

Psychological Aspects on Autonomous Mutually Supportive Network During Disasters

Psychological Investigations on Local Visitors at the Kagoshima Spring-Water Spot

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Abstract- In this research, we have verified whether spring-water spots have what it takes to be the core of the mutually supportive network. Based on this verification, we have evaluated whether spring-water spots can become the foundation of a mutually supportive network. The above mentioned findings show us that elderly persons visit spring-water spots at their own initiative, and they can build better and cooperative relationships with other visitors. Therefore, it is highly probable that spring-water spots have sufficient qualities to serve as the core for a mutually-cooperative network.

Keywords- Spring-water Spots; Mutually Supportive Network; Factor Analysis; Mental Balance; Personalities

I. INTRODUCTION

Recently, many catastrophic disasters struck our country. When these disasters strike, local infrastructure system collapsed, followed by the failure of supply system for drinking water and basic survival foods. As the result, the weakest peoples suffer the most [1]. These kinds of cases are the aftermath problems.

Unexpectedly, in 11th of March, 2011, the disaster stroked the north eastern part of Japan. Many local peoples at that time help each other to share the drinking water. During that crisis time, it is observed that the elderly and weaker personals were given priority as well as queuing orderly for the vital supplies. It was found that the socially weaker persons were saved and the damage is controlled to the low level. Above all, this process not only limited the extent of consecutive destruction but also the network of self-reliance [2]. After the disaster, many mutually supportive networks were formed around the spring-water spot. The following reasons were considered as: "vital water can be attained, "many friends were there". The first reason will influence the location of social network at disaster time and the second reason is on the formation of the social network. But on the other hand, not all the mutually supportive network was satisfactorily carried out.

Therefore, in this study, the psychological characteristics of visitors at the local spring-water spot were analyzed and autonomous mutually supportive network. Furthermore, psychological analyses were made on the visitors at spring-water spot in Kagoshima City and Kimotsuki County. There are two reasons for not making direct interviews at the disaster stricken area; rescue and rehabilitation process were priority and with due consideration on the mental burden of the local people. And also the reason for taking, two spring-water spot at the Kagoshima area is to compare quantitatively and similarities with the ones at the disaster area which is still under investigation.

II. SURVEY APPROACHES AND ANALYSIS METHODS



Fig. 1 Spring-water spots and field work

A. Selection of Spring-water Spots

We examined whether spring-water spots can be utilized as the center of building a mutually supportive network independent of administrations. According to the preliminary analysis performed, approximately fifty spring-water spots are known to exist within Kagoshima Prefecture. A utilization study of multiple spring-water spots confirmed that most of the users of such spots were elderly persons. Additionally, it was confirmed that even there exist spring-water spots used by over 100 people a day. (Fig. 1)

To select spring-water spots, we utilized the information that is associated with Kagoshima Prefecture found in the Spring-water Preservation Portal Site produced by the Ministry of the Environment [3]. Two spring-water spots, especially those with a number of consumers, were selected out of the existing spring-water spots. One spring-water spot (hereafter spot A) is located in Kimotsuki District surrounded by richly forested mountains, and the other spring-water spot (hereafter spot B) is located in the suburbs of Kagoshima City, comparatively near to cities. At these spots, we conducted questionnaire surveys related to spring-water users' thoughts and also psychological tests with regard to mental balance and personalities. Questionnaire surveys were conducted at spot A on December 2, 2009, and at spot B on December 3, 2009. We adopted the oral interview method (with responses) by visiting each subject for this questionnaire survey. This survey method brought us about a high response rate, and moreover, we were able to obtain many opinions from elderly persons. Recommended font sizes are shown in Table I.

TABLE I SURVEY ON THOUGHTS OF ELDERLY PERSONS

Questionnaire A	
Please read the items below, and circle the number of the item you agree with. When an item does not conform to your thought, mark x on the number of that item. If you could not decide your answer, mark Δ on the number of that item. You do not have to think about each item deeply, just mark each item as you feel. What is important in this questionnaire is to recall your ordinary feelings and answer each question directly. You do not have to make yourself look good. Please answer and mark each item choosing your feeling that is approximately applicable.	
1. Sometimes I feel abnormally happy for no particular reason.	
2. Sometimes I feel like destroying something.	
3. I'm sure of my lack of confidence.	
4. I feel so nervous when I work.	
5. Usually, I feel like I did something bad or wrong.	
6. When things do not work out, I feel tempted to give up the whole thing.	
7. Occasionally, unimportant things occupy my mind and I'm distressed with such things for many days.	
8. Sometimes, I feel I'm the happiest person in the world for no particular reason, furthermore, even when things are not going well.	
This questionnaire consists of a total of 27 items.	

B. A Survey on thoughts of Elderly Persons

The purpose of this survey was to examine elderly persons that gather at spot A and spot B regarding their thoughts about spring-water spots. Referring to the Revival Guideline and Spring-water Preservation [4], we prepared survey items regarding regions, environments, cultures, and interregional exchanges (Table I).

The survey items are described here. These survey items were designed based on items related to spring-water and health, spring-water and the environment, and spring-water

and natural resources. The survey format adopted was the close-ended question system with five answers. At spot A, we were able to have a 100% of collection rate out of fifteen responders, while the correction rate at spot B was 90% out of fifty-five responders. The structure of samples obtained was as follows: The parent population at spot A was fifteen people, which was broken into eleven men and four women, having a mean age of sixty years. The spot B area has the parent population with fifty-five people, in which there were eleven men and four women whose mean age was sixty-five years old. Factor analysis was performed on the survey results. Factor analysis is an analysis method which assumes that latent variables, unobserved directly, affect observation variables, and tries to obtain the solution of this assumption. In other words, since it is impossible to observe an object that we really want to observe, we assume the object as a latent variable and prepare for observation variables that could be indexes for the latent variable. Given that, relationships are analyzed. By utilizing this analysis method, we examined major factors of the thoughts of those elderly persons who visited the spring-water spots.

C. A Survey on Mental Balance of Elderly Persons

TABLE II SURVEY ON MENTAL BALANCE OF ELDERLY PERSONS AND YOUNGER PERSONS

Please select your answer to the following questions.					
Please tell us your thoughts on spring water (spots), by answering the following questions.					
To answer each question, select your answer from 1 through 5 on the right of each question. Circle the number for your answer.					
	No, I don't agree at all	I don't agree that much	Neither	Somewhat I agree	I totally agree
Factor analysis					
A. Do you drink spring water taking care of your health?	1	2	3	4	5
B. Do you think spring water is good for your physical conditions?	1	2	3	4	5
C. Can you refresh yourself at a spring-water spot?	1	2	3	4	5
D. Do you feel spring water is more delicious than tap water?	1	2	3	4	5
E. Do you use spring water because of feeling a sense of anxiety about using tap water?	1	2	3	4	5
F. Do you want the city to organize spring-water spots as a place where people can easily draw spring water?	1	2	3	4	5
G. Do you think spring-water spots are a regional property?	1	2	3	4	5
H. Do you feel you like to tell others the merits of spring water (spots)?	1	2	3	4	5
I. Is the spring water (spots) a place where you can have personal exchanges?	1	2	3	4	5
J. Do you think you want to leave this resource to the next generation?	1	2	3	4	5

The purpose of this survey was to examine the mental health status of those elderly persons who visit spring-water spots in order to understand their inner stability. We utilized the question sheet used for the psychological test in the mental health check sheet (MINI-27) [5]. In this question sheet, there were a total of 27 question items prepared, on which responders answer each question either yes or no. The survey results were calculated as a score in which the following points were evaluated: depressive tendency (D), anxiety and strain (Pt), stress symptoms (Stress), and absence tendency (Absence). The collection rate at spot A was 100% out of all 8 responders, while it was also a 100% of collection rate out of 9 responders. The ratio of men to women for each spot was 8 to 2. Their average age was the same, 65 years old. The survey results were analyzed by using the mental health

check sheet (MINI-27) system [5], which is an application utilized for psychological tests. Considering the number of people who received the questionnaire sheets, we aggregated the elderly persons in regions of both spring-water spots. Based on this, we performed a comprehensive evaluation on the above-mentioned five psychological load factors, in order to examine inner stability (Table II).

D. A Survey on Personality of Elderly Persons

The purpose of this survey was to examine the personalities of those elderly persons who visit spring-water spots in order to understand the tendency of their personalities. We utilized the personal test question sheet used for the Five Big personality inventory based on five major personality factors [6], in which questions totaling seventy items were prepared. The survey format is a close-ended question system with two answers, either yes or no. The survey results were calculated as a score in which the following points are evaluated: extroversion, cooperativeness, diligence, stability, and inquisitiveness. This survey was performed along with the questionnaire survey performed for learning the mental health conditions of elderly persons; therefore, the number of people to whom the questionnaire sheets were distributed, the breakdown of men and women, and the average age were the same. We analyzed the survey results by utilizing the Five Big personality inventory system which is an application used for personality tests [6]. With that, we performed the analysis with the purpose of measuring the dimension of each of the above-mentioned five personality tendencies in order to understand personality tendencies (Table III).

TABLE III SURVEY ON PERSONALITIES OF ELDERLY PERSONS

Questionnaire B	
Please read the items below, and circle the number of the item you agree with. When an item does not conform to your thought, mark x on the number of that item. If you could not decide your answer, mark Δ on the number of that item. You do not have to think about each item deeply, just mark each item as you feel. What is important in this questionnaire is to recall your ordinary feelings and answer each question directly. You do not have to make yourself look good. Please answer and mark each item choosing your feeling that is approximately applicable.	
1. I often put my decision into practice without examining the matter carefully.	
2. I'd rather be lazy.	
3. I'm talkative compared to others.	
4. I'm more conservative and have a low-profile.	
5. I'm a compassionate person.	
6. I can't really put trust in even my close companions.	
7. I can look into the future.	
8. I tend to be worried too much about nothing.	
9. I don't get tired easily.	
10. I tend to make decisions and take action casually.	
etc.	
This questionnaire consists of a total of 70 items.	

E. A Survey on Mental Balance of Younger Persons

In the section II. C, the mental health survey of elderly persons who visited the spring-water spot were outlined. To make a comparison on the results obtained above, additional survey was carried out with the younger persons of our

university. This have been carried out with the aim to make the comparative study of mental health on both cool and calm elderly personals to the young and active university students. The polls were taken face to face individually and gain high response.

The comparison of mental health state of elderly and young people was made. As for the students, they cooperated with the days with least lectures at their university. And also the same mental health check (MINI-27) was used for the students. The results were analyzed using four-factor evaluation system. The questionnaire distributed to twenty-four individuals with 100% return with answers. Out of twenty-four students only one was female. Their average age is around twenties. These results were analyzed with mental health check sheet (MINI-27). As mentioned previously, using the five psychological load factors were used for general appraisal and investigations were made (Table II).

III. ANALYSIS RESULTS AND DISCUSSION

A. Survey Results of the Thoughts of Elderly Persons

TABLE IV SURVEY RESULTS OF THE THOUGHTS OF ELDERLY PERSONS: REGION (A) REGION (B)

Factor loadings and commonalities	Standard varimax values after rotation 39.126812			
	a1	a2	a3	h ²
A	0.361034	0.307571	0.148354	0.246955
B	0.670794	0.059735	0.320189	0.556054
C	0.682749	0.087343	-0.07581	0.479522
D	0.080687	0.363991	0.105748	0.150182
E	0.191813	0.120971	0.442611	0.247331
F	0.114	0.058613	0.881889	0.79416
G	-0.00785	0.972936	0.23054	0.999815
H	0.286196	0.080047	0.210612	0.132673
I	0.519736	0.127373	0.209908	0.330411
J	0.130669	0.409134	-0.06922	0.189256
Contribution amount	1.471926	1.392982	1.26145	4.126358
Contribution ratio	0.147193	0.139298	0.126145	0.412636
Factor loadings and commonalities	Standard varimax values after rotation 38.5708314			
	a1	a2	a3	h ²
A	0.889336	0.06945	0.119333	0.809983
B	0.245707	0.886562	-0.19933	0.886097
C	0.773189	0.092807	0.277772	0.683592
D	0.831396	-0.14729	0.000925	0.712915
E	-0.09534	0.709739	0.322162	0.616608
F	0.387952	0.139483	-0.41269	0.340274
G	0.12581	0.405225	0.63875	0.588037
H	0.662867	0.092067	-0.07907	0.454121
I	0.606172	0.357125	-0.12291	0.510088
J	0.065241	-0.02567	0.47932	0.234663
Contribution amount	3.126852	1.645189	1.064338	5.836379
Contribution ratio	0.312685	0.164519	0.106434	0.583638

Table I shows the questionnaire survey items for the factor analysis. Table IV(A) and Table IV(B) show the factor analysis results. We referred to the unique value of the correlation matrix that is preliminarily output, setting the number of factors for this factor analysis to three. The items A to J indicate each question number on the questionnaire sheet. a1

indicates the line of factor loading that appeared as the first factor. a2 indicates the line of factor loading that appeared as the second factor, followed by a3 in the same way. Factor analysis evaluates each factor with higher factor loading in a comprehensive way in order to interpret and organize the survey items.

Factors of the major thoughts of those elderly persons who visit spring-water spots were analysed. Table IV(A) shows the analysis results of spot A. Item B, "Do you think spring-water is good for your physical conditions?" appeared as the first factor. Item C appears next, asking "Can you refresh yourself water (spots)?" Next, item D, "Do you feel spring-water is more delicious than tap water?" appeared. This followed by item H, "Do you feel you like to tell others the merits of spring of your health?" appeared. The next item appeared was item C, which asks "can you refresh yourself at a spring-water." Finally, item I was extracted, which asks "Is the spring-water (spot) a place where you can have personal exchanges?"

Based on these findings, we are able to interpret the first factor as "spring-water is delicious and good for health; furthermore, I want to make it known the merits of spring-water spots, because in these places people can have personal exchanges." With regard to the second factor, item B, "Do you think spring-water is good for your physical conditions?" appeared. The next item that appeared was E, "Do you use spring-water because of feeling a sense of anxiety about using tap water?" With these things, we are able to interpret the second factor as "spring-water is better for health compared to tap water." The third factor should be ignored, because all factor loadings were low at a spring-water spot." Finally, item I, "Is spring-water (spots) a place for you to have personal exchanges?" was extracted. Based on these things, we are able to interpret the first factor as "spring-water is good for health, furthermore, people can refresh and have personal exchanges at spring- water spots." With regard to the second factor, only item G was confirmed, which asks "Do you think spring-water spots are a regional property?" As it is, the second factor can be interpreted as "spring-water spots are a regional property." Now the third factor is described. Only item F, "Do you want the city to organize the spring-water spot as a place where people can easily draw spring-water?" was confirmed. The third factor can also be interpreted directly as "I want the city to organize the sprig-water spot as a place where people can easily draw spring-water."

The analysis results that have been obtained up until here are organized as follows. The components that consist of the first factors of spot A and spot B have in common are physical conditions, refreshment, and personal exchange. The following comments were recorded in the interview results: "I feel healed by the green," and "I'm looking forward to seeing and talking with some people I know there." Commonalities in the thoughts of elderly persons were clarified between the spring-water spot A, located in Kimotsuki District surrounded by richly forested mountains, and the spring-water spot B located comparatively near cities. The second factor is considered here. The second factor of spot A is likely to express a pride of understanding rich local environmental resources. The second factor of spot B included a comment "I feel a slight anxiety from tap water. I think spring-water is better to drink for health," and another economic comment, "the tap water fee is expensive in cities so I use spring-water."

We can consider that these comments are a big expectation for spring-water. Spot A in which the third factor

appeared has a narrow spring-water space and only one spring-water sampling location (Fig. 2). These comments were probably made as an expression of dissatisfaction with such poor spring-water facilities.



Fig. 2 Spring-water spot A

B. Survey Results of the Mental Balance of Elderly Persons

The purpose of this survey was to examine the mental health conditions of those elderly persons who visit spring-water spots in order to understand their mental balance. We utilized the question sheet for the psychological test of the mental health check sheet (MINI-27) for this survey. The survey results were analysed by using the mental health check sheet (MINI-27) system [5]. Table II and Figure IV show the results of the psychological test. This psychological test was analysed based on a parent population of 17 people, considering the number of people in the aggregate.

The survey results were calculated as a score in which the following points were evaluated: depressive tendency (D), anxiety and strain (Pt), stress symptoms (Stress), and absence tendency (Absence). The score contains a four-staged comment evaluation described which makes it possible to read the mental balance of the responder. This four-staged comment evaluation consists of "not observed," "average," "observed," and "clearly observed." D ranged between the not-observed level and the average level. Pt was at the average level, while Stress was at the not-observed level. In those elderly persons who visit spring-water spots, it has been shown that the four factors consist of "not observed" through "ordinary factors." The mental health conditions of those elderly persons at both spring-water spots were in quite a good and stable state according to the summary of the survey results obtained up until now. Before conducting these surveys, it was expected that they could have some negative mental factors, thus they go to spring-water spots to find consolation in these places. However, the psychological tests performed at this time confirmed that almost all items resulted in average or not observed. This result shows that elderly persons who visit spring-water spots are in good mental conditions. Along with this, it can be considered that they tend to go to spring-water spots mainly because of their stable mental conditions.

The test results were calculated as a score in which the following points are evaluated: extroversion, cooperativeness, diligence, stability, and inquisitiveness. The personality tendencies of the elderly persons at both spring-water spots are now described based on Table V and Figure 3. All five

factors are in the average and balanced level. In particular, cooperativeness and stability are comparatively higher than other factors, which were better evaluated. The observation records of spring-water spots tell us that those elderly persons help each other by holding other stranger's things, and almost all responders gently answered the interviewer. These results clearly reflect the personality tendencies of elder persons.

TABLE V PERSONALITY TENDENCIES OF THE ELDERLY PERSONS

	D (depressive tendency)	Pt (anxiety and strain)	Stress (stress symptoms)	Absence (absense tendency)
1	3	0	0	0
2	4	3	2	0
3	6	2	6	0
4	3	0	0	0
5	5	4	7	1
6	5	1	2	1
7	1	1	1	0
8	2	0	1	0
9	2	0	0	0
10	4	1	1	0
11	3	0	0	0
12	1	1	1	0
13	0	0	0	0
14	3	0	0	1
15	2	0	0	0
16	2	0	0	0
17	1	0	0	0
Average	2.76	0.76	1.24	0.18
Level	Not observed - Average	Average	Not observed	Average

C. Survey Results of the Personalities of Elderly Persons

The purpose of this survey was to understand personality tendencies of those elderly persons who visit spring-water spots. We utilized the question sheet used for the personality test of the Big Five personality inventory. The survey results were analyzed by using the Big Five personality inventory system which is an application used for personality tests [6]. Table III and Figure 4 show the results of the personality test performed. Analysis was performed in this test based on a parent population of 17 people considering the number of people in the aggregate.

The test results were calculated as a score in which the following points are evaluated: extroversion, cooperativeness, diligence, stability, and inquisitiveness. The personality tendencies of the elderly persons at both spring-water spots are now described based on Table III and Figure 4. All five factors are in the average and balanced level. In particular, cooperativeness and stability are comparatively higher than other factors, which were better evaluated. The observation records of spring-water spots tell us that those elderly persons help each other by holding other stranger's things, and almost all responders gently answered the interviewer. These results clearly reflect the personality tendencies of elder persons.

D. Survey Results of the Mental Balance of Younger Persons

The purpose of this was to compare and understand personal tendencies of elders and young ones. This survey used the mental health check sheet (MINI-27) for psychological test. The obtained test results were also analyzed using the psychological test application (MINI-27).

The results were shown in Table II and Figure 5. The population for this test was 24. The surveyed results were as follows: depressive tendency (D) was at normal level, along

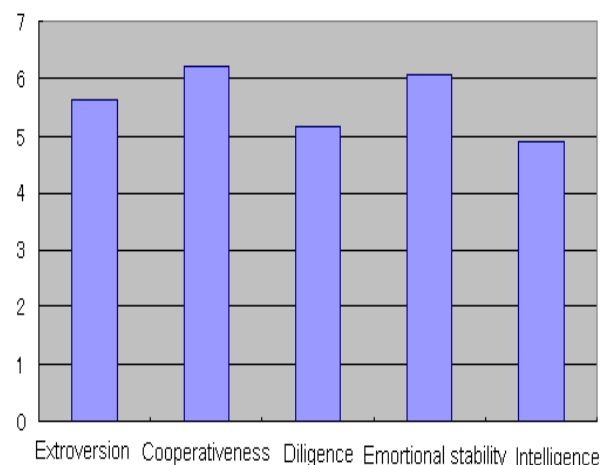


Fig. 3 Survey results of the mental balance of elderly persons

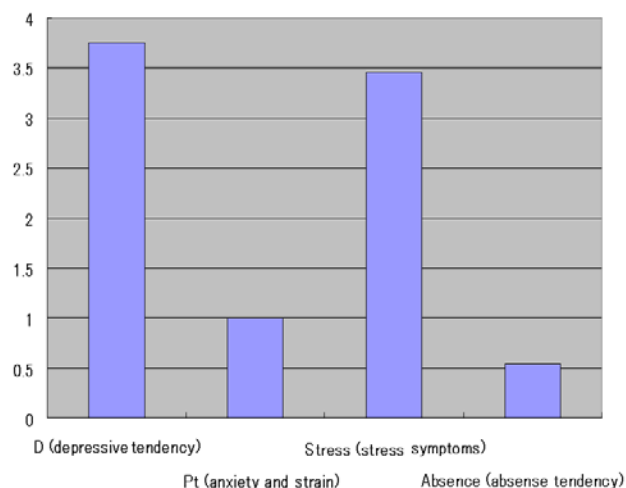


Fig. 4 Survey results of the personalities of elderly persons

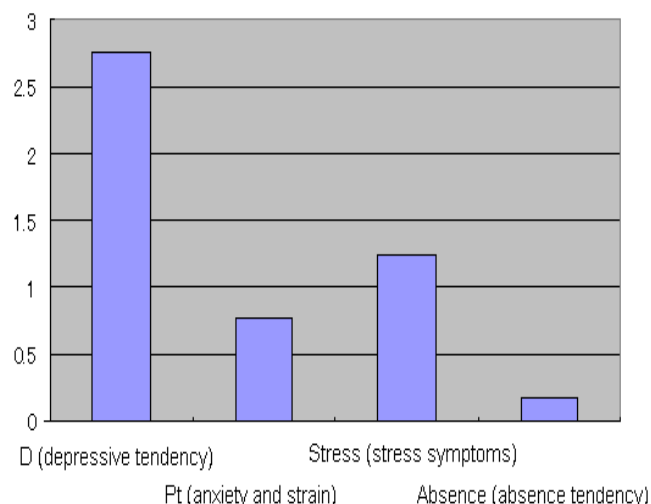


Fig. 5 Survey results of the mental balance of younger persons

with anxiety and strain (Pt). The stress symptom (Stress) was also at normal level. The absence tendency (Absence) was also at normal level. As for the university students, under

these four-factor analyses all the students were found to be at normal level and without any problem.

To conclude the survey results up till now, the university students were found to be at the stable state of mental health. But comparing to the elderly with respect to four-factor against the university students, they showed higher values in all cases. When personal interviews were made to students, they had worries for their future and romances. In spite of being in good mental health, they still had worries about their present student life and future.

The comparison between elders and young ones visiting the spring water spot, on mental health, the elders were in better state and stable as shown in Table II and Figure 5.

E. Comprehensive Analysis Results on Selection of Spring-water Spots

In this research, we have verified as to whether spring-water spots have proper qualities to become the core of a mutually-supportive network, from the viewpoint of those elderly persons who gather at spring-water spots.

We have analysed major thought factors of those elderly persons who visit spring-water spots. This analysis has shown that the elements that comprise major thoughts of elderly persons at spot A and spot B had the factors of physical conditions, refreshment, and personal exchanges in common. It can be considered that elderly persons take care of their physical conditions, thinking that drinking spring-water is good for their health. It has also been shown that elderly persons consider such spring-water spots as a place for personal exchanges. These findings show us that elderly persons voluntarily visit spring-water spots, because spring-water is good for their health and they can have personal exchanges with other visitors.

We have analysed the inner stability of those elderly persons who visit spring-water spots. This analysis has clarified that the mental health conditions of elderly persons at both spring-water spots are in a better and stable status. These findings show us that elderly persons are mentally stable, and are able to build good relationships with others.

The personality tendencies of those elderly people are also analysed at spring-water spots. This analysis has shown a good balance between major five factors, with good values. Cooperativeness and stability was especially shown as a tendency that was comparatively higher than other factors. These findings show that elderly persons are mentally stable and have a cooperative personality. Given this, we can say that elderly persons are able to build cooperative relationships with others.

The comparison on mental health of the elders and young ones visiting the spring-water spot were made. The results showed that the elders had better mental health and stability. Therefore, the elders with more mental health stability got along with the others well and along with their constructive engagements between each other.

The above-mentioned findings show us that elderly persons visit spring-water spots at their own initiative, and they can build better and cooperative relationships with other visitors. Therefore, it is highly probable that spring-water spots have sufficient qualities to serve as the core for a mutually-cooperative network.

IV. FUTURE WORKS

In this paper, it is cleared on the mutually supportive network condition. The above personal exchange condition can be made at the spring-water spots, visitors were mentally stable and have good relationship between each other. Through this research, we have learned that spring-water spots have potential to be utilized for the core of a mutually-cooperative network as one of the support measures for elderly persons. In times of peace, this network is utilized for a place of information and personal exchanges for elderly persons, contributing as a resolution to the problem of social withdrawal and a lack of information for those elderly persons. Moreover, elderly persons are willing to participate in this network, where they enjoy building good and cooperative relationships with others. Maintaining this function and relationship under times of disasters is likely to be useable as a mutually-cooperative network. If this system can be utilized in times of disasters, it can serve as help to confirm the safety and whereabouts of people, and it also serves to prevent elderly persons from being isolated. In the Great East Japan Earthquake that occurred previously, there existed many cases where disaster preventative measures did not function well. Utilization of such a mutually-cooperative network centering on spring-water spots probably serves to realize a redundant social network, and thus it leads to build a social network that is more robust for natural disasters. Expanding the research range more, in the future, we will examine as to whether spring-water spots have adequate qualities for being the core of a mutually-cooperative network from the standpoint of those elderly people who gather around such spots [7] [8]. Moreover, we would like to cooperate with various municipalities including Kagoshima Prefecture in order to build mutually-cooperative networks centering on spring-water spots [9].

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