A Study on the Implementation of Big Data
for Suicide Prevention Programs

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Abstract

In a rapidly changing environment, big data is becoming important as a response capability through rapid situational awareness. The purpose of this study is to propose a suicide prevention safety program that responds to the latest increases in suicides through big data collection and analysis. To this end, I will study the process of creating a pool of big data, selecting data items that discover suicide syndrome, and developing suicide prevention programs. When I designed the suicide prevention program, the necessary data was defined and the analysis process was proposed. For this study, the big data 7 step methodology is applied. I created a big data pool for suicide prevention programs. The data used in the big data pool can be categorized into structured and unstructured data. The overviews of city, disaster, situation of injuries, and injury details use structured data, whereas injury factor can utilize either unstructured or structured data. To set up a suicide prevention program, first, the high-risk group is derived, second, the priority control target is derived, and finally, the detailed program is implemented. I suggested utilizing structured and unstructured data for effective analysis and selection of suicide prevention programs.

Keywords: *Big data; Data classification; Suicide Prevention; Safety Data Analysis; Safety Data Pool; WHO Safety community*

1. Introduction

The human desire for safety is a fundamental need for life, and once safety is fulfilled humans can quickly move on from the stage in which they need to fulfill their basic needs on to the next stage. Situational awareness is an area associated with human cognitive activities and is an effective means of decision making by expressing vast amounts of data in a limited space for human cognitive expansion purposes [1]. In a society where change is rapid, speed is important, and rapid decision making determines the success of outcomes [2]. The suicide rate in Korea has nearly tripled over the last 20 years. According to the National Statistical Office, the number of suicides per 100,000 people rose from 9.4 in 1993 to 22.6 in 2003 and again to 28.1 in 2012. This is the highest rate among OECD member countries. As Figure 1 shows, suicide can be prevented by social efforts, as shown in Finland, where the suicide rate has been reduced by half after 30 years of national efforts.
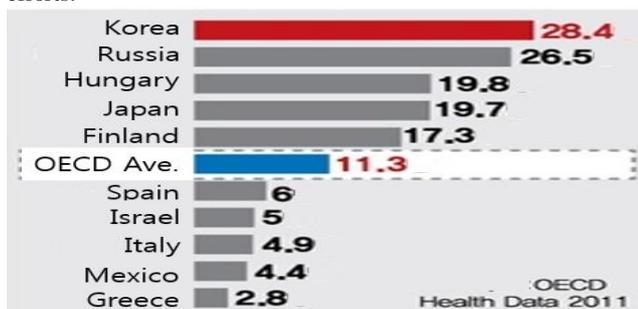

Fig. 1: Status of suicides per 100,000 people in OECD member countries

Therefore, it is necessary to carefully evaluate the effectiveness of the government's support policies in accordance with the life cycle of childbirth, which leads to marriage, pregnancy, and childcare, and to devise measures to provide more tangible support from a consumer perspective. There is a lack of a systematic approach considering the seriousness of the situation. The WHO Safety Community has implemented the city of safety model through its major projects to prevent damage and anxiety, create a safe living environment, and improve and maintain safety.

In this study, the WHO safety city model's ' scientific approach to damage ' is used as a frame for basic analysis as shown in Figure 2 [3]
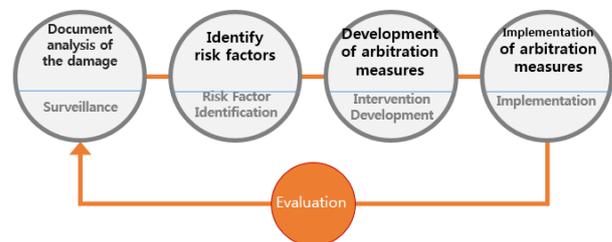

Fig. 2: Big Data Analysis framework

2. Definition of big data and suicide model

2.1. Understanding Big Data in Smart City

All paragraphs must be justified alignment. With justified alignment, both sides of the paragraph are straight. Recently, one of the most frequently cited terms is smart city and smart life. The term

'smart city' should not be defined as the sum of 'smart' + 'city', but it must incorporate the whole process necessary to build a city to be smarter. It should also be recognized and studied as a process aimed at achieving the common goals of smart cities in a variety of fields, which includes 'optimized environment,' 'smarter city,' and 'society where everyone feels happy'[4].

Smart city can be defined as a city that strives for health and wholesome growth through the utilization of advanced technology and the economic development of the era. Also smart city can be defined as a city where self-deterministic, independent, and conscious civic activities operate on a smart combination [5,6].

Big data in smart cities does not refer to a large-scale data but data that is networked. This big data only proves its value when the data of individuals, groups and the society are linked and correlated altogether.

The human desire for safety is one of the most basic desires associated with life which must be fulfilled in order to move to the next stage of needs. Pursuing a safe and secure life is a crucial part of securing and developing sustainable smart cities.

2.2. Understanding the Model for Suicide

The World Health Organization (WHO) has defined suicide as "the act of identifying the intent and motive of death in the event of a suicide attempt." Keinhorst, Wilde, & Diekstra also expressed extreme emotions of disappointment, despair and anger, as well as the intent to hurt themselves [7]. Suicide is one of the phenomena in which the noblest   human life disappears from the earth. If we share the sense of despair that an individual feels at the moment that he or she gives up his life, we must concentrate on finding and presenting an alternative. It is very difficult to grasp and understand the true nature of a suicide because so many factors are the product of events that have extremely complex, organic connections [8].Various theories and models have been suggested in relation to suicide and these models include psychology, sociology, genetics, biology, and stress vulnerability theories.

In psychological theory, there is a psycho-dynamic, behaviorist, and cognitive approach. In the psycho-dynamic approach, suicide is seen as anger toward the self-turned into self-hatred. In the behaviorist approach, suicide is selected as the way of strengthening that which persisted in the life of an individual. In the cognitive approach, cognitive distortions or adverse effects related to suicide are important and modifying these would make life more adaptable.

Social theory states that individuals are involved in the degree of integration and suicide rate in their societies and explained the cause of suicide by focusing on social structural factors. As a result, they can commit suicide because of unexpected poverty, economic crisis of family, and family conflict, and feel suicidal when they are not integrated into society.

The theory of genetic biology stresses the biological characteristics of individuals, such as genetic factors and neurotransmitters, as risk factors for suicide. In addition, the theory of stress vulnerability states that an individual's genetic and sociological characteristics and experience with interacting with their environment contribute to psychological disorders or suicide. In other words, individuals with a high stress vulnerability are more likely to commit suicide because they lack the power to tolerate any event or stress, while those with few weak factors adapt well to severe stress [9,10].

2.3. Big data 7 step methodology

The purpose of this study is to propose the use of big data in the implementation of a suicide prevention program. When I designed the suicide prevention program, the necessary data was defined

and the analysis process was proposed as shown in Figure 3. For this study, the big data 7 step methodology is applied [3]
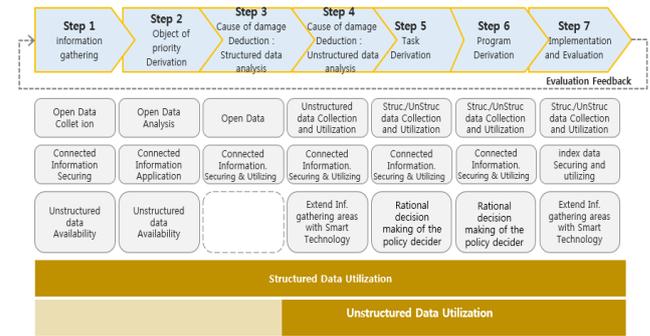

Fig. 3: Big Data 7 Step Methodology

Step 1 is a collection of information about the general status of injury using public information, which necessitates improvements in collecting structured data which is more accurate. Even if I do not understand the entire picture, efforts must be made to collect better data.

Step 2 is an extraction of objects through analysis of the collected status information. Here, I select high-risk groups and target the factors of high-risk injuries.

Step 3 investigates the causes associated with injuries based on the general status. The data items of the injuries are realized and the contents are then further subdivided. The deduced result must be based on data analysis here.

Step 4 investigates and analyzes unstructured data to figure out the cause of the injuries which cannot be identified by the general status. Step 4 improves items to collect, and methods and means in order to obtain better data. It should also explore the possibility of any existent complementary structured data, which is interpreted on its size and quantity.

Step 5 looks for a solution to the cause of the injuries extracted by Step 3 and Step 4.

Step 6 provides programs and policies to implement tasks. In the process of developing programs, the decision-making skills of the policy makers are highly important.

Step 7 is the assessment of the implementation of programs and policies. It should be evaluated that the program or policy support derived from Step 6 is functioning correctly. The entire process is structured to circulate the entire steps according to the results of the assessment.

2.4. Big data pool deployment and classification criteria

Data used in the big data pool can be categorized into structured and unstructured data. As Table 1 shows, the overviews of city, disaster, situation of injuries, and injury details use structured data, whereas injury factor can utilize either unstructured or structured data [3]

Table 1: Classification and Personality of data items

Level 1 category	Data classification
overview of city	Structured data
disaster	
Situations of injuries	
Injury details	
Injury Factor	Structures / Unstructured Data

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3. Defining Big Data to Prevent Suicide

3.1. Utilization data for focus target elicitation

The purpose of this study is to implement suicide prevention programs through the collection and analysis of Big Data. In other

words, the purpose is to define the data needed to design a suicide prevention program and present the analysis process. To set up a suicide prevention program, first, the high-risk group is derived, second, the priority control target is derived, and finally, the detailed program is implemented.
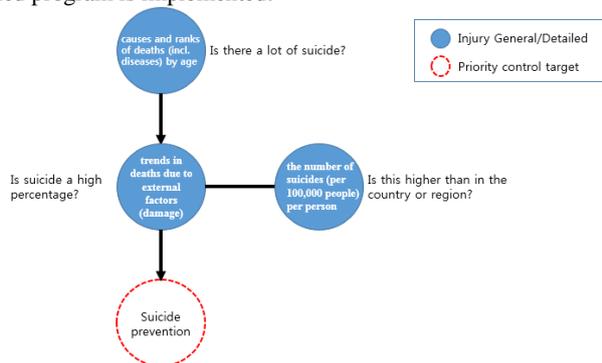

Fig. 4: Priority control target derivation Process (Death)

3.2. Program elicitation process by Priority control target

Detailed data are used and analysed as shown in Table 2 in order to prepare specific programs for the prevention of suicide derived as a focus target.

Table 2: Developing suicide prevention programs

Program	Utilization data	
	Level 1 Classification	Data items
Identifying the Consciousness of the Elderly	Injury General	Age / gender suicide death toll and mortality rate
	Injury General	Suicide fatalities by age versus population
	Injury Factor	An unresolved problem in the suicide of an aged man
Support for suicide prevention	Injury Factor	A suicide attempt
Expansion of counseling facilities	Injury Factor	Identification problem counseling status
	Injury Factor	Counselling target
Gate keeper Training	Injury Factor	Counsellor response status

1) Use and analyze the following data to prepare specific programs for the prevention of suicide as a focus point.

2) The data on the ' Age by Age / Gender suicide death toll and mortality ' identify the ratio at which suicide occurs by sex (Male / Female).

3) Analyze the cause of death data from the last few years, for ages 0 to 90 years, as shown in Table 3. Check the death data from suicide, not from disease or damage.

Table 3: Analysis of causes of death by age group

Years old	Rank 1	Rank 2	Rank 3	Rank 4
0 yr.	Congenital deformity	:	:	:
1~4 yr.	Accident , An intestinal infection , …			
:	:	:	:	:
15~19 yr.	respiratory diseases, suicide, accident			
20~24 yr.	suicide	XXX	XXX	XXX
25~29 yr.	suicide	accident		
30~34 yr.	suicide			
:	:	:	:	:

4) Identify in which of these age groups suicide is most likely to occur. As Figure 5 shows, it also checks if the suicide rate is high when compared to specific countries or regions with the data of the number of suicide deaths by population age.
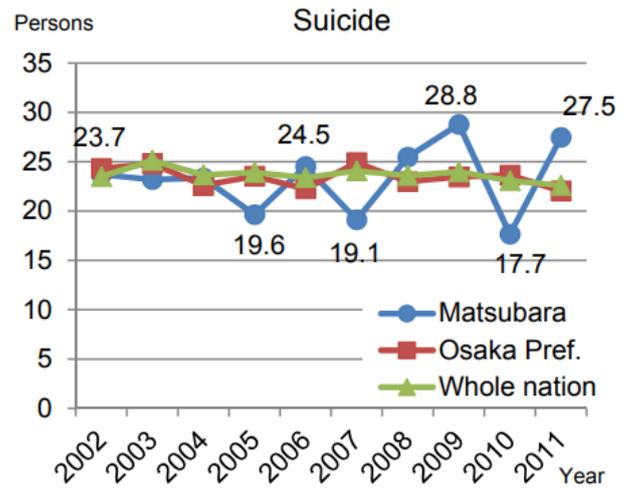

Fig. 5: Change in death rate by suicide (per 100,000 population) (Citing Matsubara City http://jisc-ascsc.jp/pdf/matsubara_sc_a.pdf, p.10)

5) Analyze the data that has been carried in an ambulance in recent years regarding self-destruction, as shown in Figure 6.
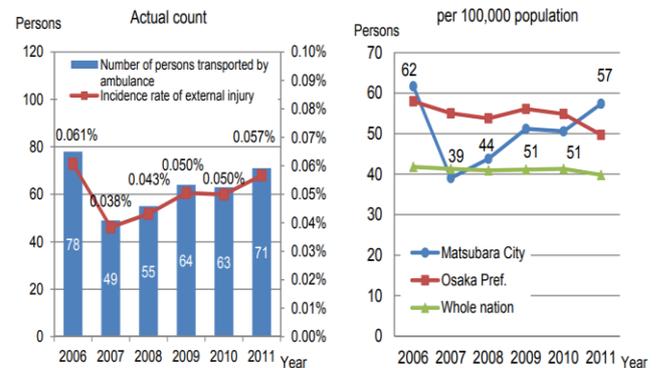

Fig. 6: Change in the number of persons transported by ambulance due to self-harming behavior (Citing Matsubara City http://jisc-ascsc.jp/pdf/matsubara_sc_a.pdf, p.29)

6) Analyze data on self-inflicted acts on emergency transport personnel in recent years. Conduct a male and female analysis, self-injury analysis, and an analysis on the degree of injury and the location of self-injury.

7) Analyze whether a consultation has been conducted in the case of a problem. If consulted, analyze in whom. Eventually, the person who was consulted a lot can be considered to have acted as a gatekeeper to prevent suicide, as shown in Figure 7.
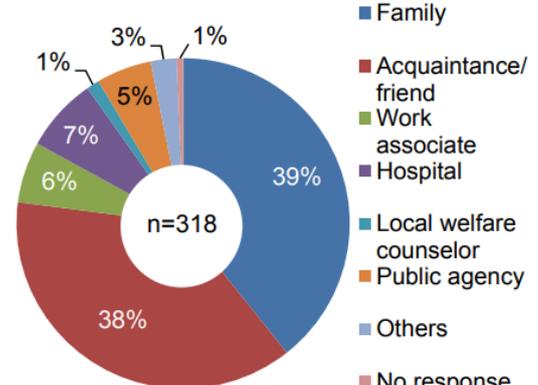

Fig. 7: Rate by place of consult when available to person seeking advice (Citing Matsubara City http://jisc-ascsc.jp/pdf/matsubara_sc_a.pdf, p.39)

8) When a person close to you says they want to "die", a counselling history analysis is conducted on how they responded, as shown in Figure 8.
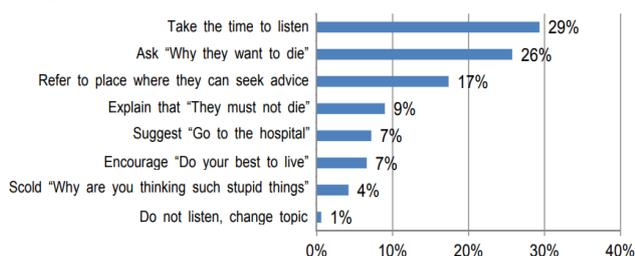

Fig. 8: How to handle the situation when close a person confide that he/she "wants to die"
(Citing Matsubara City http://jisc-ascsc.jp/pdf/matsubara_sc_a.pdf, p.65)

9) Analyze data on high-risk groups of suicides. The person who tried suicide often tried again.

10) Based on the analysis of data so far, the task of preventing suicide based on the analysis results is set.

11) Then, I select targets that risk suicide.

12) After suicide prevention task and target of suicide risk are set up, a program was developed based on the relationship between data. Leverage both structured and unstructured data for effective analysis

3.3. Leverage both structured and unstructured data for effective analysis

Kandelletal generally found that a lack of social support was associated with suicidal behaviour, and that social support directly eased suicide behaviour and reduced depression [9]. Social support refers to all the positive help an individual can get from various interpersonal relationships. In other words, social support refers to emotional support, information support, material support, and evaluation support provided by important people in situations in which an individual needs help [10]. In other words, social support revolves around an individual and supports the emotional, information, material and evaluation provided by the family, relatives, friends, neighbours, and experts surrounding a person [11]. Emotional support means the attitudes and actions of love, care, understanding, encouragement, optimism, trust, interest, and listening. Information support refers to a number of acts of information provision related to event resolution. Material support means the provision of money, time, food, and household goods and services. Evaluation support refers to attitudes and actions that evaluate oneself, such as praise, recognition and respect. In particular, a close and supportive relationship with parents was not related to suicidal thoughts, regardless of depression. It was also reported that those with suicidal thoughts lack affection with or commitment to their families and lack mutual relations with people [11,12].

This study suggests how to select a social support program based on big data to prevent suicide. I searched for the behaviour of people with suicidal thoughts as data, established a process for discovering the suicide prevention programs needed for them, and collected and analysed the necessary big data:
- If the cause of suicide for a man or woman of a certain age can't be identified, it is recognized as a problem and a

suicide prevention program is chosen to identify the consciousness of the age zone involved

- Set up a program to support those who have attempted suicide, reflecting the result that those who have attempted suicide are likely to attempt it again.

- The medical institution implements a suicide prevention program in order to check whether a medical institution or public institution is consulted, and to expand the counseling agency in case of problems.

- If there is a target for consultation, check the results of the counsellor's response.

- If the data show that the person in question is not responding to suicide counseling, the role of the person in the neighborhood is important. Based on this result, the gate keeper is selected as a suicide prevention program. This shows the importance of data mapping.

It is important to collect data, particularly on the injury details and injury factor, when organizing suicide prevention safety programs from a big-data perspective. This is because the data links define specific tasks. That is, after identifying the link between big data items and them, they should help develop suicide prevention programs [13, 14]. If coordination data is lacking at any stage, it is difficult to clearly identify the real cause of suicide prevention because the clear link between the data is unknown. What this means is that connectivity between big data is more important than the amount of data. Of all big data, it is important to take advantage of the existing open structured data. In particular, unstructured data plays a significant role in identifying the source of damage.

For the general status of the injury and the detailed status of the injury, comprehensive use of the damage death data and damage injury data is effective.

- The data on the ' Age by Age / Gender suicide death toll and mortality ' identify the sex ratio at which suicide occurs (Male / Female).

- A wide range of damage injury data should be focused on the frequency and extent of the damage.

- The injury detail status should include a variety of data items (middle and small groups) of subjects, locations, times, behaviors and conditions, types and degrees of injury.

- Detailed injury status should provide a more specific distinction between classes and sub-separation items.

- It should contain a variety of data related to the causes of damage to the primary target, from the data on safety and anxiety felt by local residents in the region for the items of damage

Efforts should be made to reduce the number of such occurrences with direct cause data that could cause damage
Figure 9 shows the implementation of the suicide prevention program with big data. The data to be verified have already been described in Table 2. Formatted data, injury general data and injury detailed data can be found in regions or countries (Blue in Figure 9). However, it is important to use unstructured data, that is, the data that is the cause of the injury, to determine the real cause (Green in Figure 9).
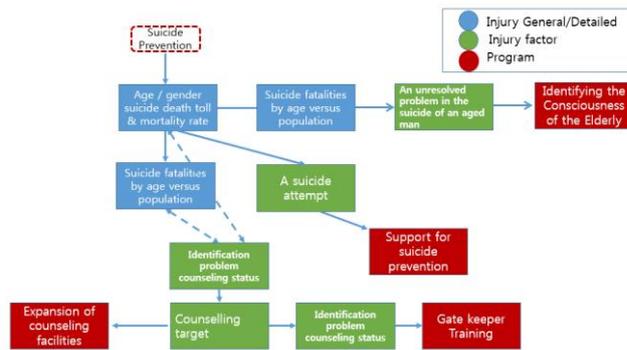
Fig. 9: Big Data and suicide prevention program processes

Without the link between structured and unstructured data, it is difficult to design and execute accurate suicide prevention programs.

4. Conclusion

Rapid technological development and changes in the world can only add to the anxiety about reality, such as stress on change and loss of control. In this paper, Korea, the country with the highest suicide rate among OECD countries, presented objective and scientific methods of preventing suicide in terms of big data to clear this stigma. We already have structured data on the general damage of a country or region, but the association between the data and suicide prevention programs should be carefully considered. It is also important to collect and store unstructured data at the site of the source of the damage. In order to run programs that can be applied and prevented in real life, it is important to look at unstructured data for the connectivity and root cause analysis of open structured data from a big-data perspective. In addition, providing objective and scientific data to local residents to ensure the continuing interest and participation of the community will increase interest in suicide prevention programs. Future studies hope to develop a program centered on the beneficiaries through design thinking methods and big data with government or local agencies implementing suicide prevention programs on site.

References

[1] Chae SB, Ahn SH, Jeon SI (2012),Big data - industrial epicenter of cataclysm, SERI CEO Information, Vol.851, pp.1-20, available online:

[2] http://www.seri.org/db/dbReptV.html?g_menu=02&s_menu=0202 &pubkey=db20120430001, last visit: 18.07.2018

[3] Min GY, Jeong DH(2013), Research on assessment of impact of big data attributes to disaster response decision-making process, CALSEC,Vol.18, No.3, pp22-25, available online: http://www.jsebs.org/jsebs/index.php/jsebs/article/viewFile/39/47, last visit: 18.08.2018

[4] Chang HJ (2017), Implementation of the safe community in perspective of big data in smart city, SungKyunKwan University, available online:

[5] http://dcollection.skku.edu/public_resource/pdf/000000102832_201 80809210607.pdf, last visit: 10.07.2018.

[6] Choi BM (2011), A study on setting up the concept of smart city through analysis on the term 'smart'. The Journal of the Korea Contents Association, Vol.11, No.12, pp943-949, available online: http://www.riss.kr/search/detail/DetailView.do?p_mat_type=1a020 2e37d52c72d&control_no=4bfeff13727eaeffc85d2949c297615a, last visit: 15.08.2018.

[7] Renata PD, Camile RS(2014), Smart city - how to create public and economic value with high technology in urban space, Springer, pp.3-4

[8] Lee JH, Seong WJ(2013), Utilization of big data for realization of Gov. 3.0, KIPA Research Report, No.2013-04,

[9] available online :

[10] https://www.kdevelopedia.org/mnt/idas/asset/2014/08/07/DOC/P DF/04201408070133509078863.pdf, last visit: 07.08.2018.

[11] Wilde EJD, Keinhorst CW, Diekstra RFW, Wolters WH (1994). Social support, life events, and behavioral characteristics of psychologically distressed adolescents at high risk for attempting suicide, Adolescence, Vol. 29, N0.113, pp.49-60

[12] Cho BH(2013), A study on the risk factors for youth suicide on suicidal ideation-focused on the mediating effects of and the moderating effects, CheongJu University, available online : http://cju.dcollection.net/public_resource/pdf/000001562502_20 180809210842.pdf, last visit: 01.08.2018

[13] Kandell DB, Raveis VH, Davies M(1991), Suicidal ideation in adolescence: depression, substance use, and other risk factors, Journal of youth an adolescence, Vol.20, No.2, pp289-308

[14] Kim DN(2014), The effects of MBSP-T on the reduction of complex PTSD and suicide ideation of the adolescent victims of school violence and the promotion of helping behavior of the peer Group, Chonbuk National University, pp. 20-25, available online :

[15] http://dcoll.jbnu.ac.kr/common/orgView/000000032714, last visit: 03.08.2018

[16] Norbeck JS, Sheiner M(1982), Sources of social support related to single-parent functioning, Research in Nursing and Health, , Vol 5, No.1 , pp3-12

[17] Park JW(1985), A study to development a scale of social support, Yonsei University, pp.6-9, available online : http://dcollection.yonsei.ac.kr/public_resource/pdf/000000133547_ 20180809211517.pdf, last visit: 03.08.201

[18] Chang HJ, Kim DN(2016), A study on inhabitants self-help scheme via socio technology for disaster safety of the smart city - mainly on lessons of Kamaisi-city in Japan, JKIIECT, Vol.9, No.4, pp388-403, available online : http://www.dbpia.co.kr/Journal/ArticleDetail/NODE07001339, last visit: 01.08.2018

[19] Chang HJ, Kim DN(2016), A Study on data utilization for implementation of the resident participation type safe community planning of the smart city, JKIIECT, Vol. 9, No.5, pp478-495, available online :

[20] http://www.dbpia.co.kr/Journal/ArticleDetail/NODE07040501, last visit: 01.08.2018