

An Exploratory Study on Measures for Aging Society based on Big Data Convergence

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Abstract

Objectives: This study attempted the exploratory approach to measure and improves the welfare for senior citizens in Seoul where the population is concentrated. **Methods/Statistical Analysis:** Based on the public data of Seoul, this study refined/analyzed data by using open source R. Through cluster analysis and association analysis based on the refined data, the correlations between happiness index of senior citizens in each borough and diverse variables were analyzed. Through time-series analysis, the number of senior citizens of Korea in the future was predicted. **Finding:** This study performed analysis focusing on measures to solve senior citizen problems by using the public data of Seoul. In the results of the analysis, voluntary hobby, religious activity, work, and activity in senior citizens center had no direct influence. However, senior citizens' volunteer work showed a certain correlation, which was directly connected to their happiness. **Improvements/Applications:** The results of this study could provide the practical guidelines to establish the advanced hub project policies based on senior citizens' social contribution to cope with aging society.

Keywords: Aging Society, Big Data, Data Analysis, Policy Convergence, Senior Citizen Happiness, Senior Citizen Welfare

1. Introduction

Currently, big data is grabbing the biggest attention domestically and internationally. As big data has created diverse values in recent years, people compared big data to 'crude oil'. Just as machine is not running without oil, we cannot live in the information age without big data.

Also, Gartner, a US market research institute said, "Data is the crude oil of the 21st century that decides the future competitiveness. Companies should understand/cope with the upcoming data economy". Like this, big data is becoming a driving force that creates high values as the most essential resource in the present¹⁻³.

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Currently, big data is used in various areas like bio, politics, finance, education, industry, communication, and SNS. President Obama actively used SNS for the election campaign from 2008, which has been recognized to find a new way out of communication with the public.

At that time, he needed differentiated strategies to win Romney, the Republican presidential candidate. Strategically using big data, he eventually won the election.

Also, Amazon developed/established the system to prepare shipping in advance before consumers' purchase, by analyzing consumers' consumption patterns like who, when, and what product will be purchased. Currently, it is providing the dash-button service combined with IoT (Internet of Things) and internet shopping⁴.

When generally people get cold, they search words like cold or flu before going to doctor or pharmacy. Considering this fact, Google has provided 'Flu Trend' service informing the spread condition of cold virus based on search data and location since 2008.

Korea is continuously developing services and researches using the public big data. There have been continuous efforts for diverse researches and service development in many areas such as Seoul late-night bus^{1,2}, safe coming back home, analysis on local businesses⁴, fire prevention by using CCTV⁵, measures to improve illegal parking by using CCTV⁶, and prediction of demands for newborn vaccine through ARIMA analysis as a time-series analysis⁷.

Big data is a lot used in the public area to improve citizens' welfare. Since entering the aging society in 2000, Korea will take 18 years to enter the aged society in 2018, and then eight years to enter the super-aged society in 2026. In case of the US, it will take 72 years and 18 years respectively⁸. In case of Japan which is considered as the 'oldest country in the world,' it will take 24 years and 11 years respectively.

Comparing with the US and Japan, Korea shows the faster rate of aging, which is unparalleled. According to the UN, if Korea is continuously aging like today, the rate of the elderly population in Korea (37.3%) will reach the world highest level in 2050^{9,10}.

Human's eternal goal might be 'happiness'. However, the rates of Korean people feeling happy are like people in their 19-29 (91.3%), people in their 30s (90.1%), people in their 40s (83.3%), people in their 50s (85.5%), people in their 60s (75%), and people in their 70s and older (67%). In other words, the happiness index of Korean people drops as time passes Figure 1⁸.

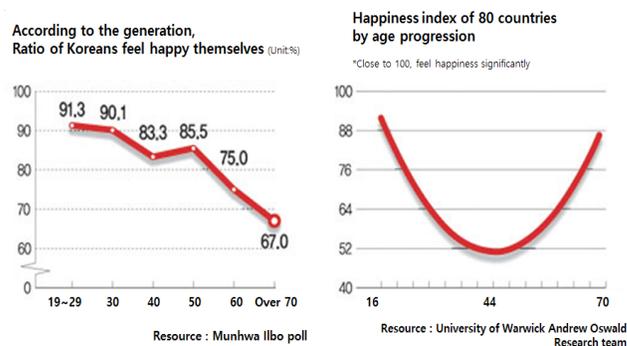


Figure 1. According to the generation, ration of Koreans feel happy themselves and Happiness index of 80 countries by age progression.

However, the happiness index trend of 80 countries in each age shows 'U' shape, which is contrary to the declining shape of Korea. In other words, when people become senior citizens in the world, their happiness index rises while senior citizens in Korea become unhappy.

In order to seek for measures to increase the happiness index of senior citizens who cannot be happy in spite of the rapidly increasing elderly population, the cluster analysis and association analysis were conducted by using a big data analysis tool, R. The visualization technique was also used.

2. Theoretical Background

2.1 Super Aged Society

Super-aged society means a society in which the age group older than 65 years occupies more than 20% of the whole population¹¹. Most of the advanced countries entered aging society around the early 20th century while countries like UK, Germany, and France became aging society in the 1970s. In case of Japan, it entered aging society in 1970, and then aged society in 1994.

In case of Korea, it already entered aging society as the elderly population was the 7% of the whole population in 2000. It is predicted to reach aged society (rate of elderly population: 14.4%) in 2020, and then super-aged society (rate of elderly population: more than 20%) in 2026.

2.2 Politics to Cope with Aging Society of Seoul

As Korea is quickly changing into aging society, the relevant researches using big data are also rapidly rising. In

the public welfare area, diverse researches to cope with aging society are conducted based on the existing data. Recently, there are active researches on welfare for senior citizens^{12,13}.

Seoul is carrying out four policies to cope with aging society. First, it is the creation of jobs for senior citizens. It is one of the main welfare projects for senior citizens to obtain effects like senior citizens' health, expansion of social participation, and subsidiary income support, by creating 'jobs suitable for senior citizens' targeting people older than 65 years.

Second, it is the improvement of retirement pension system. Through the retirement pension system, companies or workers save cash or share for the security for the aged. It is paid after the regular retirement. It is also called retirement saving, corporate pension, and occupational pension.

Third, it is the expansion of cultural facilities for senior citizens. Seoul is planning to perform a research on measures to establish leisure welfare facility infrastructure for senior citizens in Jongmyo Tapgol Park. It is also planning to open Junggye Sports Center for Senior Citizens by changing the worn-out underground shopping district in Jeongja-dong and Nowon-gu.

Fourth, it is the hub project. Hub project reforms the welfare service transfer system to the residents-centered one like executing outreach welfare service by installing customized welfare teams in Eup/Myeon offices and community centers, and also reinforcing the field counseling. Actively expanding the hub project in Myeonmok-dong, Seoul, lately, the incumbent president also visited the place.

The influence of these policies on aging society is unknown. We aim to study the elements having influence on senior citizens' happiness, on top of the aging issue.

3. Research methods and Procedures

Exploratorily approaching/defining problems of welfare for senior citizens, this study collects/refines data necessary. After that, the results were drawn, visualized, and interpreted in the order through cluster analysis and association analysis using R.

3.1 Definition of Problems

The average aging speed of OECD countries is 1.6 while the one of Korea is 4.0, which is overwhelmingly higher

than other countries in Figure 2. Owing to the intensification of aging society, the welfare issue for senior citizens is rising as an issue that should be resolved as soon as possible¹⁴. Thus, this study focused on the enhancement of happiness by improving the actual variables of diverse welfare issues for senior citizens. It also aims to seek for better results by connecting the drawn results with the existing projects.

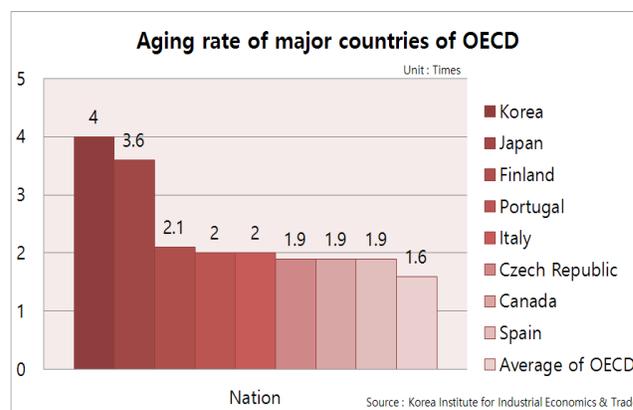


Figure 2. Aging rate of major countries of OECD.

3.2 Data Information Necessary to Problems Analysis

There are numerous environmental elements deciding human's happiness, and it can be influenced by unexpected elements. Therefore, diverse variables should be used for analysis. Using many variables as possible like health condition, type of cohabitation, and peer relation of senior citizens, the Government 3.0 was just carried forward by the Park, Geun-hye administration, so that it is unfortunate that there are not many types of data yet.

3.3 Analytical Technique for Information Deduction

The core of this study is to examine what influences senior citizens' happiness. Such data of happiness index of senior citizens and variables having influence on this happiness index would be needed.

4. Data Collection and Analysis

4.1 Data Collection and Preprocessing

In this study, the data necessary to analysis was obtained from Seoul Open Data Square, and Seoul Statistics Site.

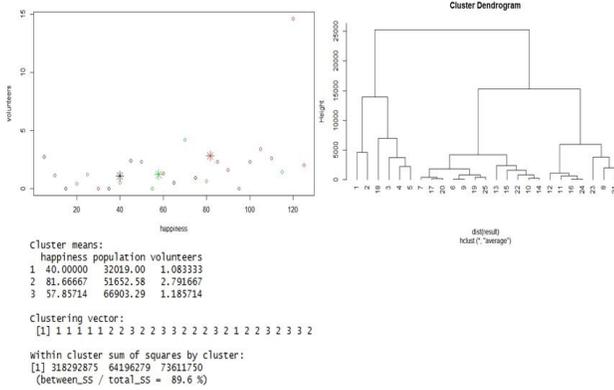


Figure 6. Related volunteers variable with happiness index.

However, senior citizens' volunteer activity gave happiness to their lives. In the results of the cluster analysis above, the volunteer activity factor showed correlations with senior citizens' happiness, which was an unexpected result showing that senior citizens feel happy from helping others, rather than something material in Figure 6.

4.2.2 Analysis on Correlations between Happiness Index and Each Activity

In the results of cluster analysis, among variables like happiness index of senior citizens in each borough, work, senior citizens' center, hobby, religious activity, civic group, income level, and the number of elderly volunteers, when the number of elderly volunteers was more, the happiness index of senior citizens in the relevant borough was also higher.

In order to understand the degree of association between happiness index and the number of elderly volunteers, and correlations between variables, the association analysis was conducted.

Such data to perform association analysis includes 1. The number of elderly population (older than 65) in each borough of Seoul, 2. The level of senior citizens' economic activity in each borough, 3. Income level of senior citizens in each borough, and 4. Happiness index of senior citizens in each borough.

Based on data of the level of senior citizens' economic activity in each borough, nursing facilities for the elderly in each borough, and happiness index of senior citizens in each borough, the preprocessing was performed in Figure 7.

lhs	rhs	support	confidence	lift
1 {}	=> {happy}	0.1566618	0.1566618	1.0000000
2 {}	=> {class}	0.3704246	0.3704246	1.0000000
3 {}	=> {rate}	0.3850659	0.3850659	1.0000000
4 {}	=> {hobby}	0.4480234	0.4480234	1.0000000
5 {}	=> {awareness}	0.4655930	0.4655930	1.0000000
6 {}	=> {volunteer}	0.4187408	0.4187408	1.0000000
7 {}	=> {religion}	0.4758419	0.4758419	1.0000000
8 {happy}	=> {awareness}	0.1010249	0.6448598	1.3850291
9 {happy}	=> {happy}	0.1010249	0.2166811	1.3850291
10 {happy}	=> {volunteer}	0.1112738	0.7102804	1.6962290
11 {volunteer}	=> {happy}	0.1112738	0.2657343	1.6962290
12 {happy}	=> {religion}	0.1010249	0.6448598	1.3551977
13 {religion}	=> {happy}	0.1010249	0.2123077	1.3551977
14 {class}	=> {rate}	0.2020498	0.5454545	1.4165226
15 {rate}	=> {class}	0.2020498	0.5247148	1.4165226
16 {class}	=> {hobby}	0.1434846	0.3873518	0.8645793
17 {hobby}	=> {class}	0.1434846	0.3202614	0.8645793
18 {class}	=> {awareness}	0.1800878	0.4861660	1.0441867
19 {awareness}	=> {class}	0.1800878	0.3867925	1.0441867
20 {class}	=> {volunteer}	0.1830161	0.4940711	1.1798972
21 {volunteer}	=> {class}	0.1830161	0.4370629	1.1798972
22 {class}	=> {religion}	0.1976574	0.5335968	1.1213743
23 {religion}	=> {class}	0.1976574	0.4153846	1.1213743
24 {rate}	=> {hobby}	0.1903367	0.4942966	1.1032829
25 {hobby}	=> {rate}	0.1903367	0.4248366	1.1032829
26 {rate}	=> {awareness}	0.1874085	0.4866920	1.0453165
27 {awareness}	=> {rate}	0.1874085	0.4025157	1.0453165
28 {rate}	=> {volunteer}	0.2005857	0.5209125	1.2439974
29 {volunteer}	=> {rate}	0.2005857	0.4790210	1.2439974
30 {rate}	=> {religion}	0.1947291	0.5057034	1.0627552
31 {religion}	=> {rate}	0.1947291	0.4092308	1.0627552
32 {hobby}	=> {awareness}	0.1918009	0.4281046	0.9194825
33 {awareness}	=> {hobby}	0.1918009	0.4119497	0.9194825
34 {hobby}	=> {volunteer}	0.2079063	0.4640523	1.1082088
35 {volunteer}	=> {hobby}	0.2079063	0.4965035	1.1082088
36 {hobby}	=> {religion}	0.2093704	0.4673203	0.9820915
37 {religion}	=> {hobby}	0.2093704	0.4400000	0.9820915
38 {awareness}	=> {volunteer}	0.2298682	0.4937107	1.1790364
39 {volunteer}	=> {awareness}	0.2298682	0.4895110	1.1790364
40 {awareness}	=> {religion}	0.2298682	0.4937107	1.0375520
41 {religion}	=> {awareness}	0.2298682	0.4830769	1.0375520
42 {volunteer}	=> {religion}	0.2181552	0.5209790	1.0948575
43 {religion}	=> {volunteer}	0.2181552	0.4584615	1.0948575
44 {class,rate}	=> {awareness}	0.1127379	0.5579710	1.1984094
45 {awareness,class}	=> {rate}	0.1127379	0.6260163	1.6257380
46 {awareness,rate}	=> {class}	0.1127379	0.6015625	1.6239810
47 {class,rate}	=> {volunteer}	0.1156662	0.5724638	1.3671075
48 {class,volunteer}	=> {rate}	0.1156662	0.6320000	1.6412776

Figure 7. Value LIFT between happiness index variable and volunteer variable.

In the results of analyzing to understand the influence of work, senior citizens' center, welfare center, hobby, religious activity, senior citizens' perception of social welfare, low income senior citizens, and volunteer activity in each borough on their happiness, based on the data of happiness index in each borough, the volunteer activity showing the highest lift value showed the biggest relation with happiness is shown in Figure 8.

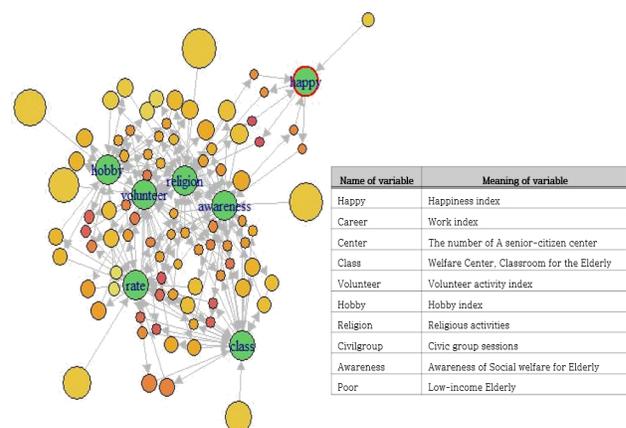


Figure 8. Association analysis between happiness index and variables.

5. Alternative Measures for Aging Society

Through cluster analysis, this study extracted the volunteer activity data showing positive correlations with happiness index of senior citizens. Through association analysis, the high lift value of this happiness index and volunteer activity was drawn.

Through classification analysis, based on the significance level of welfare facilities in each borough, boroughs with high and low happiness indexes were classified. Through time-series analysis, the increase trend of the number of senior citizens (older than 65) in the future was predicted. In the results of cluster analysis, the happiness index of senior citizens showed high correlations with the number of volunteer activities by senior citizens.

The results of cluster analysis as an answer to ‘if the number of volunteer activities by senior citizens would be related to volunteer institutes’, showed positive correlations. Therefore, when the number of volunteer institutes increases, the number of elderly population doing volunteer activity increases in Figure 9. In other words, senior citizens’ true happiness is enhanced when helping others, instead of getting help.

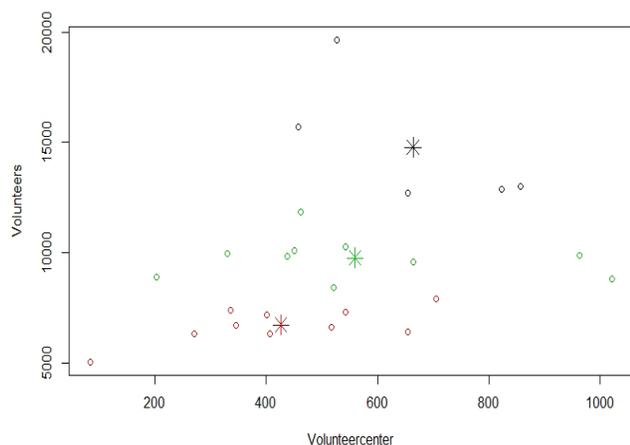


Figure 9. Cluster analysis between volunteers and volunteer centers.

It would be necessary to carry forward measures to preferentially increase the number of volunteer institutes in Gangnam-gu, Gangseo-gu, Gwanak-gu, Nowon-gu, and Seocho-gu whose number of senior citizens doing volunteer activity is the least compared to other boroughs in Figure10.

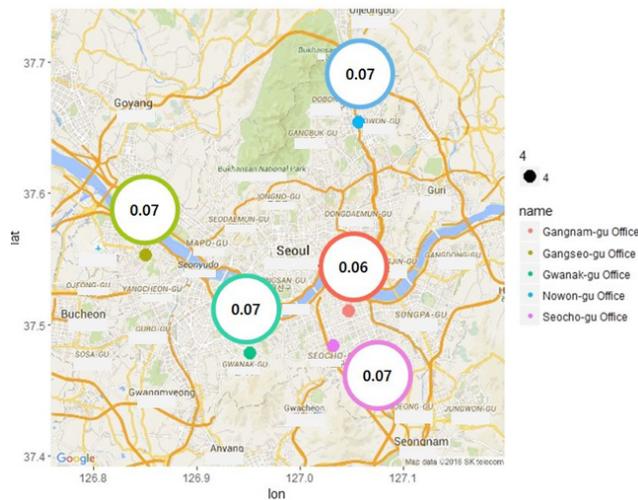


Figure 10. GGmap of 5 Boroughs with low volunteer activity index.

Welfare hub is to provide the customized welfare service suitable for individuals’ desires as civil servants directly visit senior citizens and neighbors in the blind spot of welfare, getting out of the existing way in which the civil application window should be visited to get service, which is one of the actively ongoing government welfare advancement projects.

If the result of this study like senior citizens’ happiness is enhanced when helping others instead of getting help is connected to the hub project, senior citizens who need help can be connected to healthy senior citizens older than 65 years rather than civil servants.

The happiness index of senior citizens doing volunteer activity could be increased while other senior citizens could have motivation and mutually organic happiness based on fellowship. Because of the replacement of labor force that should be originally inserted in the hub project, the cost is reduced.

6. Conclusion

This study largely understood problems of aging society, examined senior citizen problems of Seoul, and also analyzed the direct influence factors based on the current activity status of senior citizens regarding what elements make them happy.

It focused on senior citizens’ happiness as measures to resolve senior citizen problems. In the results of analyzing factors making senior citizens happy, senior citizens’

voluntary hobby, religious group activity, work, and activity in senior citizens' center showed irregular correlation coefficients, which could be interpreted that they had no direct influence.

However, senior citizens' volunteer activity was the only one showing regular correlation coefficient, which was directly connected to their happiness.

This study considered the matter of senior citizens' happiness among problems of aging society which is settled down as a huge problem of modern society, focusing on Seoul with the biggest concentration of population. It examined which factors would have direct influence on senior citizens' happiness.

As senior citizens' volunteer activity is directly connected to their happiness, it would be an interesting material to solve senior citizen problems of Korea.

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