How to Cite:
Choi, Y.-C. (2022). Searching for social characteristics and policy measures for each stage of the corona spread in Korea: Social network analysis and systems thinking. *International Journal of Health Sciences*, *6*(S1), 3564–3582. https://doi.org/10.53730/ijhs.v6nS1.5503

Searching for social characteristics and policy measures for each stage of the corona spread in Korea: Social network analysis and systems thinking

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***Abstract*---**This study analysed the social situation in Korea caused by the Corona pandemic, as shown in YouTube videos between January 2020 when the Corona pandemic began in Korea and December 2021, about two years later, along with its characteristics. The aim of the study was to derive lessons for future quarantine policies. First, the two-year period was divided into three phases in consideration of trends in the number of Corona patients. Then, for each period, YouTube videos created during this period were analysed using text network analysis and the system dynamics analysis method, both of which represent a kind of big data analysis method. This analysis method is new, and is highly significant in terms of research methodology. In addition, the analysis results provide important policy implications. One important policy meaning is the derivation of the reinforcing loop and balancing loop that policymakers should consider for each period.

***Keywords*---**Corona pandemic, text network analysis, system dynamics method.

Introduction

On 11 March 2020, the Director-General of the World Health Organization (WHO) declared a pandemic: the global pandemic of COVID-19. Since then, the damage caused by Coronavirus and its variant, Omicron, has been known around the world as something truly unimaginable. As of end January 2022, the cumulative number of Coronavirus cases confirmed in countries around the world has already exceeded 400 million as Omicron, a mutation of the highly contagious COVID-19, has spread. Furthermore, since the advent of Omicron, according to statistics for the number of deaths in countries around the world, more than

International Journal of Health Sciences ISSN 2550-6978 E-ISSN 2550-696X © 2022.
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Manuscript submitted: 18 Jan 2022, Manuscript revised: 09 Feb 2022, Accepted for publication: 27 March 2022

500,000 lives have already been lost (Statistics Korea, https://kostat.go.kr/portal/eng/index.action).

This virus has had a serious impact on Korea's economic and social sectors as well. In Korea, as of end January 2022, the cumulative number of confirmed patients exceeded 3 million, and the number of deaths exceeded 8,000. In terms of vaccination rates, among the 50 million population of Korea, the number of completed vaccinations has reached 44 million, which is over 85 per cent. As in other countries, the COVID-19 pandemic is causing social problems in Korea in a number of places. These issues must be resolved politically. Unlike pandemics we have experienced before, the COVID-19 virus is changing our way of life in all areas (Statistics Korea, https://kostat.go.kr/portal/eng/index.action)

The COVID-19 virus is seriously affecting not only economic activities but also human relations. This amplifies fear and anxiety in people. The pandemic threatens the socially vulnerable and the elderly in particular. Like other governments, the Korean Government has been implementing social distancing measures at the same time as quarantine efforts at both national and local levels. Compared to the numbers for other countries, the number of Covid patients in Korea is not at an especially serious level considering the size of the population. Still, the situation shows no signs of improving. Now, two years after the declaration of the pandemic, when looking back on the situation in Korea we observe one or two specific characteristics. The pandemic appears to have a seasonal effect, and the number of infected people increases or decreases depending on the strength and weakness of the Government's quarantine and social distancing policies (Jang, 2020; Kwon, 2020).

Against this background, while considering the trends in Corona infection in Korea, this study set out to discover the policy characteristics and social characteristics that appear at each stage. Furthermore, we will classify the development process of Corona patients in Korea step by step from the time when the global pandemic was declared, and try to ascertain what characteristics are found at each step. In order to achieve this, the study utilizes social network analysis and the system dynamics method.

Trends in the Occurrence of Corona Patients in Korea: Selection of Research Questions

General status

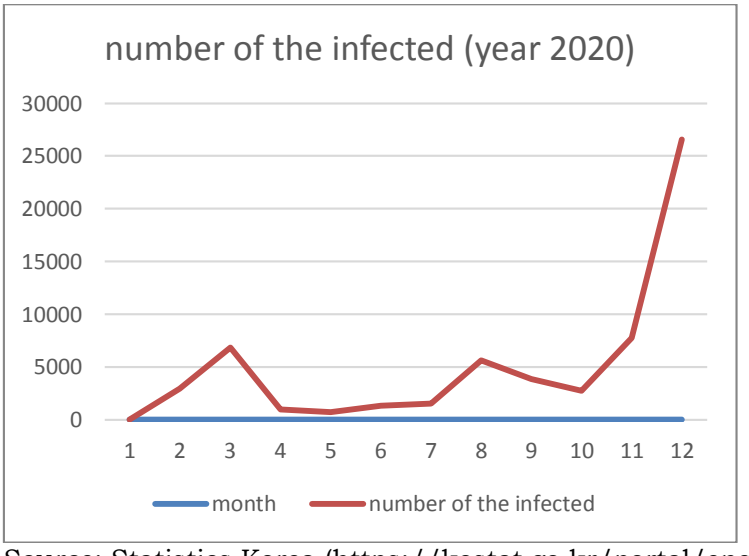
The first Corona patient in Korea was a 35-year-old Chinese woman, who entered Korea's Incheon Airport from China on 20 January 2020. Meanwhile, the first Korean Corona patient was a 55-year-old man who entered Incheon Airport from China four days later on 24 January. Since then, the number of Korean Corona patients has vastly increased, and as of end January 2022 the cumulative number exceeded 3 million. The monthly numbers of Corona patients between January 2020 and December 2021 are shown in Table 1.

Table 1 Monthly numbers of Corona patients in Korea (January 2020–December 2021) (unit: persons)

Month	Number	Month	Number
Jan-20	11	Jan-21	17494
Feb-20	2920	Feb-21	11495
Mar-20	6855	Mar-21	13430
Apr-20	979	Apr-21	18938
May-20	703	May-21	17902
Jun-20	1334	Jun-21	16109
Jul-20	1506	Jul-21	41401
Aug-20	5642	Aug-21	53121
Sep-20	3865	Sep-21	59899
Oct-20	2714	Oct-21	53450
Nov-20	7768	Nov-21	82565
Dec-20	26564	Dec-21	183680

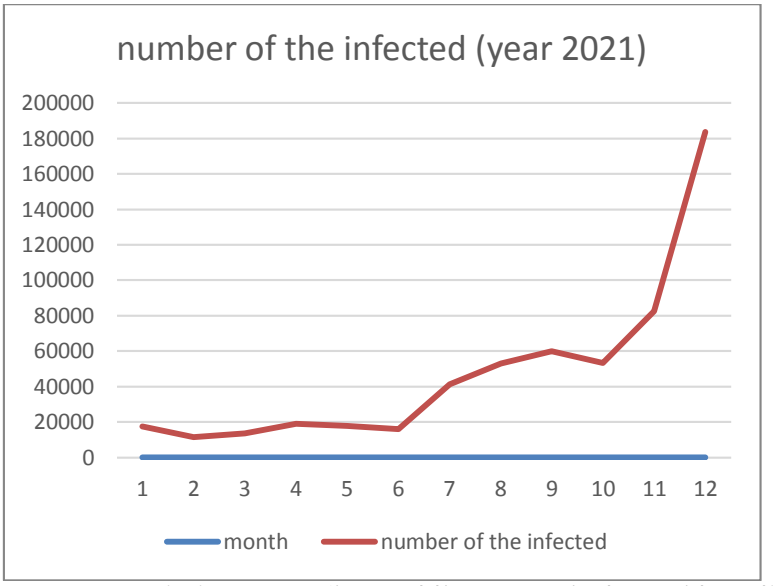
Source: Statistics Korea (https://kostat.go.kr/portal/eng/index.action)

As Table 1 shows, in January 2020 there were a total of eleven Corona patients in Korea, but in February the number increased sharply to 2,920, and in December 2020 it surged to 26,564. Figure 1 shows the monthly trends for Corona cases in Korea during 2020.



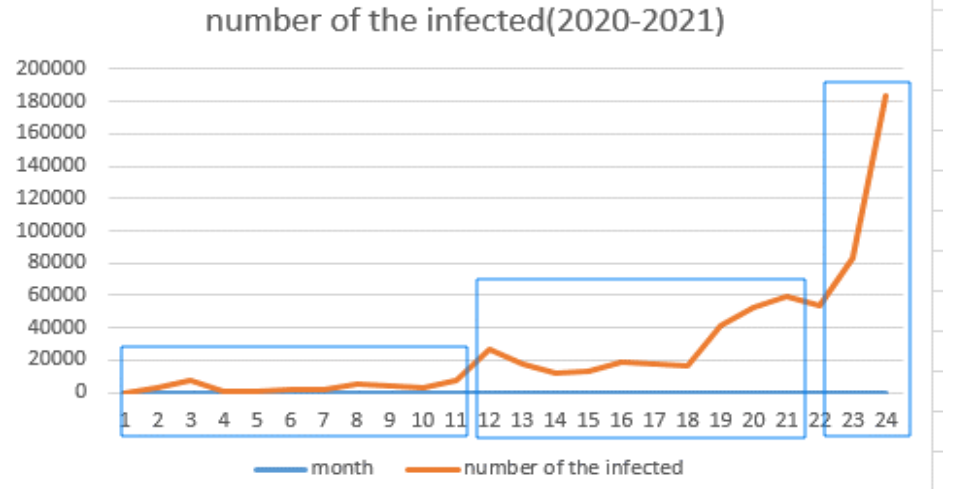
Source: Statistics Korea (https://kostat.go.kr/portal/eng/index.action)
Figure 1 Number of Corona cases in Korea by month (2020)

Figure 2 shows the monthly numbers of Corona cases for 2021. The numbers start in January 2021 at 17,494, which is understandable given that the number of Corona patients in December 2021 was 26,564.



Source: Statistics Korea (https://kostat.go.kr/portal/eng/index.action)
Figure 2 Number of Corona cases in Korea by month (2021)

As Figures 1 and 2 indicate, January 2020 and 2021 both start with a low number of Corona cases, but by December of both years the number of Corona patients has hugely increased. Figure 3 shows the number of Corona patients in Korea by month for the two-year period January 2020 to December 2021.



Source: Statistics Korea (https://kostat.go.kr/portal/eng/index.action)
Figure 3 Number of Corona cases in Korea by month (2020–1)

Looking at Figure 3, we can discern a certain pattern. From January to November 2020, the number of Coronavirus patients is relatively low. However, it can be seen that between December 2020 (12 on the X-axis of the graph) and September 2021 (21 on the X-axis of the graph) the number of patients increased, while showing a different pattern from before. It can be seen that between October 2021 (22 on the X-axis of the graph) and December (24 on the X-axis of the graph) the number of infected persons increases rapidly. In this respect, the change in the number of Koreans infected with Corona can be analysed by dividing the overall time-period into three stages. The first stage is a period in which the number of infected persons is relatively small, and includes the period from January 2020 to November 2020. Phase 2 covers the period from December 2020 to September 2021, and Phase 3 the period from October 2021 to December 2021.

Theoretical discussion

The Corona pandemic has left many challenges for Korean medical policy and the social environment in general. From fundamental discussion of public health policy to discussion of the national crisis response system, it has raised awareness of many issues. If another infectious disease should re-emerge next year (2023), how should central and local government respond from a policy point of view? – how might they respond most effectively, and how expand public hospitals from a long-term perspective? In particular, the issue of how to secure medical staff with professional capabilities is very important. In addition, treatment should be improved so that these medical staff can safely engage in quarantine work, and measures to increase morale should be prepared so that they can serve public health devotedly (Huang, 2020; Beaunoyer et al, 2020; Bond, 2020; Bozkurt and Sharma, 2020).

In government research institutes and academic circles in Korea, numerous research papers are being published investigating what policies are needed to solve the Coronavirus problem effectively following the outbreak of the pandemic. However, many of these papers approach these issues from a superficial point of view, and only a few deal with them comprehensively and systematically. Seeing that social problems are not simple and are connected in complex ways, it may be said that the limitations of existing studies are large. When one policy variable changes, it affects other variables, and these variables in turn affect yet other variables. That is why more sophisticated methodologies are needed (Freeman, 2004).

A methodology that can take this into account must be developed, so that the impact of a disease such as the Corona pandemic on society can be lessened and countermeasures can be devised. However, not many studies have attempted to approach the pandemic from this point of view. Therefore, numerous researchers have argued that in order to solve this problem, individual methods that are capable of analysing complex phenomena, such as the big data analysis method, the social network analysis method and the system dynamics method, should be combined (Borgattiand Lopez-Kidwell, 2011; Forrester, 1994; Freeman, 2004, 2011).

There is a high probability that new infectious diseases will become prevalent in the future. Since these infectious diseases are expected to occur on a large scale and spread globally in a short period of time, all countries should prepare for this possibility (Fischer, 2020; Sundarasen et al., 2020; Barzilay et al., 2020; Bhuiyan et al., 2020). The consequences of various infectious diseases are not limited simply to health and medical problems. They also cause enormous social and economic damage, and cause social and cultural fear. If these problems are not resolved promptly, they may accumulate to create political dissatisfaction and lead to hostility towards the government.

Since an infectious disease problem such as the Corona pandemic is highly likely to cause unexpected adverse social effects in the future, preparing in advance will be the most effective method of addressing the problem (Coughenour et al., 2020; FP Analytics, 2021; Poudel and Subedi, 2020). There is a pressing need, therefore, for: systematic analysis; rapid detection and early control of new infectious diseases; effective infectious disease monitoring; management-and-control organization; training of infectious disease experts with crisis management capabilities; preparation of manuals for new infectious diseases, and regular education and training based on them. It is necessary to secure and utilize diagnostic test methods for new infectious diseases, and to research and develop effective therapeutic agents and highly effective vaccines (Torales et al., 2020; Wang et al., 2020; Williams, 2020). In addition, international organizations and individual countries need to accurately analyse and systematically respond to the process by which the Corona pandemic has occurred and spread in their own country.

Against this background, this study selects three research questions:

1. How did the trend in Corona patients in Korea change between January 2020, when the first case of infection occurred, and December 2021?
2. If we divide Corona infections in Korea into three chronological stages, what is the causal relationship between the variables that affect the increase or decrease in the number of cases at each stage?
3. What implications for healthcare policy can be drawn from analysis of the two preceding research questions?

Survey Design

In order to achieve the basic aim of the study, Korean YouTube videos addressing the Corona pandemic are analysed. The analysis operates on the basis of the three periods discussed above, and employs the text network analysis method, which is a form of social network analysis. Using this method, it is possible to analyse the social impact that the Corona pandemic is having on Korean society by specific time-period. For this analysis the Netminer 4.4 program is utilized, which makes it possible to directly use the videos for analysis. In the process of employing the text network analysis method, *Corona* and *Korea* are used as keywords. The videos analysed represent the first 100 YouTube videos extracted via the Netminer 4.4 program.

As mentioned above, the basic analysis period, January 2020 to December 2021, is divided into three phases. Phase 1 runs from January 2020 to November 2020, and Phase 2 from December 2020 to September 2021. Phase 3 represents the three months from October to December 2021. Thus, it is possible to analyse what kind of impact the Coronavirus has had on Korean society, and what issues have been raised by each period.

If the major variables relating to Corona are derived at each stage through this process, a causal map will be created by the system dynamics method through the causal relationship between these variables. Via this causal map, a reinforcing feedback loop and a balancing feedback loop can be derived (Hovmand and Pitner, 2005; Kampmann, 2021; Lane, 1999; Lane and Loiva, 1994)). The reinforcing feedback loop means that the variables included in the feedback loop bring a positive feedback effect, and the balanced feedback loop means that the variable feedback loop brings a negative feedback effect. This feedback loop has great meaning for policymakers and policy executors: policymakers can use it to receive information that can enable them to use limited resources effectively (Newman, 2010; Loiva, 2004; Pruyt, 2007)..

Analysis Result

Below, we divide the spread of Corona infections in Korea into the three stages; analyse the social characteristics of Korean society at each stage; derive important variables; and create a causal map using the system dynamics method. On the basis of this causal map, we seek to derive the reinforcing feedback loop and the balanced feedback loop.

Analysis of spread cause variables by stage of Corona spread: text network analysis

The results of word cloud analysis conducted by performing text network analysis for each of the three periods are presented in Table 2.

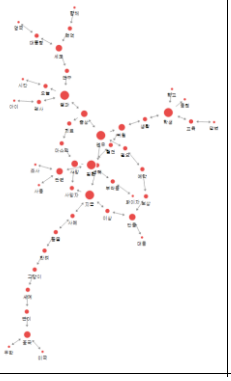
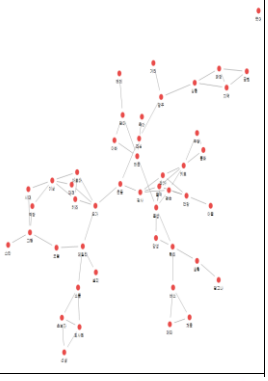
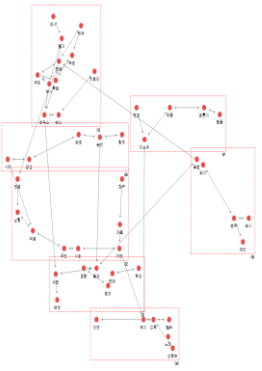
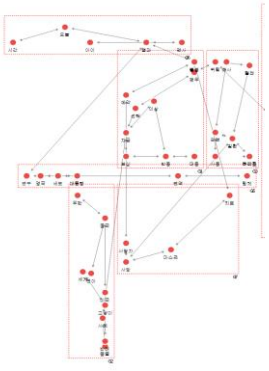
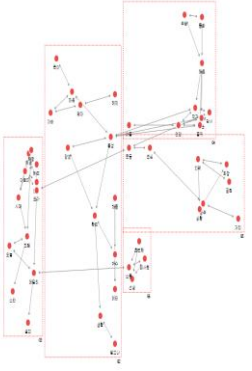
Table 2 Word cloud analysis results for each stage

	Phase 1 (January 2020–November 2020)	Phase 2 (December 2020–September 2021)	Phase 3 (October 2021–December 2021)
Word cloud analysis results			

Number of YouTube videos	100 YouTube videos, 9,130 words	100 YouTube videos, 9,159 words	100 YouTube videos, 9,230 words

The word cloud analysis presented in Table 2 serves as basic visual data. Path-finding net (PFnet) analysis was performed in order to analyse important keywords and the causal and connection relationships between keywords using text network analysis at each stage. The clustering analysis was performed again, targeting the important keywords derived from the PFnet analysis; thereby, the connection and causal relationships among all the keywords were identified and reflected in the causal map.

Table 3 PFnet analysis results for each stage

	Phase 1 (January 2020–November 2020)	Phase 2 (December 2020–September 2021)	Phase 3 (October 2021–December 2021)
PFnet analysis result			
Clustering results			

As a result of the word cloud analysis, PFnet analysis, and clustering analysis conducted over the three stages, it may be said that the social phenomenon caused by the Corona pandemic in Korea embodies the following 31 important keywords: *border closures*, *number of foreign migrants*, *cooperation with private companies*, *follow-up surveys*, *social distancing*, *mask wearing*, *public acceptance*, *urban gatherings*, *large-scale events*, *holiday movement*, *holiday population*, *booster shot vaccination rate*, *medical care manpower sufficiency*, *dedication of*

medical personnel, *sufficiency of hospital facilities*, *public health personnel*, *public health facilities*, *use of multi-use facilities*, *seasonality*, *indoor activities*, *government trust*, *self-employed business*, *support budget*, *scientific quarantine*, *social relations*, *influence of medical personnel*, *media neutrality*, *public hygiene awareness*, *number of Corona infections*, *number of Corona deaths, normal activities*.

Creation of causal maps and derivation of feedback loops

Description of keywords

Explanations for the 31 keywords (variables) derived as a result of the analysis performed above, and the abbreviated forms of these keywords, are shown in Table 4.

Table 4 Description of keywords

Variable name	Abbreviation	Explanation
border closure	*bordercon*	degree to which border control is adequately exerted
foreign immigrants	*incomingpop*	number of in-flows from abroad
co-operation of private companies	*privatecoop*	degree to which private companies co-operate
follow-up	*tracking*	effectiveness of follow-up on infected persons
social distancing	*distancing*	degree of social distancing
wearing a mask	*mask*	whether to wear a mask
co-operation of the people	*publiccoop*	degree to which people co-operate with government policies
meeting in the city centre	*downtownrally*	group activities in the city centre, such as group demonstrations
large event	*largeevent*	large-scale events such as weddings
go on holiday	*nationalmove*	mass migration during holidays such as Thanksgiving
vacation population	*holidaymove*	massive migration during the holiday season
booster shot inoculation rate	*vaccination*	vaccination rate
sufficiency of medical personnel	*medicaladeq*	sufficient medical personnel
commitment of medical personnel	*medicaldedic*	professionalism and dedication of medical

		personnel
sufficiency of hospital facilities	*hospital*	sufficient facilities for receiving infected persons
public health personnel	*healthcarer*	professionalism and sufficiency of public health personnel for handling infected persons
public health facilities	*healthfacility*	Corona risk education and adequacy of public health support facilities
public facilities	*multiusefac*	facilities used by the public, such as public baths
seasonal specificity	*seasonal*	characteristics that have a seasonal effect, such as temperature
indoor activities	*indooract*	indoor activities
trust in government	*govtrust*	degree of public trust in the government
self-employed business	*selfemployed*	business activities of self-employed people, such as restaurants
support budget	*budget*	budget for Corona prevention and treatment
scientific quarantine	*scientific*	efforts to scientifically solve quarantine
social relationship	*socialrelation*	social relations, such as human relations
influence of medical professionals	*medicalinflu*	influence of medical professionals on government and society
media neutrality	*media*	independent coverage of the mass media
national hygiene awareness	*hygiene*	hygiene awareness of the public about hand washing, etc.
number of Corona infected	*infected*	number of people infected with Corona
Corona death toll	*death*	number of deaths due to Corona
normal activity	*normal*	normal daily life and economic activities before Corona

Deriving feedback loops

First, a causal map that can represent the overall causal relationship between the keywords was drawn up (Figure 4). As Figure 4 shows, among the variables coloured green, *seasonal* refers to a variable that policymakers cannot control because it is an exogenous variable. This refers to seasonal effects such as rising and falling temperatures. The green-coloured variables on the left-hand side of the diagram have meanings as important policy variables. *bordercon* relates to border control policies for controlling the entry into the country of travellers or migrants from abroad. The *scientific* variable refers to the degree of scientific approach to the quarantine problem. If the quarantine problem is used for purposes of domestic politics, it may be said to run contrary to the scientific approach. *budget* refers to the size of the government budget relating to quarantine. *Distancing* refers to social distancing policies.

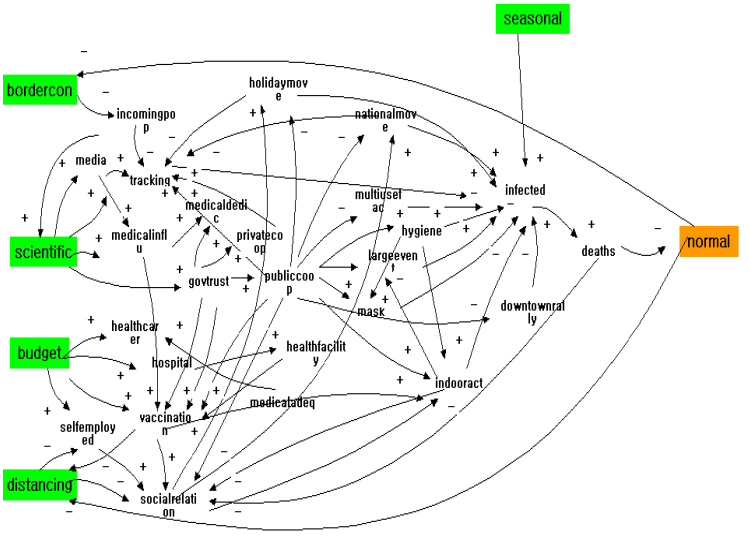


Figure 4 Causal map of Corona pandemic

The *normal* variable located on the far right means returning to the previous situation before the Corona pandemic. In other words, it means a return to a normal life. The plus sign (+) and minus sign (–) beside the links with arrows indicate that the later variable is affected as the value of the preceding variable increases. If the value of the preceding variable increases as the value of the second variable affected by it increases, the latter variable has a value of positive effect (+). First, in the first stage of the Corona pandemic, two feedback loops were found, as shown in Figure 5. Of the two feedback loops, one is a reinforcing loop and the other is a balancing loop.

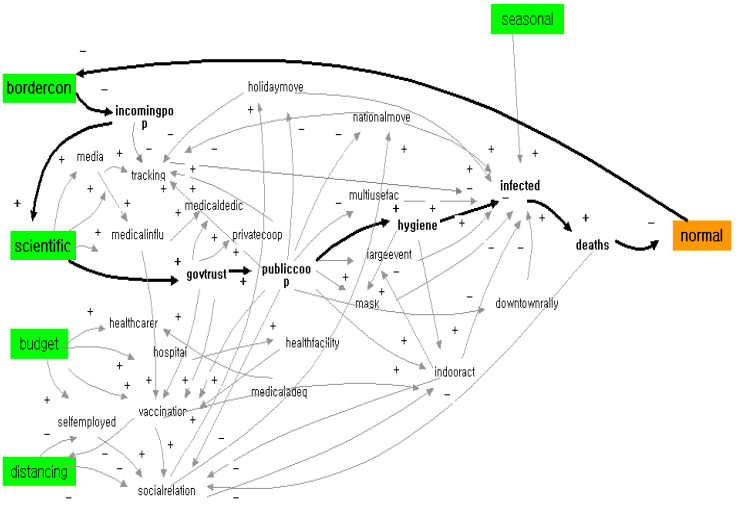


Figure 5 Step 1 feedback loop: border control reinforcing loop

The first-step reinforcing loop above explains the causal relationship between variables. If border control is strengthened (*bordercon*), the number of inflows into the country (*incomingpo*) is reduced. If the number of inflows (*incomingpo*) increases, the demand for a scientific approach to quarantine will be strengthened. As trust (*govtrust*) increases, it is expected that the public's awareness of hygiene (*hygiene*) will increase. The people's strong hygiene awareness (*hyegiene*) reduces the number of people infected (*infected*). As the number of infected persons increases, the number of deaths will increase, and if the number of deaths increases, the probability of a normal life will decrease. Ultimately, it can be hypothesized that when normal life is achieved, the need for border control (*bordercon*) will be lowered, and a reinforcing loop will be created in this causal relationship.

Figure 6 shows the one-step tracking balancing loop. In other words, if border control is strengthened (*bordercon*), the number of inflows into the country (*incomingpo*) will decrease. As the number of domestic immigrants increases, tracking of infected persons becomes difficult. If the tracking of infected persons is strengthened, it is expected that the number of additional infected persons will decrease, and if the number of infected persons increases, the number of deaths will increase. It can also be assumed that as the number of deaths increases, it becomes difficult to return to normal life. Due to the causal relationship between these variables, this feedback has a characteristic as a balancing loop.

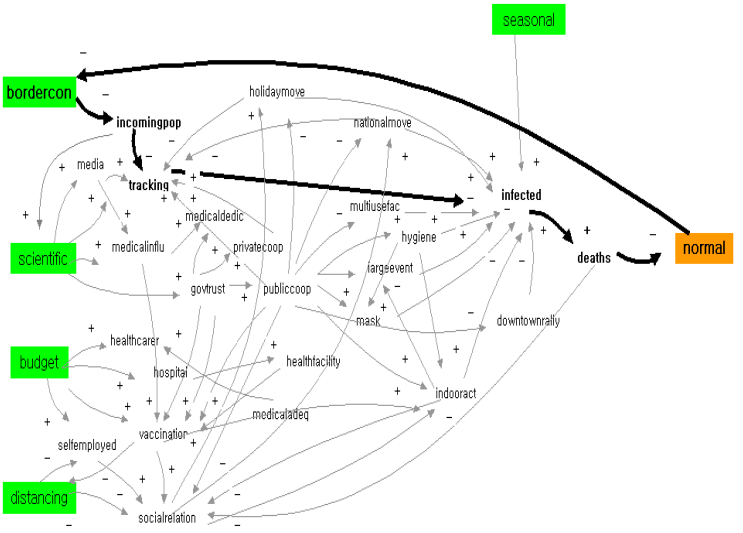


Figure 6 Step 1 feedback loop: tracking balancing loop

Figure 7 shows the two-stage *govtrust* reinforcing loop. As Figure 7 shows, it is assumed that when government trust (*govtrust*) increases, people's awareness of co-operation with government policies (*publiccoop*) increases. If the public's awareness of co-operation (*publiccoop*) increases, the proportion of people living confined to inside the house (*indooract*) will increase. If the proportion of people living inside their house rises (*indooract*), the number of people infected (infected) will decrease, and if the number of people infected (infected) rises, the number of deaths (deaths) will increase. It is assumed that as the number of deaths rises, the probability of a return to normal life (normally) decreases. Because such a causal relationship is created, this feedback loop has the characteristics of a reinforcing loop.

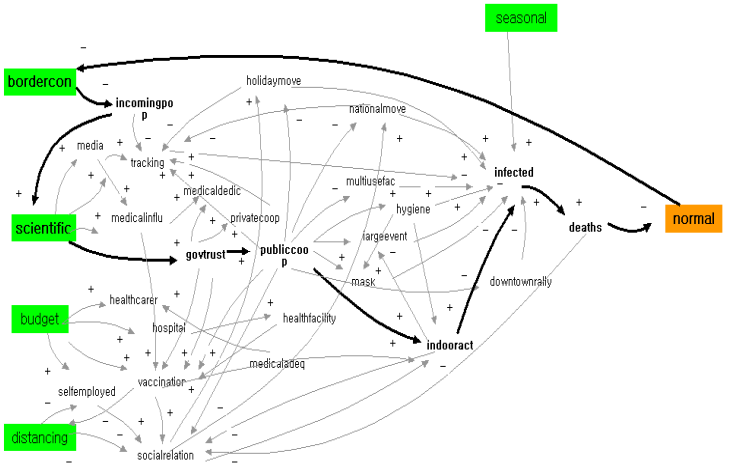


Figure 7 Two-step feedback loop: trust in government reinforcing loop

Figure 8 shows that the inoculation rate loop has the characteristics of a balancing loop as a two-step feedback loop. When the vaccination rate is high, social life (*socialrelation*) is high. When social life (*socialrelation*) is strengthened, life inside the house (*indooract*) is reduced. When living inside the home (*indooract*) increases, the number of infected people (infected) is more likely to decrease. As the number of infected persons increases, the number of deaths will increase, and if the number of deaths increases, the probability of a return to normal life will decrease (normal). Because it contains such a relationship, this feedback loop has the characteristics of a balancing loop.

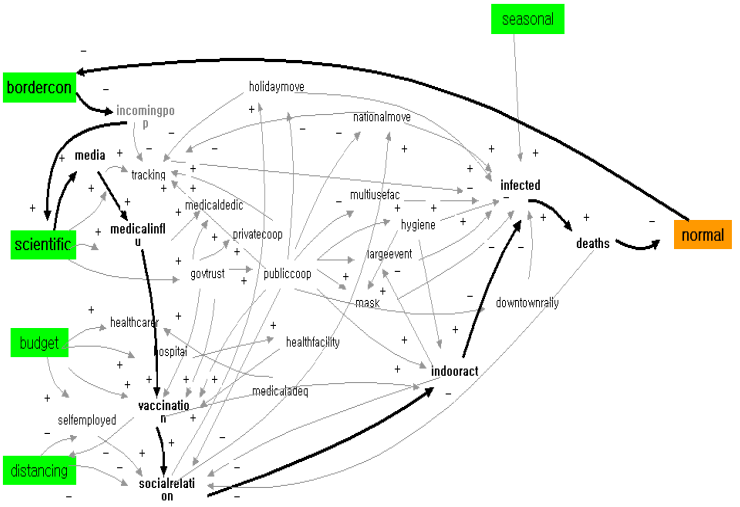


Figure 8 Step 2 feedback loop: inoculation rate balancing loop

Figure 9 shows the reinforcing loop related to the movement of people in step 3. If national movement becomes active, the number of infected persons will increase, and if the number of infected persons increases, the number of deaths will increase. And as the number of deaths increases, the probability of a return to normal life will be lowered (normally). Since a causal relationship between these variables will be formed, this feedback loop has the characteristics of a reinforcing loop.

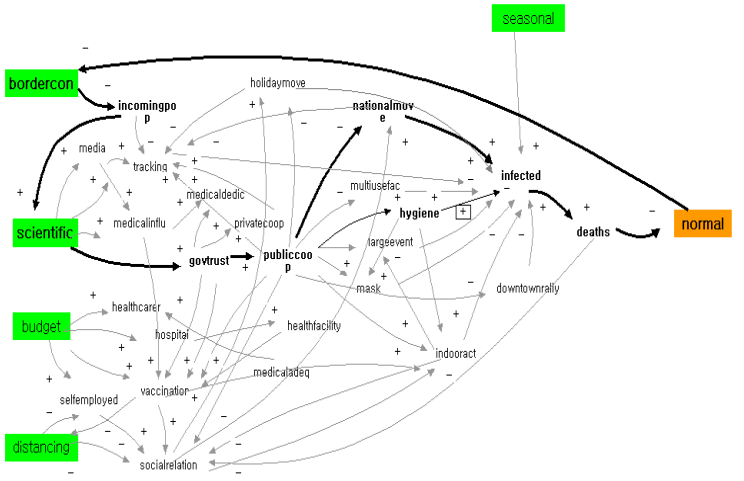


Figure 9 Step 3 feedback Loop: Kookmin Movement reinforcing loop

Figure 10 shows that the social relationship loop in step 3 has the characteristics of a balancing loop. In other words, if the people's social relations become active, national movement will increase, and if national movement increases, the number of infected people is expected to increase (infected). If the number of infected people increases, the number of deaths will increase, and if the number of deaths increases, the probability of returning to normal life decreases (normal). Since a causal relationship between these variables will be formed, this relationship can be called a social relationship balancing loop.

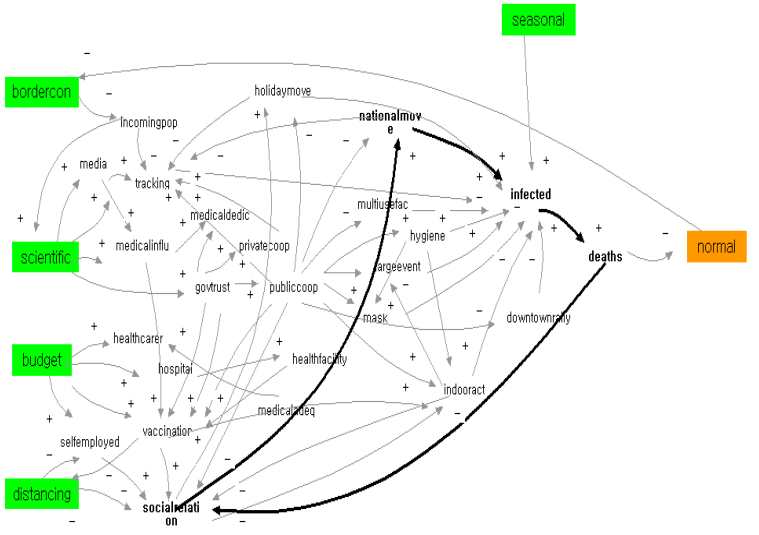


Figure 10 Three-step feedback loop: social relationship balancing loop

Implications and Conclusions

For two years, from January 2020, when the first Corona patient was reported in Korea, to December 2021, the quarantine problem caused by the Coronavirus, and the impact of the pandemic on Korean society, have been enormous. Analysing the important keywords that dominated Korean society during the series of quarantine activities that took place in the country for around two years, and discovering what kind of causal relationship exists between these keywords, is important not only in the theoretical sense, but also from the policy point of view. In this study, the transition period of Corona in Korean society was divided into three stages and important issues and policy variables were derived for each stage. Text network analysis, which is a type of social network analysis method, was used for this purpose, and to supplement this, we attempted to derive causal map creation and a feedback loop by systems thinking. The implications are as follows.

First, the number of infections caused by the Corona pandemic in Korea seems to have a certain pattern. Of course, since the analysis is limited to two years, there are certain limitations, but there seems to be a seasonal effect. In other words, a relatively low number of infections occur at the beginning of each year, but it seems that the number of infected people increases as winter approaches in the second half of the year. It can be understood that seasonal factors such as temperature affect the number of infected people.

Second, Korean society is being affected by Corona, and this influence can be said to be related to around thirty policy variables. These policy variables include: border blockade, number of foreign migrants, cooperation with private companies, follow-up, social distancing, mask wearing, public acceptance, city rallies, large-scale events, holiday movement, holiday population, booster shot vaccination rate, medical care manpower sufficiency, dedication of medical personnel, sufficiency of hospital facilities, public health personnel, public health facilities, use of multi-use facilities, seasonality, indoor activities, government trust, self-employed business, support budget, scientific quarantine, social relations, influence of medical personnel, media neutrality, public hygiene awareness, number of Corona infections, number of Corona deaths, and normal activities. These variables need to be managed in a policy context.

Third, from the point of view of policymakers dealing with the pandemic, various feedback loops can be used as a means of mitigating or ending the pandemic. Such feedback may have a reinforcing feedback loop and, conversely, a balanced feedback loop. As a result of the analysis conducted in this study, in the first stage a border control reinforcing loop and a tracking balancing loop to track the infected persons are found. In step 2, a trust reinforcing loop and an inoculation rate balancing loop are derived. In step 3, the reinforcing loop of people's movement and the balancing loop of social relations were derived.

The feedback loop found here provides important policy implications. First, from the point of view of policymakers in charge of disease management or quarantine, when a new pandemic occurs in the future it is necessary to prevent population movement through active containment policies such as border control at the

initial stage. The point is that policies such as controlling borders and selectively allowing entry to people from countries with few patients are necessary in the early stages of the pandemic. This will prevent the full-scale domestic spread of the virus. In addition, it is necessary to effectively conduct tracing of infected persons. There is a need for a system that can isolate infected people in a certain place by effectively and quickly tracing them through the development and application of a tracking device.

Second, when the pandemic enters the second stage after about a year, it is especially important to increase public trust in the government. If it becomes common for people to experience inconvenience in their daily lives due to the pandemic, they will inevitably feel fatigued. If this situation continues, dissatisfaction will accumulate, creating a strong sense of opposition to the government. Since this can lead to political instability, it is necessary to restore people's trust in government so as to prevent this phenomenon in advance. In order to increase trust in the government, government policy on the quarantine issue must be consistent, and political leaders must lead by example. At the same time, it is necessary to increase the vaccination rate. A very few people, if they receive the vaccine, may die or suffer serious mental and physical side-effects, and so people are hesitant about getting vaccinated. This phenomenon has also been observed in Korea. In order to solve this problem, medical efforts on the part of quarantine experts based on public trust in government are needed.

Third, when the pandemic enters the third stage after two years, issues such as the spatial movement of people and the restoration of social relations become important. As a result of long-term social distancing, people can experience increasing fatigue, and dissatisfaction with the government policies that have caused social relations to cease can accumulate. Considering this, in the third stage, a delicate policy effort is needed in order to operate the social distancing policy flexibly and alleviate people's problems concerning spatial mobility. If these points are borne in mind, responding to future pandemics will reduce trial and error and contribute to maintaining an effective quarantine system.

This study has several limitations, however. It analysed texts appearing in YouTube videos, not questionnaires or interviews directly asking people's opinions. In other words, since the big data analysis method was used, it is difficult to say that the analysis is perfect, due to limitations connected with data accuracy or with the analysis method. In addition, YouTube videos have limitations, in that they cannot but disproportionately reflect the opinions of young people. This is because it is difficult for older people to make and use YouTube videos. It is hoped that in the future, many empirical studies will be conducted in order to overcome these limitations and contribute to overcoming the serious catastrophe that a pandemic represents.

Acknowledgements: This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF-2019S1A5C2A03082775).

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