted to analyze news big data in order to examine the trend of change in housework due to technological innovation and family changes. News big data analysis shows changes in social discourse on keywords or topics, so it is a suitable analysis method to capture changes in household work.

News big data was collected from *Bigkinds* for trend analysis. A total of 8,270 articles containing 'housework' were extracted from news articles between January 1, 1990 and December 31, 2021 by selecting 11 general daily newspapers and 8 business newspapers, and analyzing them by dividing them into five-year units. As an analysis method, the importance of keywords in news articles or relationships with other keywords were identified by network analysis. For network analysis, centrality analysis was performed using Gephi 0.9.2.

Combining the above results, it can be seen that the words that appeared highly related to housework in the 1990s were housewives, women, and full-time housewives. At this time, keywords such as gift tax, inheritance tax, consolation fee, property division, and family court appeared in related terms because the right to claim property division was newly established in the 1990 revision of the Civil Act. It is interpreted as meaning that social interest in housework has increased and discussions on housework productivity have started to take place on an institutional level. Time Use Survey, which started in 1999, became an objective data for the evaluation of the value of housework. Based on the time use data constructed in this way, it became possible to compare the time spent on housework between countries. In the 1990s, legal and institutional interest in the valuation of unpaid housework, which was only regarded as the work of women and housewives, arose, and it can be said that international comparisons began to take place in the 1990s.

In the 2000s, with the establishment of the Ministry of Gender Equality, the institutional interest in domestic work that began in the 1990s and international comparisons developed further. In particular, in the second half of the 2000s, 'double-income earning' appeared as a high-level connecting word, due to the rapid change in the structure and role of the Korean family after the 2000s. In addition, as the burden of housework increased due to changes in family structure and roles, health related keywords such as holiday syndrome appeared.

In the 2010s, housewives and women were still mentioned as related words for housework, but as 'dual-income' continues to appear, it can be seen that the change in gender role division within the family has increased. In the late 2010s, in addition to dual-income earners and working mothers, a system to support housework such as parental leave appeared in earnest. This is understood that as the work-family balance expanded, the policy supporting working families caused the low fertility problem to become more serious in the 2nd Basic Plan for Low Fertility and Aging Society. In addition, the tendency of replacing housework with the market has increased to such an extent that keywords related to domestic workers have risen to the high rank in connection centrality. It was in the late 2010s that the trend of replacing the domestic labor market with new home appliances such as dryers began to appear.

The 2020s are a period in which the burden of housework in individual households has increased as the time spent at home has increased due to the impact of the COVID-19 pandemic. It can be seen that changes in the external environment such as COVID-19 are also factors that cause changes in housework. As telecommuting leads to an increase in demand for domestic work, new household appliances such as robotic vacuum and dishwashers have emerged as home appliances to efficiently perform housework. According to the technological innovation of the 4th industrial revolution, a new wind of change is appearing in the home appliance market.

The change trends in housework that appeared through news big data analysis between 1990 and 2021 can be summarized into three categories.

First, the tendency to regard housework as the work of women or housewives is gradually weakening. The rankings of 'woman' and 'housewife', who appeared at the top of the centrality of connection in the early 1990s, fell below the top 10 in the late 2000s, but disappeared completely after 2020. The continued mention of 'dual-income earners', which began to appear as a related word for housework in the late 1990s since the 2000s, also shows the change in the perception of housework work due to changes in women's roles. It can be said that this trend reflects changes in the structure and values of the family where the gender role division system, which is divided into 'work for men and family for women', is no longer common.

Second, as the institutional approach to the value evaluation of housework was strengthened, a social consensus that recognized the productivity of housework was established. Changes in laws and policies, such as the establishment of the right to claim property division in 1990 and the establishment of the Ministry of Gender Equality in 2001, acted as a direct trigger. In order to establish time data in accordance with international trends, Time Use Surveys have been conducted since 1999, which also became the basis for enabling an institutional approach for the evaluation of productivity and value of housework. In the early 1990s, terms related to property division claims such as gift tax, inheritance tax, alimony, property division, and family court appeared in large numbers, and in the late 1990s, country names such as Korea, the United States, Germany, and Japan were mentioned in large numbers. This means that housework is a social agenda and is treated as an international agenda. Since the 2000s, the absence of keywords related to the value evaluation or productivity of housework is interpreted to mean that the recognition that housework is a productive work has become a natural proposition that is not without controversy.

Third, the possibility of market substitution for housework is expanding. The washing machine, which made it possible for women to enter the labor market by dramatically shortening the time of housework, first began to appear

as a related word for housework in the late 1990s, which coincides with the time when ‘dual-earning’ appeared as a related word. It can be interpreted in the same context as the evaluation of the washing machine as a greater technological innovation than the Internet (Chang, 2011) in that it dramatically shortened the time of housework and made it possible for women to enter the labor market. After that, dryers appeared after 2015, and after 2020, household appliances such as robot vacuums, dishwashers, and refrigerators other than washing machines appeared as related words. In addition, the possibility of replacing the domestic labor market is emerging not only in household appliances but also in domestic service jobs. As such, market substitution for domestic work tends to expand further in the form of commodification through home appliances and outsourcing through jobs in housekeeping services. In particular, as new technologies from the 4th industrial revolution are grafted into the field of housework, the prospect that the home is soon becoming a market (Lee et al., 2022) is becoming a reality. It can also be confirmed through news big data analysis that the speed of change in housework due to technological innovation is further accelerating due to the COVID-19 pandemic after 2020.

In the era of the 4th industrial revolution, examining the impact of technological innovation and changes in the family on housework not only enables the prospect of an industry that targets housework, but also provides implications for policies related to housework. Housework is no longer regarded as unpaid work performed by women for family members at home. There is no further social controversy that domestic work is productive work. It is time to go beyond recognizing the productive value of housework, to evaluate its value at the institutional level, and to prepare policies to actively support the burden of housework at the social level. In addition, as the marketization trend of housework is expected to expand further, it is necessary to develop innovative products and services that can meet the changing needs of families. In addition, policy support will be needed so that universal families can enjoy the benefits of smart homes, which will be transformed by the technological innovation of the 4th industrial revolution.

This study examines changes in social discourse on housework through news big data analysis. In future research, it is necessary to analyze the market trends related to housework in more detail by dividing the market replacement trend into household appliances and housekeeping services. In addition, it will be necessary to study the needs of policies to publicly support household work in response to changes in the family structure where single-person households or dual-income households are increasing. Finally, if changes in housework are analyzed in conjunction with macro-environmental factors such as social and economic indicators, we will be able to draw policy implications from a wide range of aspects.

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