Doctoral Dissertation

Study on Evaluation of Social Activation Systems Based on a Knowledge Construction Model

Fei MENG

Supervisor: Professor Van Nam HYUNH

School of Knowledge Science

Japan Advanced Institute of Science and Technology

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Abstract

This dissertation proposes an evaluation framework of social activation systems based on a knowledge construction model. The framework has been developed through an action research that deals with the seminar for retired men to search their purposes of second life, which surely activates the society through making people active. This seminar was a project at University of Toyama with the support of the Ministry of Health, Labor and Welfare, Japan. The knowledge construction model is the central element of a knowledge synthesis theory, which has been developed in the School of Knowledge Science, for collecting, synthesizing, and justifying knowledge. This theory has already several successful applications; however since such normative theory cannot be verified scientifically, this dissertation is also intended to provide a basis for justification of this theory.

The evaluation of such activation projects has been done from several approaches such as the pedagogical evaluation that emphasizes educational aspects, or the psychological evaluation that asks the subjects their quality of life or purposes in life. The evaluation can also be done using the concept of value co-creation because the project mentioned above is a kind of social service system. But, even though the project does not succeed without the efforts of participants, it is difficult to identify the fact that the value is co-created by the interaction between the project organizers and participants. From this reason this dissertation refers to the above project a social activation system, while recognizing it as a service system in the society in a wide sense. Taking these into consideration, this dissertation is to develop an evaluation framework from the knowledge-scientific approach.

After presenting the background and motivation of this research, this dissertation introduces the knowledge synthesis theory with its applications and universality in order to assess the validity of building an evaluation framework based on this theory. The main part of this theory is a knowledge construction model that has five ontological elements related to the will to solve problems, existing scientific knowledge, social motivation, creative activities, and systemic synthesis. This dissertation proposes a framework of evaluating creativity of participants at the above ontological elements, from the viewpoints of knowledge creation, willingness creation, and value creation. It also shows some interesting evaluation results on the above mentioned project of activating the elderly people.

Another major proposal in this dissertation is the as-is/to-be rating scale method that asks participants the current situation and the target at the same time in the self-evaluation of making and executing the plan. As a result, the achievement levels of individual participants can be inferred for attentive care. This dissertation shows some interesting findings concerning the attitudes of participants by virtue of the introduction of this method. Thus, this dissertation proposes an evaluation method for social activation systems from knowledge-scientific approach, and confirms the validity of this method in the actual project to some extent. In conclusion, this dissertation claims that this research has both academic and social contributions as a doctoral study of knowledge science.

Keywords: Evaluation, activation systems, knowledge creation, willingness creation, value creation, rating scale method.

Acknowledgment

This work was carried out at School of Knowledge Science, Japan Advanced Institute of Science and Technology (JAIST). The author wish to express her gratitude to many people who have supported her during her work.

First of all, the author is deeply indebted to her former supervisor, Prof. Yoshiteru NAKAMORI. He has not only helped her find her research direction, but also has guided her during these years with constant encouragement and precise advice as a strict while generous and kindhearted teacher. He was always willing to help the author to solve her difficulties both in research and in life. The author also truly appreciate his patience and tolerance and allowing her to grow in her enthusiasm and confidence. This dissertation would not have been possible without his invaluable support and guidance.

The author wish to express her sincere gratitude to the current supervisor Prof. Van Nam HUYNH for his insightful suggestions and comments. Without his kind help and constant encouragement, this research would not finish successfully. The author would like to express her appreciation to the official referees of the dissertation, Prof. Kyoichi KIJIMA of Tokyo Institute of Technology, Prof. Michitaka KOSAKA, Prof. Yoji KODA, and Prof. Takaya YUIZONO of JAIST, for reading the whole dissertation and giving her a lot of important comments to improve her work. Also, the author is grateful to Prof. Saburo OGATA who was her minor theme advisor on the study of 'Kansei Marketing'.

The author regards herself fortune to have the opportunity to work with a group of enthusiastic people in the project of University of Toyama. The author sincerely thanks Ms. Junko FUJIMORI and Mr. Tsuyoshi TATSUSE for giving her a chance to carry out an action research in the project. The author have enjoyed every moment that they worked together. The author would also like to devote her thanks to other friends in JAIST for their kindness and help.

Her parents have been a source of love, happiness, and support. They have devoted their whole love and unreserved support to her and let her freely do whatever she want. Their kindness and understanding have been the best gift that she could have ever had.

Fei MENG

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Chapter 1

Introduction to the Dissertation

Summary: This dissertation is to report several new proposals and remarkable findings that were developed through participating actual projects, regarding the evaluation of a social activation system. This introductory chapter first provides the definitions of technical terminologies used in this dissertation. Then it provides the summary of each chapter: the background and motivation of research on evaluation of social activation systems, the activation system development based on a knowledge synthesis theory, the evaluation of a social activation system based on participant observation, and a knowledge-scientific evaluation framework by an as-is/to-be rating scale method.

1.1 Introduction to Chapter 1

This chapter will give the outline of the dissertation. First, it will introduce the definitions of technical terminologies used here in order to share the meanings of concepts with readers. The important keywords are ‘social’, ‘activation’, ‘system’, ‘activation system’, and ‘social activation system’. The motivation of doing this research is quite important generally. However, since it is difficult to describe it easily, the background and motivation will be explained later in Chapter 2 in detail.

After declaring research objectives, this chapter introduces three main research activities as shown in Fig.1.1. Section 1.4.1 introduces participant observation of regional revitalization projects, which contributed to the development of a methodology of social activation system development and it will be described in Chapter 3. Section 1.4.1 and 1.4.2 briefly refers to stories of a three-year action research in a male retiree education program, and an ex-post evaluation of this program after one and a half years. These research activities are related to the major parts of this dissertation, and will be explained in Chapter 4 and 5, respectively.

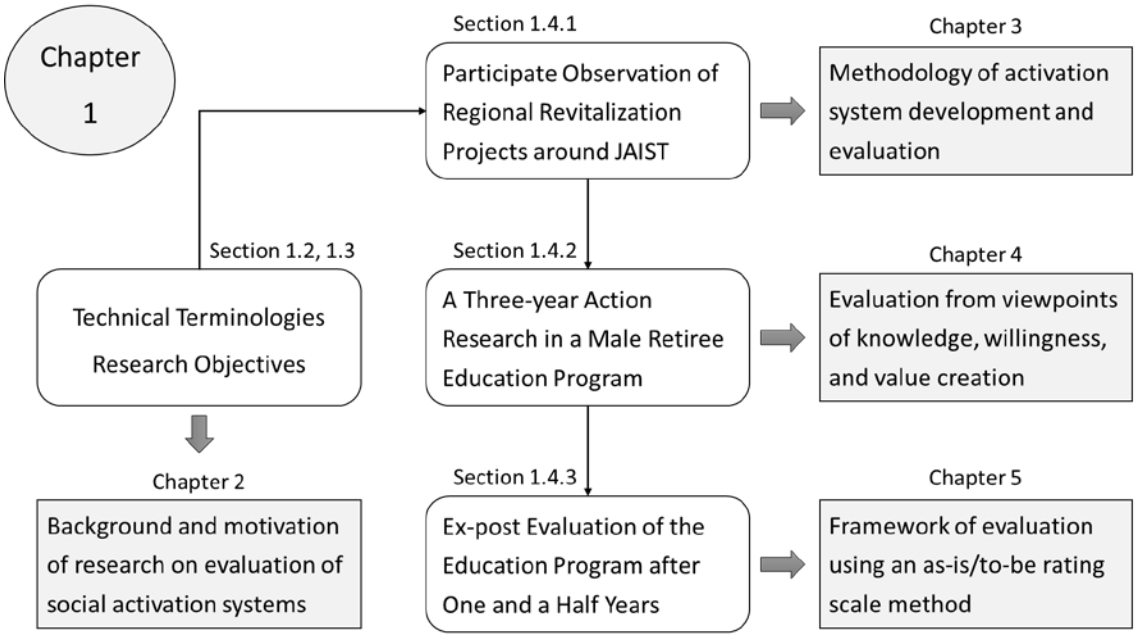


Fig.1.1 Structure of Chapter 1.

1.2 Definition of Technical Terminologies

Recent service management puts emphasis on the organizational structure and management activities to provide service. The service is evaluated mainly by customers, judging from the difference between expectations and actual results. Evaluation results are fed back to the service provider, which leads to improved service.

When the education system for providing information is considered as a service system, similarly, it is evaluated by the customer value, such as customer satisfaction. The results of evaluation are utilized to improve the service as well. However, the education system is different from the general product sales system in that *the unremitting efforts of the service recipient is required*.

Generally a social service means counseling or health care, provided by the government to advance human welfare, especially for disadvantaged people, or organized welfare efforts carried on under professional auspices by trained personnel. But, this dissertation adopts a simple definition of '*social service*' as *the organized efforts to advance human welfare*. This dissertation uses the term '*system*' defined by Checkland (1981) that a system has the emergent property, hierarchy, communication and control processes, and as a whole it can survive against the changing environment in principle.

One recent definition of a 'service system' is a value coproduction configuration of people, technology, internal and external service systems connected via value propositions, and shared information (Wikipedia, 2015).

Then, a '*social service system*' can be defined as follows: *it is a system, consisting of service providers and service recipients as elements, which creates knowledge and value as the result of emergence by the interaction between elements of the system*.

However, the system that this research treated as a concrete example is an education system for retired men to consider their second life plans. In this system the organizers and participants discussed with each other about their second-life plans deeply. However, it is difficult to identify the fact that the value is created by the interaction between them. Although this system is a kind of social service system, this dissertation refers to this system *a social activation system* because it surely activates the society through making people active.

From the above discussion, *a social activation system* is defined as follows: It is a kind of a social service system in a wide sense, which provides data or information to participants in order to activate them to create knowledge, willingness, and value. Examples of such systems are:

- A system to activate the neighborhood association;
- A system to activate the region of mountain villages;
- A system to activate the traditional craft industry;
- A system to activate the shopping street of the town; or
- A system to activate the elderly to consider their second lives.

The last one is actually the concrete example treated in this dissertation.

1.3 Research Objectives

The main objective of this research is *to establish an evaluation framework of social activation systems and to justify its effectiveness*. The social activation system treated here requires, for its success, knowledge creation, willingness creation, and value creation by participants. Therefore, it could be called educational or creative service system. Hereafter, the term '*participant*' is used instead of 'service recipients' in order to emphasize the value creation by people who participate in the system actively.

The evaluation framework must enable the evaluation of proactively creative activities by the participants themselves, and at the same time, it must enable the evaluation of creativity support of the system. In addition, the evaluation framework must enable the evaluation of achievement for the personal goals of the participants.

Since the evaluation framework is a kind of normative model, it is difficult to validate the framework itself scientifically. But, it must be justified by applying it to at least one actual social activation system. Actually, this research evaluated an education program in which the retired men tried to find the purpose of second life.

Finally, this dissertation must show that this research certainly contributes to the development of knowledge science. Traditionally, the social education system has been evaluated by psychological methods to check the change in efficacy of participants, and the service system can be evaluated by the quality and quantity of created value. But, the most important factor for the success is knowledge creation in the social activation

system. Therefore, the evaluation framework first deals with knowledge creation, assuming that knowledge creation affects willingness creation and value creation.

In summary, the research objectives of this dissertation are:

- To establish an evaluation framework of social activation systems; and
- To show its effectiveness using a concrete social activation system.

Here, the constraint conditions of the present study are:

- The evaluation framework will be developed based on a knowledge construction model, called the *i*-System, which was developed for knowledge collection, synthesis, and justification;
- The application range of this evaluation framework is limited to social activation systems such as the systems introduced in the previous section.

1.4 Research Activities

The major research achievements will be shown in Chapter 3, 4, and 5. Here the research activities which were led to these achievements will be introduced.

1.4.1 Participant observation of regional revitalization projects around JAIST

The origin of this study can be traced back to an open lecture '*Regional Revitalization Systems Theory*' which has been held at Japan Advanced Institute of Science and Technology (JAIST) since 2006. 'Regional Revitalization Systems Theory' is a series of lectures for participants including leaders of the community and persons in charge of industry-government-academia collaboration, (for example, local government officials, local business managers, or representatives of NPOs), in addition to graduate students.

Lectures are provided on general theory, regional revitalization policies, and case studies, followed by group work where participants have to propose new regional revitalization plans. Participants have been implementing various regional revitalization projects through collaboration with universities, local governments, and private sectors. This open lecture and some revitalization projects derived from this lecture will be introduced in Chapter 2 in detail.

The author has been involved, as a supporting staff, in developing '*a methodology of social activation system development*', based on the accumulated theories and practices of regional revitalization projects. The author understood, through these activities, that contribution to local communities has been recognized as the new role of universities in Japan, and that research on the theory and practice of social activation systems provided by the university is needed.

This activity was regarded as one of the successful application of knowledge science. Nonaka (1991) established this discipline, which included courses taught in the fields of business administration, information systems, management, and library-information sciences (Alavi and Leidner, 1999). Knowledge management is growing rapidly and has attracted considerable interest from the academic community, and much research is emerging every year. Recently, Serenko (2013) summarized the knowledge management field using a meta-analysis of scientometric research.

There is an important proposition in knowledge science that knowledge emerges from creative activities or intuitive (emotional) creative processes; however, the process can be analyzed rationally. Its first example is the organizational knowledge creation model (Nonaka and Takeuchi, 1995). This model provides a rational and algorithmic-like recipe for increasing knowledge, using arational abilities of the human mind. According to this idea, Wierzbicki and Nakamori (2006) proposed several academic knowledge creation models, and Tian et al. (2009) examined these models in a graduate university successfully.

A knowledge synthesis theory was proposed in Nakamori et al. (2011), which is a systems approach to synthesis of a variety of knowledge and justification of new knowledge. The theory consists of three parts that relate to each other, which are a knowledge construction model, analysis of actors' abilities against social structures, and knowledge justification principles. This theory deals with different types of knowledge integration such as specialized integration, interdisciplinary or intercultural integration.

Based on this theory, together with the experience of many regional revitalization projects, we developed a methodology of social activation system development. Although the role of this author in developing this methodology was limited, it gave the author the motivation of this study.

Chapter 3 explains this methodology using an example of developing a social activation

system, which is a remote health management system in Nomi city with the support by the Ministry of Internal Affairs and Communications, Japan. The participant observation experience through this project gave the author a research motivation and pushed her to develop an evaluation framework of such social activation system, and let her to perform the researches which will be introduced in Chapter 4 and 5.

Chapter 3 is written based on the following peer-reviewed conference papers:

- Meng F, Nakamori Y: Knowledge management for regional revitalization, *Proceedings of the 1st International Conference on Interdisciplinary Studies of Natural and Social Sciences*, 205-206, December 14-15, 2012, Beijing, China.
- Nakamori, Y, Meng F, Kosaka M, Tian J, Xiang JW: Service systems development based on a knowledge synthesis methodology, *Proceedings of the 2015 IEEE International Conference on Software Quality, Reliability and Security Companion*, 245-250, August 3-5, 2015, Vancouver, Canada.

1.4.2 A three-year action research in a male retiree education program

Since the outcome of a social activation system usually does not appear immediately, the verification of the system is difficult in the short term. Therefore, to convince people and promote the revitalization project, the justification process is indispensable before verification. Here, the most important thing is to have the points of view as follows: What kind of knowledge has been created and how the project members have been activated by the knowledge.

A chance to carry out such research was given to the author from the University of Toyama. A project of searching the goal of second life for retired men was launched in 2011 with the support of Ministry of Health, Labor and Welfare Japan. The author started the research on project evaluation with her supervisor Professor Nakamori.

The details of this project will be introduced in Chapter 2. In brief, it is an education system for retired men to discover worth living. After listening to the lectures, the participants have to make a plan of their second lives. They have to create ideas to activate themselves and to create value of lives or of communities. This project lasted three years, and we were in charge of the evaluation of this project. The details will be

introduced in Chapter 4. This section outlines our action research with other project members.

The project was prepared in summer and implemented in autumn of 2011. We developed a method of evaluating both participants and the project from the viewpoint of knowledge creation, focusing on whether the participants converted information into knowledge.

The main characteristics of the evaluation results for the first year participants are: In *self-evaluation*, importance recognition of the result is slightly higher than others, and the recognition of the social significance is slightly low; In *course evaluation*, recognition of the need of the result is slightly lower than others, and there is room for the improvement of the course because evaluations are lower than the necessity in about one point.

The self-evaluation and course evaluation by the second year participants were performed similarly. The tendency of the self-evaluation is the same as the first year evaluation. On the other hand, the course evaluation became considerably high, and the participants feel it more necessary. These are evidence that the course has been refined. The main finding from this analysis is that it might be difficult for participants to convert information into their own knowledge.

In the second year of the project, we investigated how the participants raised their motivation or willingness to make and practice their plans. The traditional psychological survey was carried out by Mr. Tatsuse who is a project fellow. He reported that the personal motivation indicator rose after the course. In order to clarify the willingness creation, we developed an evaluation method using the three-value logic of the knowledge construction model (Wierzbicki and Nakamori, 2006).

The detail results will be reported in Chapter 4, but here we present an important finding. We tried to explore differences in the average values of answers among before, just after the course, and the future aspirations. Significant difference can be seen in most of the combinations. The significance difference between before and after the course indicates that the participants feel meaning of the course. The significance difference with the future aspirations suggests that there was a certain significance in the course.

We also tried to check whether there are differences in the average values of answers among before, just after, six months after the course, using the answers by the first year participants. There is no significant difference in about half places. This indicates that the participants might not act to raise the level of willingness six months after the course. There is a need for further aftercare. It is necessary to promote the willingness of participants by collecting the graduates at an appropriate timing.

In the third year of the project, we investigated what kinds of value were created by the participants. The survey was carried out for all participants of the past three years. Although there are some variations in the content from year to year, the common answers will be shown in Chapter 4. Similar to the survey by the psychological method, most of the created value is related to participants themselves. This may be the limit of this project. The future study must include the improvement of course to let the participants to consider social contribution.

Chapter 4 is written based on the following peer-reviewed papers:

- Meng F, Huynh VH, Nakamori Y, Fujimori J, Tatsuse T: Development and evaluation of a social service system. *Proceedings of the 16th International Symposium on Knowledge and Systems Sciences*, 155-165, September 24-26, 2015, Xi'an, China.
- Meng F, Nakamori Y: Knowledge-scientific evaluation of community service systems. *Journal of Systems Science and Systems Engineering*, Springer, in press (accepted on September 10, 2015), 15 pages.

1.4.3 Ex-post evaluation of the education program after one and a half years

The project introduced in the section above continued three years from April 2011 to March 2014. Since April 2014, the project leader, Ms. Fujimori, has been organizing the seminar where some of the graduates gather together once a month to discuss how they are executing their plans. The purpose of Chapter 5 includes to find the differences of knowledge, willingness, and value of those who are participating in the seminar and those who are not participating in it. For this purpose, Chapter 5 introduces a new rating scale method to ask participants their current level as well as their goals.

In Meng et al. (2015) we reported a knowledge-scientific approach to evaluate this project from the viewpoints of knowledge creation, consciousness reform, and value

co-creation. We found that it was quite difficult for the participants to convert given information into their own knowledge, and the willingness of participants returned to the original level six months after the course. In Meng et al. (2015) we also treated the value created in the course qualitatively. However, a quantitative analysis is needed for elaboration of the course and aftercare of the participants. Therefore, Chapter 5 tries to establish a quantitative evaluation for such activation systems.

We improved the evaluation list developed in the action research of three years, including a quantitative evaluation list for value creation. Using this list, we carried out the survey of ex-post evaluation for all participants of three years in summer of 2015. We set some hypotheses to be verified by the survey. An overview of the hypothesis and the major findings are as follows.

About differences between participants and non-participants in the aftercare seminar, we assumed that participants are promoting more than non-participants. But this hypothesis was rejected because we found the level of plan execution is the same in both groups. Then, by virtue of the new evaluation method, we found the non-participants were more satisfied in willingness and value creation than the participants. This is because the goals of non-participants are lower than those of participants.

Especially, from the viewpoint of value creation, non-participants might consider that they almost reached their targets in the course and might judge that they do not need to participate in the aftercare seminar. On the other hand, since participants might be those who are not yet satisfied, we should consider the care for them more carefully. With respect to knowledge creation, participants might create more idea that non-participants.

Chapter 5 also reports the path analysis on the relationships among the evaluation items using the data of *current status*. The method, which is in the class of the covariance structure analysis, is the structural equation approach that assumes the effect relationships among measured variables. In this approach, we use the path analysis which tries to explain plural dependent variables by plural independent variables. We use the recursive model in the path analysis, especially, the multivariate regression analysis for determining the correlation between the dependent variables after removing the effect of independent variables. Some of the findings are listed below.

For the knowledge creation, a good plan can be created by learning the method hard. The plan creation depends on the idea creation to some extent. Therefore, we should

prepare lectures on knowledge creation by individuals. Since the result is highly dependent on the collected information, the selection of information is very important.

In willingness creation, the strength of enthusiasm weakly affects other activities of making the plan. We have to run, in parallel, some regional contribution projects and ask the students to contribute to one of the projects in order to raise the level of complexity of integration.

In value creation, since questions are if the value is worth to you, your group, or the society in all evaluation items, the correlation coefficients between items are rather high. Therefore, the achievement level of each item is important. However, in the current investigation, we could not find the evidence that the students created big value. This suggests the need of further aftercare.

We found that there is little correlation between 'plan execution' and 'plan creation'. There might be personal problems during the actual practice of the plan. There is a need to develop a lecture in order to fill the gap of plan creation and plan execution.

The method in Chapter 5 has the possibility to be used for evaluation of any educational system. Therefore, the future study must include the development of an evaluation framework for general social (educational, creative) activation systems.

Chapter 5 is written based on the following paper under peer-review:

- Meng F, Nakamori Y, Huynh VN: Knowledge-scientific evaluation of a social service system. *International Journal of Knowledge and Systems Science*, IGI Global, in press (accepted on December 28, 2015), 18 pages.

1.5 Structure of the Dissertation

Chapter 1, as described above, defined technical terms used in this dissertation, and then gave an overview of the three major achievements in this research.

In Chapter 2, the public open lecture 'Regional Revitalization Systems Theory' and some of the regional projects derived from the lecture, which were the motivation of this research, will be introduced.

Then, the subject of the case study in this research will be introduced in Chapter 2. That is a social activation system which provides education to retired men to help search purposes of their second lives.

The declining birthrate and aging population will progress rapidly in Japan. Therefore our society must care the lives of the elderly, and on the contrary, it is extremely important to promote social contributions by the elderly.

This dissertation aims at developing an evaluation framework for social activation systems. The second half of Chapter 2 reviews the existing evaluation methods to appeal the novelty of the proposals in the present study.

The contents in Chapter 3, 4, and 5 were described in this chapter already. They are not repeated here, but they are the main outcomes of this research.

Finally, Chapter 6 gives some conclusions of this dissertation. After referring to the academic contribution and social contribution of this study, it will refer to future challenges.

Chapter 2

Background and Motivation of Research on Evaluation of Social Activation Systems

Summary: This chapter explains the background and motivation of this research. First, an open lecture held at JAIST named ‘regional revitalization systems theory’ and some regional vitalization projects are introduced, which gives the background and motivation of this research. Then, this chapter introduces the case project in the dissertation, which is an education system for retired men to search the purpose of their second lives. The role of this chapter includes the survey of existing evaluation methods to explain that the proposed method is novel and useful.

2.1 Introduction to Chapter 2

The origin of this study can be traced back to an open lecture 'Regional Revitalization Systems Theory' held at Japan Advanced Institute of Science and Technology since 2006. The author has been involved, as a supporting staff, in developing a methodology of social activation system development. The author understood that contribution to local communities has been recognized as a new role of universities in Japan. Before long, the author was given a chance to study the education program for retirement men at University of Toyama as a social activation system.

This chapter first introduces the open lecture on regional revitalization briefly in Section 2.2, which can be recognized as a social activation system, and the education program for retirement men at University of Toyama in Section 2.3. Because the purpose of this dissertation is to develop an evaluation framework for such social activation systems, the chapter will review evaluation methods for such systems in Section 2.4. These experience gave the author the chance to develop an evaluation framework for social activation systems. Figure 2.1 shows the structure of Chapter2, and the relationships among Chapter 3, 4 and 5, and the research results in this dissertation.

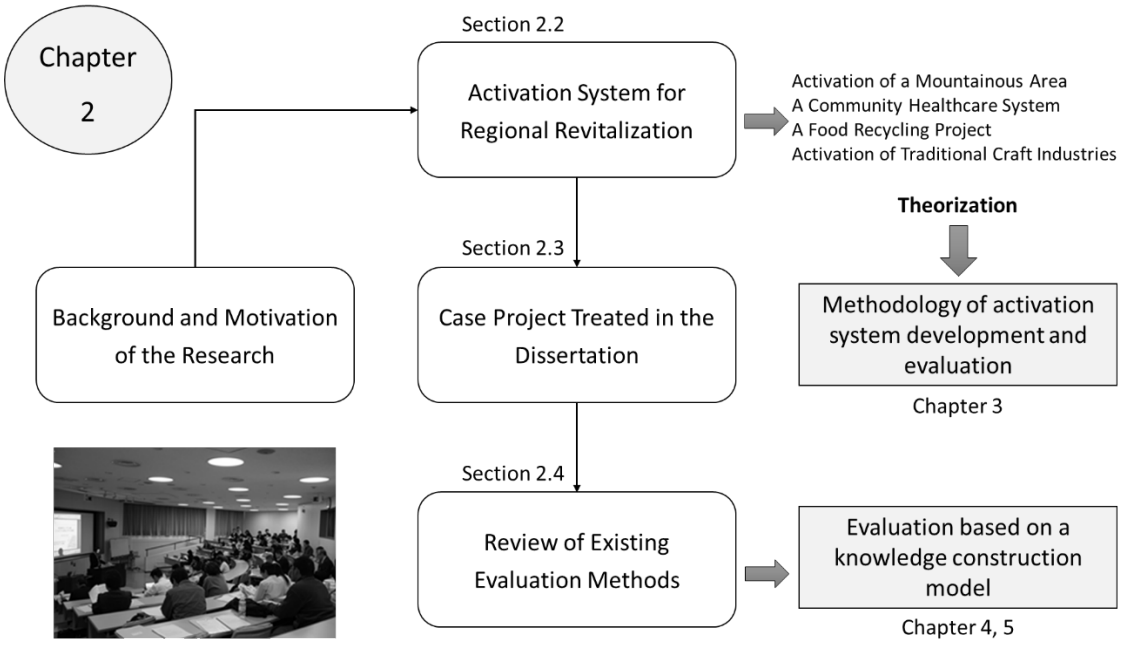


Fig.2.1 Structure of Chapter 2.

2.2 Social Activation Systems for Regional Revitalization

With the progress of the aging population, the decline of vitality of the local areas is continuing in Japan. The central government of Japan is encouraging local revitalization projects based on the idea of respective community. It is asking local universities to support such projects as a base of knowledge of the region. JAIST, as one of the local research and educational institutions, responded to the request of the central government, started a lecture named 'Regional Revitalization Systems Theory' in cooperation with the Cabinet Office, which is open to the general public.

According to Nakamori (2013), this chapter introduces some successful stories in this lecture, and theorizes knowledge reconstruction and justification for regional vitalization, by referring to them. The main concern is the *emergent property* that any system has by definition (Checkland, 1981), which is essential in knowledge creation or idea generation for regional vitalization.

Similar ideas can be found in the following works. Meta-synthesis (Gu, Tang, 2005) is interpreted as a systems thinking for a holistic understanding of the emergent characteristic of a complex system, and for creating a new systemic knowledge about a difficult problem confronted. Wierzbicki et al. (2006) proposed a new approach called the 'Informed Systems Approach', which serves as the basic tool of knowledge integration considered as emergence. This systems approach emphasizes three basic principles: the principle of cultural sovereignty, the principle of informed responsibility, and the principle of systemic integration.

The problem is how we can fulfill a *systemic integration* in the context of knowledge synthesis. One of the answers to this is the *knowledge synthesis theory* (Nakamori et al., 2011), which consists of three fundamental parts: a knowledge reconstruction model (Nakamori, 2003), the structure-agency-action paradigm (Nakamori, Zhu, 2004), and the evolutionally constructive objectivism (Wierzbicki, Nakamori, 2008). This chapter introduces this knowledge reconstruction model, and then explains an actual regional vitalization project that was planned using this model.

The lecture is open to the public. Participants are local government officials, leaders of local industry, general citizens, in addition to graduate students. The number of participants from outside varies from year to year, but is about 80 people.

It has been offered on Saturdays in the fall semester. Lectures on general overviews and successful cases are given in the morning, and group works are employed in the afternoon. Topics of group works include:

- Activation of a mountainous area,
- A community healthcare system,
- A food recycling project, and
- Activation of traditional craft industries

These were carried out in the cities around JAIST as shown in Fig.2.2.

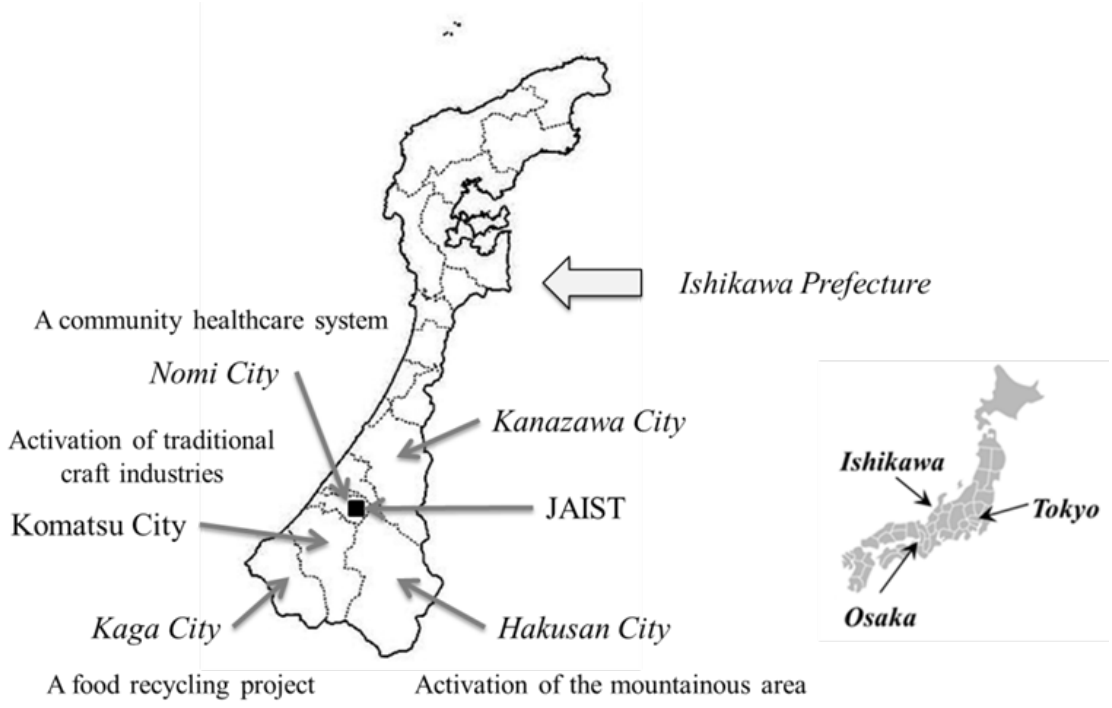


Fig.2.2 Revitalization projects in the cities surrounding JAIST (Nakamori, 2013).

2.2.1 Activation of a mountainous area

The Hakusan Foothills region consists of 61 districts. Among them, the marginal villages account for 16 percent, and the semi-marginal villages account for 33 percent. Here, the marginal village and the semi-marginal village mean that the population of more than 65 years old is over 50 percent, and the population of more than 55 years old is over 50 percent, respectively. A regional vitalization project was proposed by the parties concerned in the autumn of 2008 in the lecture, integrating several existing

projects such as ‘a crop rotation project’, ‘a boar capture project’, ‘an agricultural training project’, and ‘an experiential learning project’.

2.2.2 A community healthcare system

With the progress of the aging society, community health management is becoming more important than before when thinking of the capacity of the local hospitals. Nomi city is trying to establish a community healthcare system in cooperation with a medical association of the local hospitals, an information equipment company, and an NPO working on this problem. In this system, diabetic patients send their data every night to the NPO ‘Health Service’, and then the dietitians send medical care guidance to the patients, sometimes data was sent to medical doctors in order to obtain a higher level of judgment.

2.2.3 A food recycling project

Kaga City considers a regional environmental protection activity to develop a biomass town. A biomass town refers to an area in which a proper profitable use of biomass is or will be executed, by constructing an overall profit use system, which links the generation of biomass with its effective utilization, under the wide cooperation of all parties concerned. Kaga city has been practicing the recycling of food waste. This project is quite successful, but there are two problems which are obstacles to promotion of the biomass town plan in this city as follows:

- The lack of scientific basis for economic and environmental effects, and
- The lack of business models or management methodologies.

2.2.4 Activation of traditional craft industries

The area including Komatsu City and Nomi City is famous for its traditional craft industry. However due to the change in life style, the production value has been decreasing steadily. Our institute has been offering a technology management course for traditional craft workers since 2007, using a budget from the central government by the proposal considered in the lecture. As a result, more than 100 workers have taken this course and some of them produced new products with economic effects.

2.3 The Case Project Treated in This Research

This section introduces a social activation system which is an education program through which old men can find their reason for living after the retirement. Since Japanese society is heading rapidly to an aging society, we have to realize a society in which the elderly can have a life worth living.

The tendency of declining birthrate and aging population is a big problem in many countries of the world. Especially its progress is remarkable in Japan. According to the statistics of the Cabinet Office, Japan's population of October 1, 2012 is 127.52 million people. And the population of people who are over 65 years old is 30.79 million, which is equivalent to 24.1% of the total population (Cabinet Office, Government of Japan, 2015).

According to 'Japan's future estimated population' published by the National Institute of Population and Social Security Research in January 2012, the total population of Japan will decrease continuously and become less than 90 million in 2060 (See Fig.2.3). Among them 40% of the population is 65 years old or older and 25% of the population is 75 years old or older (National Institute of Population and Social Security Research, 2012) (See Fig.2.4). Thus, Japan is about to enter an aging society that no country in the world has ever experienced.

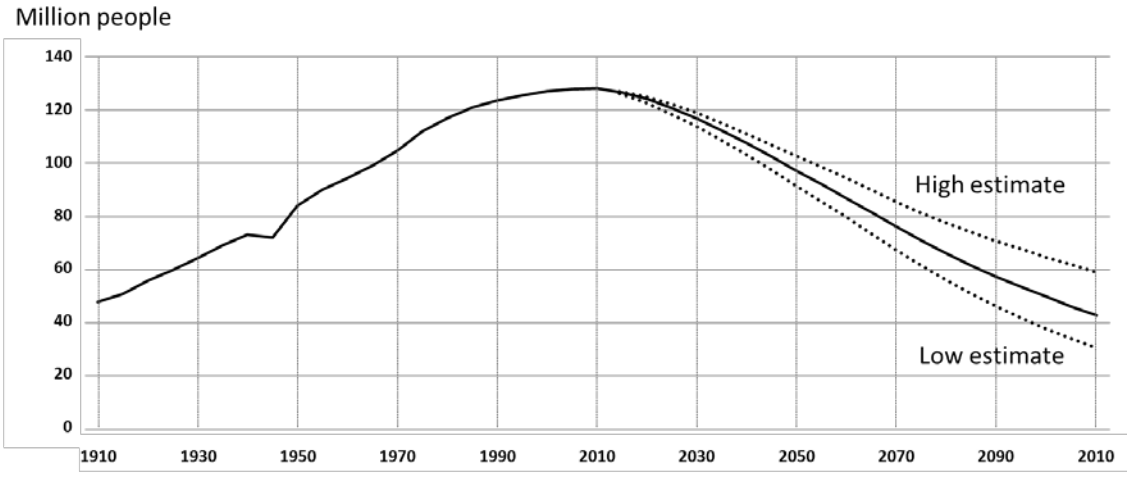


Fig.2.3 Long-term trends of Japan's population.
(Created by the author based on the government data)

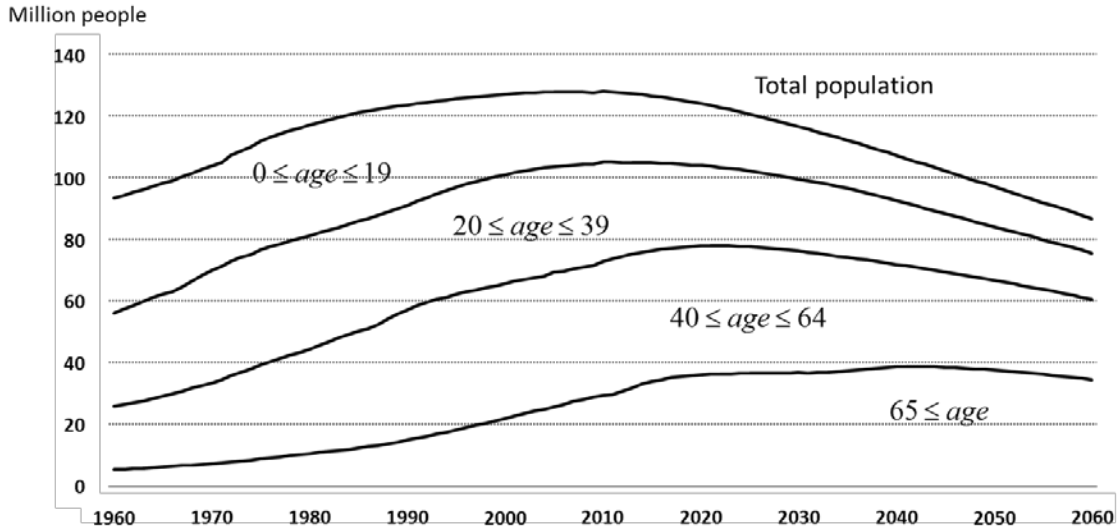


Fig.2.4 Medium-term trend of Japan's population structure.
(Created by the author based on the government data)

The Japanese government began to implement a variety of initiatives from around 1990. Actually, the government has launched measures against the declining birthrate one after another. However, these measures do not seem to have significant effects up to the present. The government has also been working to promote 'social participation of the elderly' for aging society measures. Nevertheless, the suicide rate among elderly men in Japan is the top level in the world (OECD, 2013).

Under the circumstances of such Japanese society, the first major challenge is to help every retired man find a new purpose of life and thereby contribute to the society. This is an extremely important initiative because it contributes to not only the healthy and bright second life of elderly people but also the burden reduction of young people.

One of the important activities treated in this dissertation is the 'worth living discovery seminar for retirement men' (Fujimori, 2012, 2014). The formal name and the details will be introduced in Chapter 4. This dissertation regards this as one of the social activation systems, which is a kind of service system in a wide sense. Although the concept of service system is not new, it has attracted attention mainly in the service economy in recent years (see for instance, Demirkan et al., 2011; Taylor and Tofts, 2012).

Fujimori (2012) defined the decision-making of elders at each stage of their lives until

nursing care is needed as '*Care-Will*', which refers to the 'Will' of elders in the process of their lives. It is different from 'Living Will', which is medical care with the intention of life-prolonging. Fujimori (2012) further defined the series of processes leading to the 'Care-Will' as the '*Care-Will Model*'. It is a process model that retirees make new relationships with others and thereby participate in communities.

Fujimori (2014) reported a series of lectures which she organized to support male retirees to design their second lives. She carried out the education to more than 50 participants during three years (April 2011-March 2014) with the research fund from the Ministry of Health, Labor and Welfare, Japan. This is actually a service system in which the value must be co-created by the collaboration between experts and participants. The curriculum of the '*Care-Will Course*' was designed by referring to an educationist Havighurst (1969), a psycho analyst Erikson (1986), and a psychologist Bandura (1997).

The course was about 20 hours in total using four Saturdays each year. On the first day and the second day, the course provided information about rich living to the participants. The lectures included the following subjects:

- Daily life after retirement;
- How to stare at mind and body;
- Towards positive aging;
- Home management;
- Concertos of men and women;
- Family and nursing care;
- Community and health;
- Life course and social connectedness;
- Richness and health of modern society; and
- Social systems of the elderly support.

On the third day, the participants were asked to design their own second life carriers (See Fig.2.5), and on the last day, the participants were asked to present their plans and mutually evaluate their plans. The meaning of 'Care-Will' in Fig.2.5 will be explained in Chapter 4. Because the major concern of the above program is to create new ideas by the participants in order to make plans of their second-lives (See Fig.2.6), the traditional psychological approach is not enough to evaluate this course. Therefore, based on the knowledge construction model, we should explore what kinds of information were

converted into knowledge, what kinds of consciousness were changed, and what kinds of value were created.

Care-Will Planning Sheet Name Created Date

Title _____

Goals / Practice	Today	When( )	When( )	
	Health: Learning:	Health: Learning:	Health: Learning:	Final goal
	As habit	As fun	As self-realization	
Achievement status				
Basic habits (Survival)				Current goal
Human relations Social relations (Relationship)				
Learning Realization (Growth)				

Fig.2.5 The second-life planning sheet developed by Fujimori (2014).

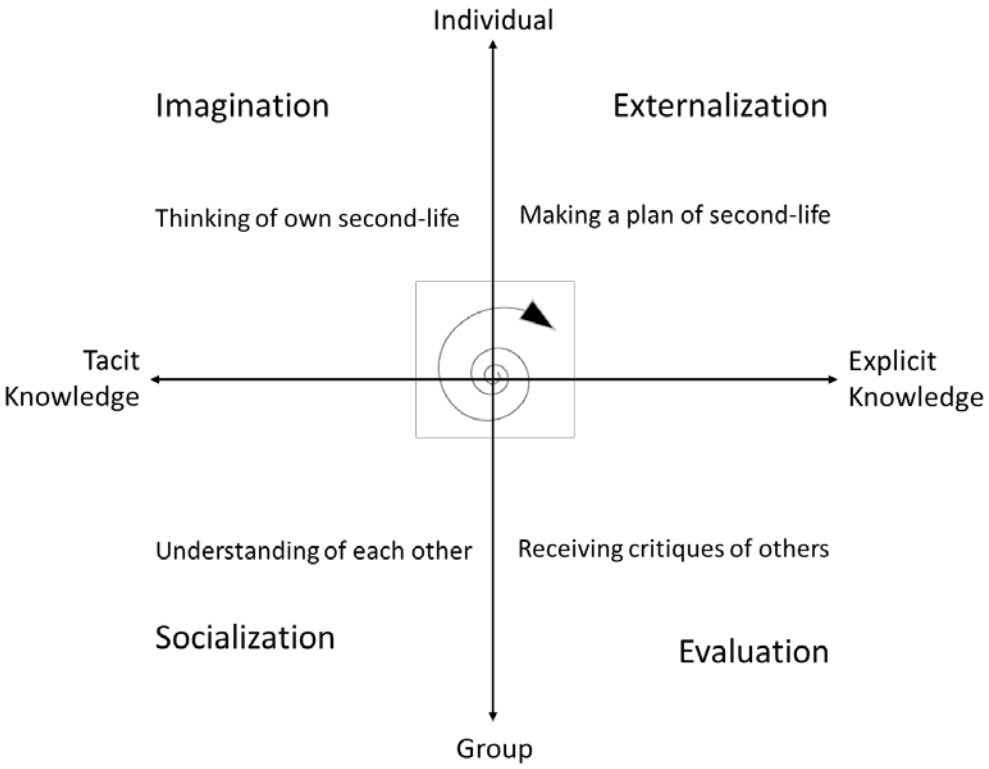


Fig.2.6 The idea of the education program.
(Developed by the author after hearing the idea from Ms. Fujimori.)

2.4 Review of Evaluation Techniques

Because evaluation is a fundamental activity of human beings to obtain insight into existing initiatives and to consider future change, these exist a huge amount of literatures; for instance, see House (1978), Stufflebeam and Webster (1980), Ross, et al. (2004), or Reeve and Paperboy (2007). Evaluation methods may be qualitative or quantitative, and include case studies, survey research, statistical analysis, model building, etc.

This section will review evaluation techniques from three fields: education systems, service systems, and quality of life, since the subject of this study is a project, which can be regarded as a social service system to create the value of life, or an education system for the elderly to improve the quality of life.

2.4.1 Evaluation techniques for education systems

Evaluation of education systems includes two main purposes: one is evaluation of students and the other is evaluation of courses. Because this is a common sense, this dissertation also considers these two purposes, and they will be shown in Chapter 4. We will consider how given information is converted into students' knowledge, and how the systems supported this conversion. From this point of view, we should refer to the 'knowledge survey' that is a method of evaluating a course based on the knowledge which the students acquired after the instruction.

Knowledge survey is effective in helping students learn, instructors improve their delivery, and department explore new curricula and pedagogies (Feldman, 1998). Examples of questions in knowledge survey are (Fink, 2003): "I know the topic quite well", I know at least 50% of the topic partially, and I know where I can find more information about it. Within 20 minutes, I am confident I can find the complete answer", and "I am not confident I can answer the question".

In this way, the evaluation of education system usually focuses on how students increased knowledge, but does not focus on *how students created new knowledge*. It is important to develop an evaluation method for the latter purpose. This research

proposes a new evaluation method that focuses on whether data or information is converted into knowledge. The author convinces that the evaluation from the perspective of knowledge creation in Chapter 4 is a novel proposal.

2.4.2 Evaluation techniques for quality of life

Quality life means the quality of the contents of life or the quality of social life. It measures how a human feels happy in his/her life. Here happiness is measured from various viewpoints such as physical and mental health, good relationships, rewarding work, comfortable living environment, adequate education, recreational activities, etc.

Standard indicators of the quality of life include not only wealth and employment but also the built environment, physical and mental health, education, recreation and leisure time, and social belonging (Gregory et al., 2009; Nussbaum and Sen, 1993).

The most important keyword used in the project introduced in Section 2.3 is 'self-efficacy'. It is the recognition of possibility to carry out the necessary action in a certain situation (Bandura, 1977, 1997). Or, it is the extent or strength of one's belief in one's own ability to complete tasks and reach goals (Ormrod, 2006). Self-efficacy affects every area of human endeavor, especially health (Luszczynska and Schwarzer, 2005).

There exist many indices to measure quality of life. Among them, 'CASP19' and 'Ikigai9' are often used recently for elderly worth living survey. The CASP-19 is a quality of life measure, consisting of 19 items, comprising four domains: control, autonomy, pleasure and self-realization, developed initially in a population aged 65-75 years (Hyde et al., 2003; Sim et al., 2011).

'Ikigai9' is a measure of worth living consciousness of the elderly developed in Japan (Imai et al., 2009; Imai et al., 2012). It consists of 9 items of evaluation: "I often feel I am happy", "I think I will learn and want to start something new", "I think I am useful for others and society", "I think there is room in my heart", "I am interesting in many things", "I think I am a need for something or someone", "My life is fulfilling rich", "I want to stretch out my potential", and "I think I have an effect on someone".

The aim of this research is not to measure general quality of life, but to measure increased desires of participants in the course for knowledge and value creation. That is, the existing indices to measure the quality of life are not sufficient for our purpose.

Therefore, this dissertation adopts the method of measuring the actor's action level in three-valued logic at each node of the knowledge construction model (Wierzbicki and Nakamori, 2006). The author has a confidence that this approach is novel and useful to measure willingness of participants in social service system.

2.4.3 Evaluation techniques for service systems

A service system is a configuration of resources (including people, information, and technology) connected to other systems by value propositions, and service science is the study of service systems and of the co-creation of value within complex configurations of resources (Maqlio et al., 2007; Vargo et al.,2008).

In a business to business context, service encounter quality is directly related to customer satisfaction and service quality perceptions, and indirectly to perceived value and loyalty (Jayawardhena, 2010). But generally, evaluation of the quality of service is determined from the difference between the expectations and actual results, and 'service' itself is evaluated by the 'customer value' (Sakao and Lindahl, 2012).

This dissertation treats service systems, the value of which cannot be created without the great efforts of the customer. Typical examples are hospitals and schools in which the user's self-effort is required to create value.

As defined in Chapter 1, a 'social service system' consists of service providers and service recipients as elements, and creates knowledge and value as the result of emergence by the interaction between elements of the system. A concrete example to be treated in Chapter 4 and 5 is an education providing system for retirees to search the purpose of their second lives.

This dissertation regards this systems as a social service system in a wide sense. It is difficult to provide an objective indicator to measure the level of value that a participant create because the value judgments differ greatly by individuals. Therefore, in the action research to be presented in Chapter 4, we investigated value creation qualitatively. That is, we asked the participants in the course what kinds of value they created in searching their purposes and in implementing their plans.

In chapter 5, we will analyze the value creation by using the three-valued logic: personal value, group value, and social value. We will perform questionnaire survey to participants in the course by asking "Do you wish to create your own value, or

family/community value, or the value for the society?"

The author believes that this approach has a great potential as an effective evaluation of value creation, although she feels that this approach must be elaborated more by the feedback from the application results.

Chapter 3

Introduction to a Knowledge Construction Model with Its Applications and Universality

Summary: This chapter introduces the knowledge construction model that was used as the basis of developing evaluation methods of social activation systems, with its

applications and universality by comparing other existing methodologies. This chapter also presents an approach to social activation system development based on this model, and as a concrete example of this approach, this chapter introduces a social experiment of developing a remote health management system, which requires not only information management but also knowledge management for the success.

3.1 Introduction to Chapter 3

The knowledge synthesis theory proposed by Nakamori et al. (2011) is a systems approach to synthesize various knowledge and justify the new knowledge. Theory is composed of three parts: a knowledge construction model, actors' abilities against social structures, and knowledge justification principles. Section 3.2 introduces this theory with recently developed theory of systemic knowledge creation (Nakamori. 2013). This chapter is written based on the recent publication of Nakamori (2015a, 2015b).

Section 3.3 presents an application of this theory to development of a methodology of social activation system development. Regional development and vitalization is a major social problem especially in an aging society. Various activation projects by local governments, enterprises, or citizens can be regarded as service providing systems in which value will not be created unless there is a big contribution of participants. As a concrete example of this methodology, this chapter introduces a social experiment for developing a remote health management system and its evaluation by the theory of knowledge construction systems in Section 3.4. See Fig.3.1.

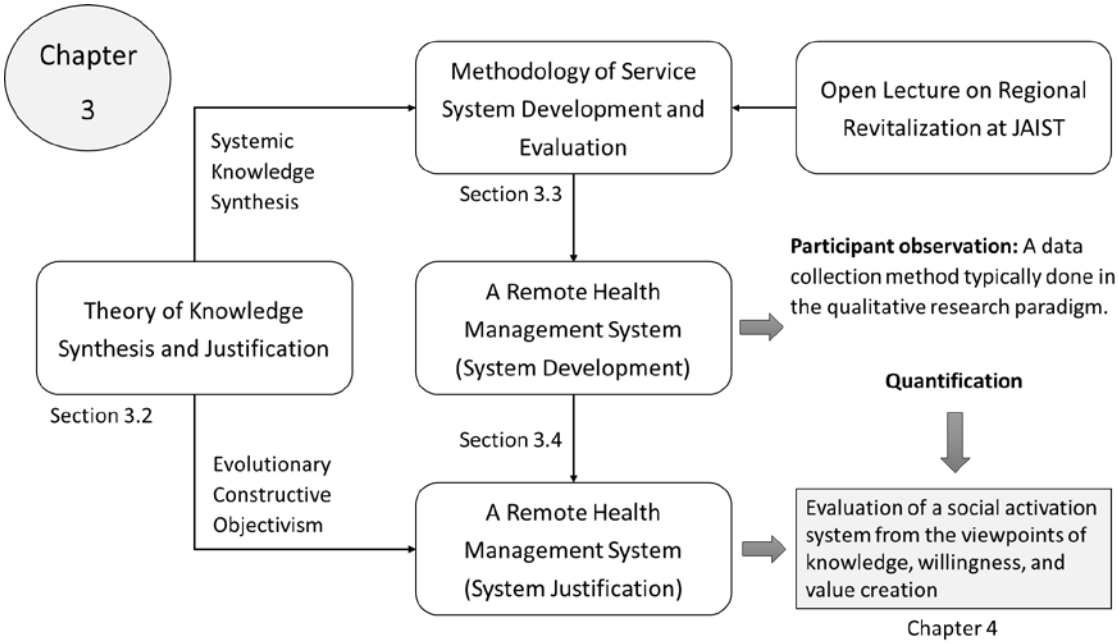


Fig.3.1 Structure of Chapter 3.

3.2 A Theory of Knowledge Synthesis and Justification

To solve complex problems in society must use the knowledge of those who have the respective intention. Such knowledge is usually poor in universality, but we must utilize it by taking into account its logicality and effectiveness. The knowledge synthesis theory proposed in Nakamori et al. (2011), considering this point, suggests how to construct the necessary knowledge to solve complex problems of modern society. The theory consists of the following three parts:

1. Knowledge construction (integration, or synthesis, or creation) model
2. Knowledge collection capabilities (and actions) under social structures
3. Knowledge justification (validation, or verification) principles

The effectiveness of this theory has been confirmed in various situations, in particular, it is useful in the following points when a young researcher is writing a research plan:

- How to set the problem;
- How to collect scientific knowledge;
- How to collect social knowledge;

- How to create his/her own knowledge; and
- How to justify the synthesized knowledge.

3.2.1 A knowledge construction model

The knowledge construction model proposed in Nakamori (2000, 2003) is a systemic approach to knowledge creation. The five ontological elements or subsystems of the knowledge construction model are:

- *Intervention*: the will to solve the problem;
- *Intelligence*: existing scientific knowledge;
- *Involvement*: social motivation;
- *Imagination*: an important aspect of creativity; and
- *Integration*: systemic knowledge.

If you have a problematic situation, you must define a structured problem at *Intervention*, considering how to collect existing knowledge, how to create necessary knowledge, how to integrate various knowledge, and how to justify the synthesized knowledge. See Fig.3.2. You collect objective knowledge at *Intelligence*, and you collect experience-based, wisdom-based, or insight-based knowledge at *Involvement* and *Imagination*, and finally you synthesize knowledge and justify created knowledge at *Integration*, where you usually find a new problem by enlightenment.

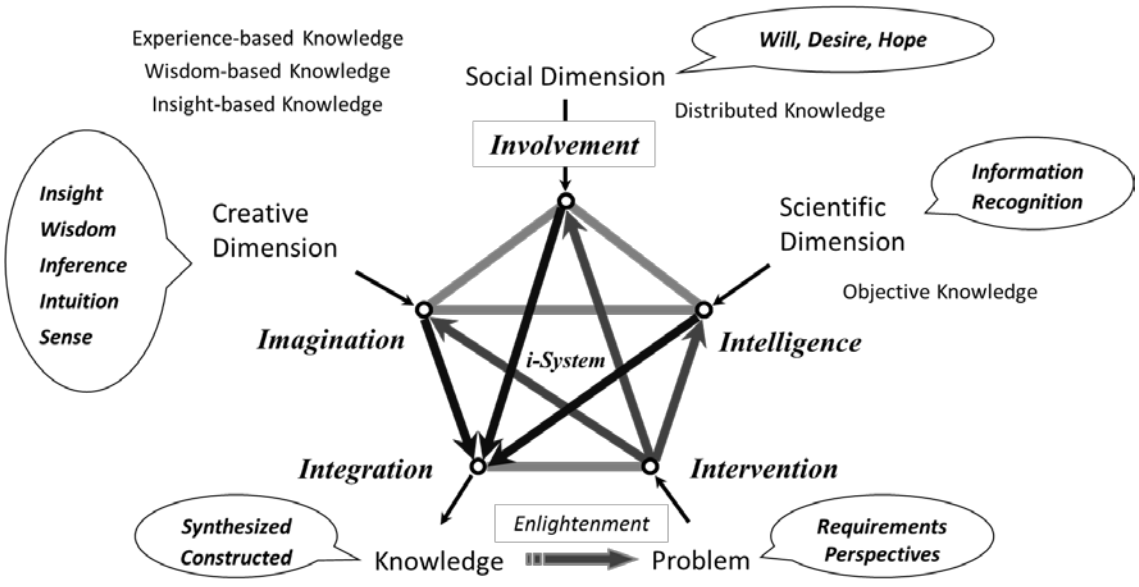


Fig.3.2 A knowledge construction model called the *i*-System.

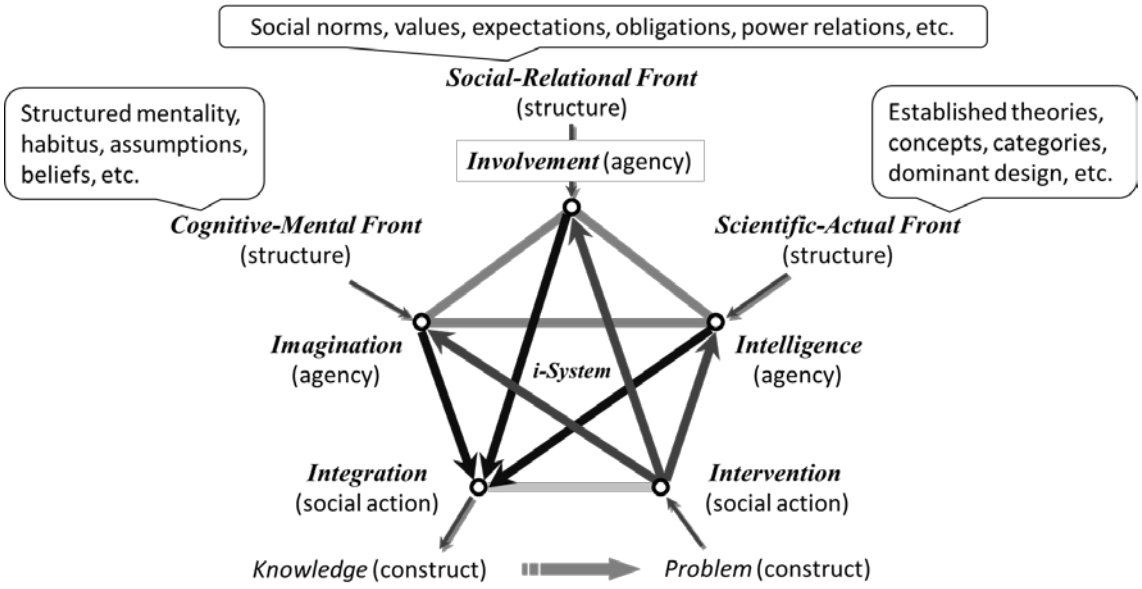


Fig.3.3 A sociological interpretation of the *i*-System.

Nakamori and Zhu (2004) gave an interpretation from the point of view of the sociology of the above model. They regarded the scientific, social, and creative dimensions as the *scientific-actual*, *social-relational*, and *cognitive-mental fronts*, respectively. See Fig.3.3. These fronts correspond to the structures of our society, which are the systemic, collective contexts and their underlying principles which constrain and enable human action.

As shown in Fig.3.3, in the scientific-actual front we consider established theories, concepts, influential design, etc. In the social-relational front we consider social norms, values, expectations, obligations, and power relationships, etc. Then, in the cognitive-mental front we consider habit behavior, assumptions, and beliefs, etc. In such an interpretation, the three nodes: *Intelligence*, *Involvement*, and *Imagination* in Fig.3.2 are regarded as agencies (abilities) of actors.

Agency is the ability with which actors, who are socio-technologically embedded, reproduce and transform the world. The *Intelligence* agency includes logic, experience, technical skill, rationality, etc. The *Involvement* agency includes interest, emotion, intent, faith, trust, empathy, social capital, social skills, political skills, etc. Then, the *Imagination* agency includes intuition, innocence, the skill of enlightenment, etc.

The remaining two nodes in Fig.3.2, *Intervention* and *Integration*, are a pair that cannot be separated. A famous Chinese philosopher Wang Yangming (1472-1529) said that knowledge and action are but one, implying that knowledge is not knowledge if you do not use it. Here we interpret this from a constructivist viewpoint. That is, if you want to find good knowledge, you have to set up a good problem; but if you wish to set up a good problem, you have to have some knowledge already.

3.2.2 An approach to knowledge synthesis

The most significant challenge in Fig.3.2 is how to synthesize the different types of knowledge. In fact, new knowledge has to be created by interaction of knowledge of three dimensions. Therefore, the Yin-Yang approach to systemic knowledge synthesis as shown in Fig.3.4 (Nakamori, 2015a). First we consider the interaction between society and science in the dimension of explicit knowledge. Then we consider the interaction between individuals and the whole in the dimension of tacit knowledge. We use the knowledge from the social dimension twice, since this knowledge consists of both explicit and tacit knowledge. We finally consider the interaction between tacit and explicit knowledge in the epistemological dimension.

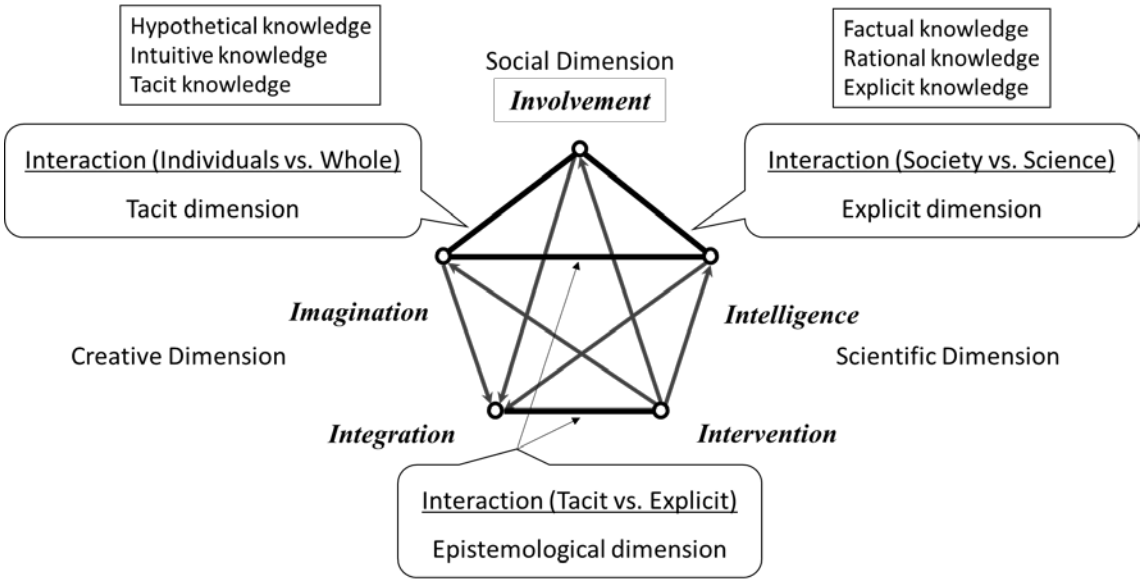


Fig.3.4 Yin-yang approach to knowledge synthesis.

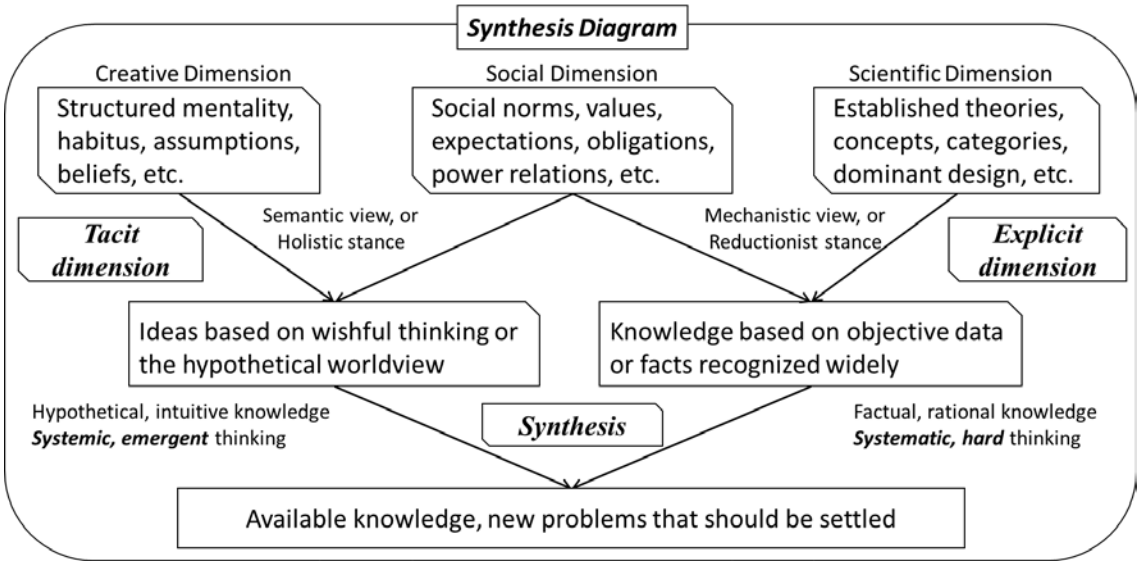


Fig.3.5 A knowledge synthesis diagram.

We can use the synthesis diagram as shown in Fig.3.5. We synthesize knowledge of scientific and social dimensions, using the mechanistic view or the reductionist stance, and create knowledge based on objective data or widely recognized facts. We synthesize knowledge of the social dimension and the creative dimension, using the semantic view or the holistic stance, and create ideas based on wishful thinking or a hypothetical world view.

3.2.3 Knowledge justification

Nakamori et al. (2011) proposed the '*evolutionary constructive objectivism*' as a possible knowledge justification theory in the knowledge-based society, and adopted it as one of the elements of the knowledge synthesis theory. Originally, it was proposed for testing knowledge creation theories in Wierzbicki and Nakamori (2007, 2008). It consists of three principles:

1. *Evolutionary falsification principle*: Hypotheses, theories, models, and tools evolve. The measure of their evolutionary adaptation is the number of attempted falsification tests that they have successfully passed, or the number of critical discussion tests leading to an inter-subjective agreement about the validity.
2. *Emergence principle*: The new nature of the system emerge with the increase in the level of complexity. It is qualitatively different from, and irreducible to, the properties of its parts. We should not hesitate to create a new concept by intuition.
3. *Multimedia principle*: Language is an approximate code to describe the very

complex reality. Generally, visual or nonverbal information is much more powerful the language information and relates to intuitive knowledge and reasoning. We should stimulate creativity using multiple types of media. We should try to make people understand the new knowledge by using all possible media.

3.2.4 Applications of the knowledge construction model

There exist several applications of the knowledge construction model in the areas of education system (Nakamori, 2006; Ma et al., 2007), technology development (Yamashita et al., 2009), regional vitalization (Nakamori, 2013), etc. These applications have gained high praise from participants, but the model has not been verified by the scientific meaning. This is because the knowledge construction model is not an explanatory model but a *normative* model. The latter can only be justified through applying it to many cases. In this sense, this model is still in the process of justification.

3.2.5 Universality of the knowledge construction model

Nakamori and Zhu (2004) explained the universality of the knowledge construction model (the *i*-System) as follows:

> The multi-front, multi-cluster, multi-dimension *i*-System conception can be seen as rooted in Confucianism, a life philosophy of the Chinese and the Japanese, which is modelled based on the 'Eight Wires' in *Da Xue* (*The Great Learning*), a chapter in a 3000 years-old classic, *Li Ji* (*The Book of Rites*). The Eight Wires have been subsequently categorized into three broad groups: (1) investigating things, extending knowledge; (2) being sincere, rectifying the mind, cultivating the self; (3) regulating the family, governing the state, pacifying the world (Chan 1963, Linstone and Zhu 2000, Zhu 2000).
>
> Although mainly concerned with epistemology (how to know) and methodology (how to do) in social life and lacking sufficient interest in metaphysics, the Confucian teaching does, in our view, implies a latent view of reality: reality as a complex web of relations: relation with Nature, relation with the Mind, relation with Human (others). The *i*-System conceptions of structure, agency and action are to us therefore all informed by these 'chordal triad' relations.

We find interesting affinities of the *i*-System conceptual multiplicity with, underneath

diverse and perhaps confusing terminologies:

- Giddens (1979): facility, interpretive scheme and norm modalities;
- Harbamas (1972): three worlds and corresponding human interests and knowledge;
- Archer (1995): structural and cultural conditions;
- Scott (1995): regulative, cognitive and normative pillars;
- Ghoshal (1998): material, cognitive and relational structures;
- Nahapiet and Ghoshal (1998): structural, cognitive and relational dimensions of social/intellectual capital; and
- Garud and Rappa (1994): three basic definitions of technology: technology as objective artefacts, as subjective beliefs, and as legitimized normative evaluation routines.

This convinces us that the *i*-System sociologist underpinning is on the one hand localized and culturally bound, which manifested in its emphasis on, e.g., ignorance, emotion and dialectics in terms of oppositional complementarities rather than of the thesis-antithesis-synthesis grand order. But it is on the other hand *universal*, on the ground that the *i*-System shares many similar concerns, values and conceptual patterns, such as 'chordal triad' conceptions, with its 'Western' counterparts, which we see at odd with the 'clash of civilizations' thesis.

3.3 A Methodology of Social Activation System Development

This section introduces a methodology of social activation system development. This methodology has been built on the basis of accumulated theory related to innovation as well as experience in regional revitalization projects. Because the social activation system that is covered in this dissertation is a kind of social service system in a broad sense, it is necessary to consider the mechanism of co-creation of the service value.

3.3.1 Co-creation of service value

Recently, the term service system often appears in the context of service science, service management, service marketing, and service engineering. For example, see Maglio et al.

(2010), van Looy et al. (2003), Srinivasan (2004), or Dustdar and Li (2011). In fact, there are many service systems, such as those related to education, health, transportation, hospitality, utilities, etc.

When we think about the value of the service, we are able to divide them into two groups roughly:

- One group includes restaurants and hotels where the customer pays the fee to the service, but he/she does not create value so much. The customer considers that the service value is equivalent to the money he/she paid. Traditionally, such a system has been regarded as a service providing system.
- On the other hand, there is another group in which a service system cannot create big value unless the user makes a great effort. The private supplementary school, such as an English school, is a typical example. Even if you pay a high tuition fee, value is not created unless you do enough personal learning. The hospital is a similar example. Even if you receive appropriate medical treatment and advice from a doctor, unless you take care of your health properly you may need to receive medical treatment again and again.

In this way, like hospitals, clinics, and sports gyms, there are service systems where the value varies depending on whether you manage yourself according to the given advice. Moreover, there are service systems that require the efforts of users to create value. A community health care system is a system that provides service, but is a system that will not succeed unless users of the system contribute to value creation.

In this dissertation, the value co-creation service system refers to the system that has the following features.

- The value is not increased without the cooperation and efforts of the system users.
- The system inputs (users) form temporarily part of the system.
- The value is created by the interaction between the system elements and the system inputs (users).

Here, the value is defined as new knowledge that the system gains as a whole. Moreover,

any element of the system does not have the new knowledge that emerges through the interaction between elements of the system and inputs to the system.

However, new knowledge does not emerge automatically. Value is not generated just by receiving a service, because you are only being provided with information. The service value is not seen at the level of information. It is seen at the level of knowledge. Energy is needed to convert information into knowledge.

3.3.2 Stages in the methodology

The methodology of social activation system development is shown in Fig.3.6, where the knowledge construction model is used four times in Stage 2, and the knowledge justification principles are used in Stage 3. As shown in Fig. 3.6, the methodology consists of four stages:

Stage 1: *System definition*: Definition of the trial system including purposes, elements (actors, information, funds), and their relationships.

Stage 2: *Idea generation*: There are four phases in Stage 2, in which the knowledge construction model is used for knowledge collection, knowledge integration, knowledge practice, and knowledge verification.

Stage 3: *System evaluation*: According to the theory of knowledge construction systems, effects of social structures are examined, and created knowledge is justified by the evolutionary falsification test.

Stage 4: *Idea Execution*: If the trial system is evaluated positively, the actual stage of idea execution will start by defining the practical system.

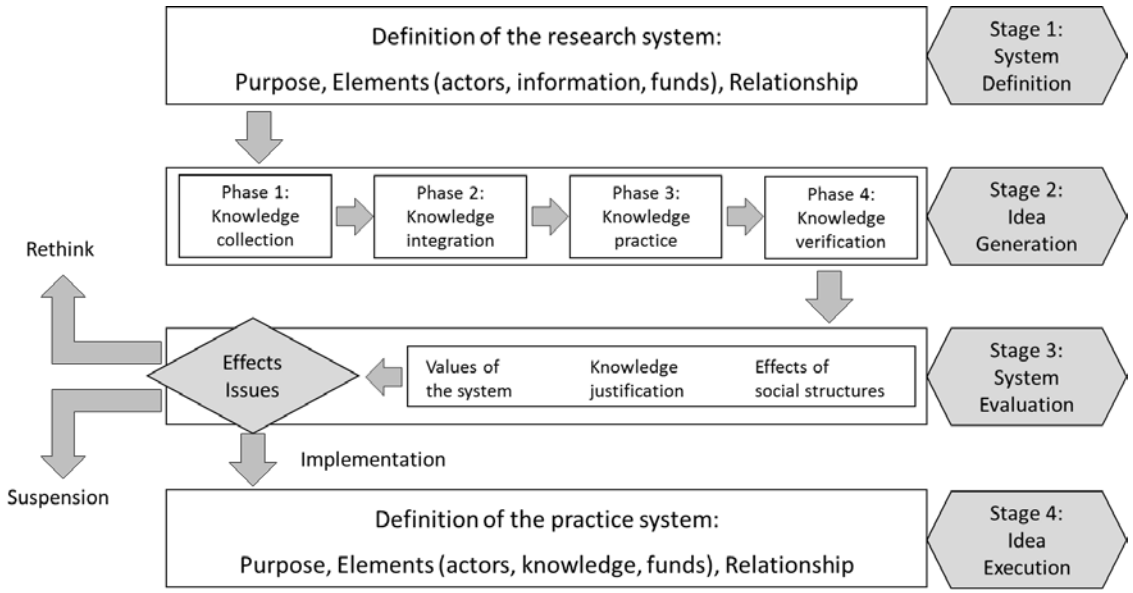


Fig.3.6 A methodology of social activation system development.

In the next section, this methodology will be described with an example of developing a social activation system, which is a remote health management system in Nomi City with the support of the Ministry of Internal Affairs and Communications of Japan (Nakamori 2015b).

3.4 A Remote Health Management System

The public expenditure related to the health care and medical care has been increasing year by year with the progress of the aging society in Japan. Nomi City, where the Japan Advanced Institute of Science and Technology is located, tried to establish a remote health management system for mild diabetic patients. In order to develop such a system, it is necessary to integrate interdisciplinary, or even intercultural knowledge from politics, economics, medicine, bioscience, information technology, and management technology.

The main difficulty of this project was to adjust the opinions and interests among the system elements such as the mayor, medical doctors, engineers, etc., and the system users, that is, mild diabetic patients. In accordance with the social activation system development methodology as shown in Fig.3.6, we will describe the steps of the remote health management system construction. In addition, we will reveal the effectiveness

and difficulties by the social experiment.

3.4.1 Stage 1: system definition

The system facilitates the lifestyle improvement of mild diabetes patients with health monitoring using mobile phones, thereby reduces the risk of stroke or heart attacks, etc., over their lifetime. Here, diabetes is a serious disease that there is too much sugar in the blood. If someone has a stroke, an artery in the brain suddenly bursts or becomes blocked, so that they may die or be unable to use certain muscles.

The system elements (actors) are as follows.

- The city government (The roles are grant applications and the overall management.);
- A hospital as a representative of medical institutions (The role is system evaluation.);
- An NPO (The role is nutritional guidance by a dietitian.);
- An IT company (The role is development and operation of a mobile communications system.); and
- A bio-technology device company (The role is development of a simple test system.).

In this way, this project is interdisciplinary because it is dealing with knowledge of system methodology, knowledge management, information technology, data analysis, material science, life science, medicine, and pharmacy. In addition, this project is cross-cultural because it involves people from different cultures such as the city staff, knowledge scientists, information technicians, data analysts, material scientists, doctors, and nutritionists.

Users of the system are mild diabetes patients who are working during the daytime. They are required the following actions:

- Monitoring of diabetes (urine test, blood glucose value test);
- Recording of health management data (body weight, body fat percentage, the number of steps, photos of meals);
- Recording of health management notes (setting and managing goals, recording blood pressure, etc.);
- Transmitting of the data by mobile phone (exchanging e-mails with dietitians).

Sometimes it requires detailed medical examination.

3.4.2 Stage 2: idea generation

The contents and values of the activation system under development will be confirmed through four phases, such as the following.

- Phase 1: Knowledge collection in order to establish a problem from a complex situation through the coordination of information.
- Phase 2: Knowledge integration in order to develop a plan based on the adjustment between the parties concerned.
- Phase 3: Knowledge practice in order to operate the activation system, adjusting the system through a social experiment.
- Phase 4: Knowledge verification in order to evaluate the system using the information collected by the social experiment.

This chapter omits the introduction of the knowledge construction processes using the *i*-System and the knowledge synthesis processes with the Yin-Yang approach in each stage. For more information, see Nakamori (2015b).

3.4.3 Stage 3: system evaluation

The designed activation system is examined and justified in terms of the effects of social structure, justification of new knowledge, creation of the system value, and effectiveness and obstacles in the actual implementation.

3.4.3.1 Effects of social structure

What are the effects of social structure on the agency and the actions of the actors? With respect to this question, we noticed the effects of social structures as follows.

(a) Scientific-actual front

- The fact that the rapid progress of aging society promoted the plan.
- The recognition of the limit of the capacity of medical institutions to respond to the increasing number of patients promoted the plan.
- The completion of the remote health monitoring system using simple bio-sensors and the mobile phone prompted the plan.

(b) Social-relational front

- The cooperation between organizations constituting the system and users of the system promoted the plan.
- The collaboration between the municipal authorities and the medical association, although their duty and responsibility are different, promoted the plan.
- The regulation of remote medical treatment by the doctor by law obstructed the plan promotion.

(c) Cognitive-mental front

- The worry of people that the local medical institutions will no longer cope with the aging society promoted the plan.
- The intention of people that the society should maintain the health of residents promoted the plan.
- The recognition of people that the remote health monitoring is a promising attempt promoted the plan.

3.4.3.2 Justification of knowledge

Here, the main problem of knowledge synthesis theory is raised. How was created knowledge justified? Justification according to the respective principles can be summarized as follows:

(a) Evolutionary falsification principle

- The social experiment was planned and evaluated by the close consultation between the participants.
- The system has proved to be effective in the health recovery of patients through this social experiment.
- However, the operating fund is insufficient. In addition, it is necessary to revise laws involved with remote medical care.

(b) Emergence principle

- The health of users improved. This can be considered to be emergence from the interaction among system elements.
- It is also an important point that the consciousness of users was improved in a

short period of time.

(c) Multimedia principle

- In addition to the transmission of numeric data by mobile phone, sending photos of meals helped the decisions of the dietitian.
- The daily communication with the dietitian by mobile phone has promoted self-management of patients.
- Occasional interviews with doctors, who observe the time-series data of patients, also promoted self-management of patients.

3.4.3.3 Creation of system value

Here we discuss the creation of system value from the point of view of ideal activation systems. Where and how have values of the system emerged? The value of this service system must be as follows:

- The system promotes lifestyle improvements for mild diabetes patients through health monitoring, thereby reducing the risk of stroke and myocardial infarction etc., over their lifetime. Or, at least it makes the patients become more aware of such things.
- The value is evaluated by regular inspections (blood glucose levels, body weight, blood pressure, etc.).
- The health of the citizens is maintained by the cooperation of many people. In addition, activation of the local community is promoted.

Patients who are receiving services must implement these tasks every day to create value. In particular, they have to manage their own health.

- The system must have the function to promote the health management behavior of patients.
- Normally, such attitude might be created through face-to-face medical care with a doctor.

3.4.3.4 Effectiveness and obstacle of actual implementation

The effectiveness of the system was confirmed. In fact, the comparison of the results

between users (the intervention group) and non-users (non-intervention group) after three months of medical care shows the following:

- Blood glucose levels, body weight, blood pressure, and cholesterol values of the users were improved.

However, there are obstacles towards its continuation. In addition that the medical care is remote, it is classified as a mixed clinic that includes medical treatment without insurance. Therefore:

- There is a need to apply for a special zone of remote medical care.
- Patients want to receive face-to-face medical treatment from doctors, but the remote medical care is more suitable because they generally work during the day.

In addition, since it is not clear how much the system can reduce the future medical expenses, it is difficult to get continuous support of necessary funds. The full-scale development was postponed until the above issues have been resolved. That is, we were unable to proceed to Stage 4: Idea execution.

3.5 Conclusion of Chapter 3

This chapter tried to expand the target of knowledge science to regional revitalization or activation issues, using the idea of the knowledge synthesis theory. In addition, it expanded the perspective from knowledge creation to service value co-creation in the context of developing social service systems. Using a concrete example, it discussed the effectiveness of the service system, the contents that emerged from the system, and their justification. It will be necessary to advance the theory through further practice.

Another important factor is quantification of value. Generally, people are willing to pay the price for a service that might be valuable to them. People pay the tuition fees at an English conversation school where the value is not created without their own self-efforts. This is because they believe that they can create more value if they do their best. For a social service system, we must quantify people's value to make a forward investment. An important issue for the future is the development of these techniques.

This chapter used the idea in the knowledge synthesis theory for evaluating a social

activation system. That is, we applied the evolutionary constructive objectivism for justification of knowledge created in the project. However, it is necessary to develop more advanced evaluation criteria in order to understand the willingness of participants and the value created by participants in the service system.

We developed a new evaluation framework for social activation systems from the viewpoints of willingness creation and values creation in addition to knowledge creation. Using a concrete example of social activation system, this dissertation introduces the evaluation results by the proposed evaluation framework in Chapter 4 and Chapter 5.

Chapter 4

Evaluation of a Social Activation System from Viewpoints of Knowledge, Willingness, and Value Creation

Summary: This chapter introduces a knowledge-scientific approach to evaluation of social service systems from the viewpoints of knowledge creation, consciousness reform, and value co-creation. A concrete example of the social service system treated here is an education program for old men to find their reason for living after the retirement. After reviewing this program and the traditional evaluation methods for such program, this chapter proposes a new evaluation framework and reports an actual

evaluation result using the interview data from the participants in that program.

4.1 Introduction to Chapter 4

As introduced in Chapter 2, Fujimori (2012) defined the decision-making of elders at each stage of their lives until nursing care is needed as the 'Care-Will', which refers to the will of elders in the process of their lives. Fujimori (2014) planned a series of lectures to support the making 'Care-Will' of the male retired employees, and carried out the education to about 50 participants in three years (April 2011-March 2014) with research funds from the Ministry of Health, Labor and Welfare, Japan. The author was fortunately allowed to participate in this project as an evaluation staff, which gave the author the chance to develop evaluation method of such social project.

After reviewing the above project in Section 4.2, this chapter reports evaluation of this project from the viewpoint of knowledge creation in Section 4.3, evaluation from the view point of willingness creation in Section 4.4, and evaluation from the viewpoint of value creation in Section 4.5. These were developed as the action research in three years, based on the knowledge construction model (Nakamori, 2011). These activities for three years gave hints to establish an evaluation framework of social activation systems in Chapter 5. See Fig.4.1.

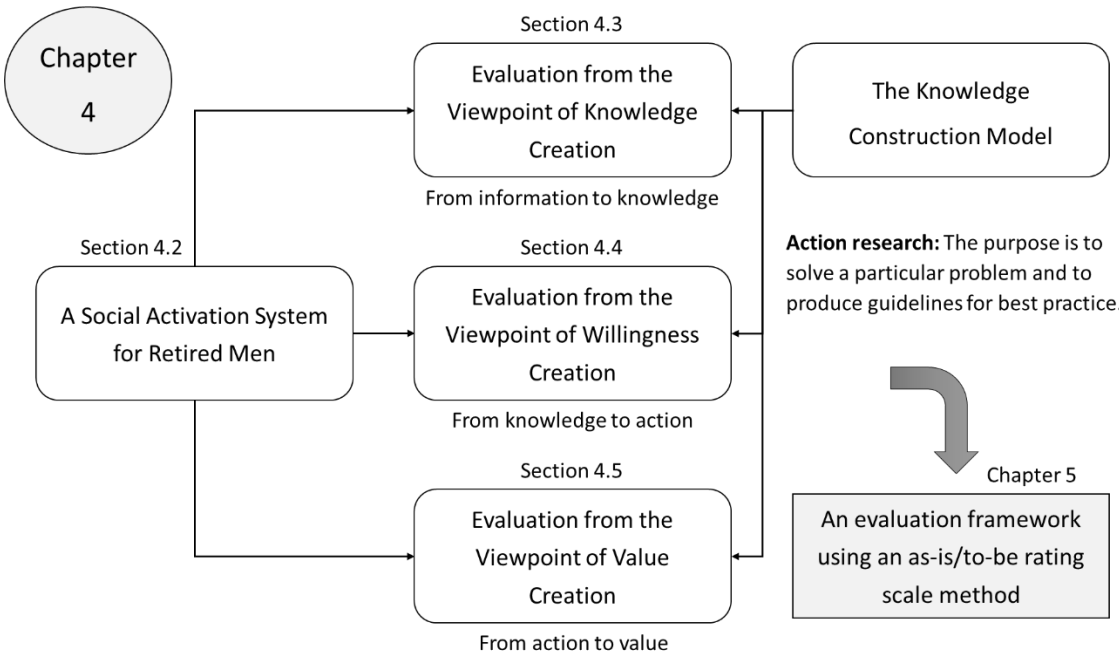


Fig.4.1 The structure of Chapter 4.

4.2 A Social Activation System for Retired Men

As introduced in Section 2.3, under the support of the Ministry of Health, Labor and Welfare of Japan, University of Toyama offered an education course to the retirement age men to search their purpose of second-life. It was a pioneering attempt to ahead of the whole country. Ms. Junko Fujimori of University of Toyama, who was the leader of this project, introduced the following concepts when managing this education course.

- *Care-Will*: The decision-making of elderly persons at each stage of their lives until nursing care is needed.
- *Care-Will Model*: The series of processes leading to the 'Care-Will'. It is a process model that retirees make new relationships with others and thereby participate in communities.
- *Care-Will Course*: The course provides lectures such as 'home management', 'cooperation of man and woman', 'positive aging', 'social systems to help the elderly', etc. by the specialists of health policy, nursing, psychology, etc.
- *Care-Will Plan*: Autonomous life design after the retirement of the elderly participating in the course.

With respect to the design and implementation of this course, the following items were considered:

1. *Achievement items* (curriculum): By referring to the challenges of elderly (Erikson and Erikson, 1986), the goals and objectives of the participants were determined.
2. *The learning process*: In reference to the effective intervention model for voluntary change of Bandura (1995), the learning flow of the course was determined, including understanding of self-state: 'Care-Will Planning', which is plan announcement and evaluation, and reconsideration.
3. *Materials* (contents): With reference to the care by Mayerrroff (1971) and Noddings (1984), and the concept of loving by Fromm (1956), the teaching materials were determined, such as goals, the learning process, teaching materials, and plan preparation methods.

4. *Needs of participants*: There were about 50 participants (students) for three years (April, 2011 – March, 2014). Their worries were vague as follows: “I do not know what to do”: “I want new knowledge”, or “I want to make sure whether my thoughts are good.

The course was in total of about 20 hours using four days each year:

- *Day 1 and Day 2*: The course provides the participants information aimed at the rich living;
- *Day 3*: The participants design their own second life carriers (‘Care-Will Planning’);
- *Day 4*: The participants present their plans and mutually evaluate their plans.

The objectives of this education program are firstly the acquisition of ‘self-efficacy’ that supports personal intrinsic motivation, and secondly the acquisition of the personal existential ‘reason for living’ that supports keeping the health. The final aim is the ‘improvement of social quality of life with the emphasis on autonomy’ and ‘self-realization in the relationship’ based on the ‘Care-Will Model’.

- Based on the interviews with the participants over three years, to what extent can the ‘Care-Will Course’ contribute to the above objectives were investigated in Tatsuse and Fujimori (2014). They reported: Indicators of the ‘Social Self Efficacy’ (Sherer and Maddux, 1982) and the ‘Social Quality of Life’ were not increased. However, the indicator of ‘General Self Efficacy’ was elevated.
- Although the survey on reason for living has been carried out with respect to the ‘life positive feelings’, ‘future active level’ and ‘self-existence meaning’, only the score of the last one was elevated.

Based on these analysis, Tatsuse and Fujimori (2014) concluded that the course was effective in the ‘self-activating’, but was not sufficient for the social outreach. Thus, it is possible to examine the change in the subjects’ emotion by the psychological evaluation indices. However, it is vague about what has improved specifically. It is also difficult for subjects to describe themselves explicitly.

Because the major concern of ‘Care-Will Course’ is to help participants create new ideas in order to make plans of their second-lives, the traditional psychological approach is not enough to evaluate this course. Therefore, from the viewpoint of

knowledge science, we tried to explore *what kinds of information were converted into knowledge*, *what kinds of consciousness were changed*, and *what kinds of value were created*.

Through such investigation we tried to establish an evaluation framework of social activation systems such as the above-mentioned 'Care-Will Course'. Based on the knowledge construction model (Fig.3.2) and its sociological interpretation (Fig.3.3), this chapter proposes the following viewpoints of evaluation:

- *Evaluation from Viewpoint of Knowledge Creation*: The main point is whether information was converted into knowledge at the three nodes: *Intelligence*, *Involvement*, and *Imagination*.
- *Evaluation from Viewpoint of Willingness Creation*: Three levels of activities were introduced at each node of the knowledge construction model.
- *Evaluation from Viewpoint of Value Creation*: This chapter carried out only quantitative assessment. The next chapter will consider the quantitative evaluation.

In the first year, we developed an evaluation model for the course by expanding the knowledge construction model, and asked the participants to evaluate the course and themselves from the viewpoint of knowledge creation. In the second year, we developed a method to investigate the participants from the viewpoint of willingness creation, and carried out a questionnaire survey for the participants of the first and the second year.

Although the course is a kind of service system (see for instance, Maglio et al., 2010; Looy et al., 2003; Srinivasan, 2004; Dustdar, and Li, 2011) for citizens, the value is not created without positive efforts of participants. Taking into account this fact, in the third year, we investigated what kinds of value were created in the course by asking participants of the first, second and third year.

4.3 Evaluation from Viewpoint of Knowledge Creation

Regarding the 'Care-Will Course' as a knowledge creation circumstance, we developed a checklist with eight items by modifying the knowledge construction model (see Fig.4.2). The viewpoint of evaluation is whether information is converted into knowledge or not.

The eight nodes in Fig.4.2 correspond to the eight items in the checklist. The meanings of the eight items are explained below:

(0) General significance (unity of act and knowledge)

1: Rational planning of 'Care-Will Plan' making (Action)

8: Outcome of 'Care-Will Plan' making (Knowledge)

(1) 'Care-Will Plan' making methods

2: Survey of methods and examples of 'Care-Will Plan' (Information)

3: Understanding of methods of 'Care-Will Plan' (Knowledge)

(2) Social significance of 'Care-Will Plan'

4: Investigation of social significance of 'Care-Will Plan' (Information)

5: Understanding of social significance of 'Care-Will Plan' (Knowledge)

(3) Justification of 'Care-Will Plan'

6: Creation of 'Care-Will Plan' (Information)

7: Justification of 'Care-Will Plan' (Knowledge)

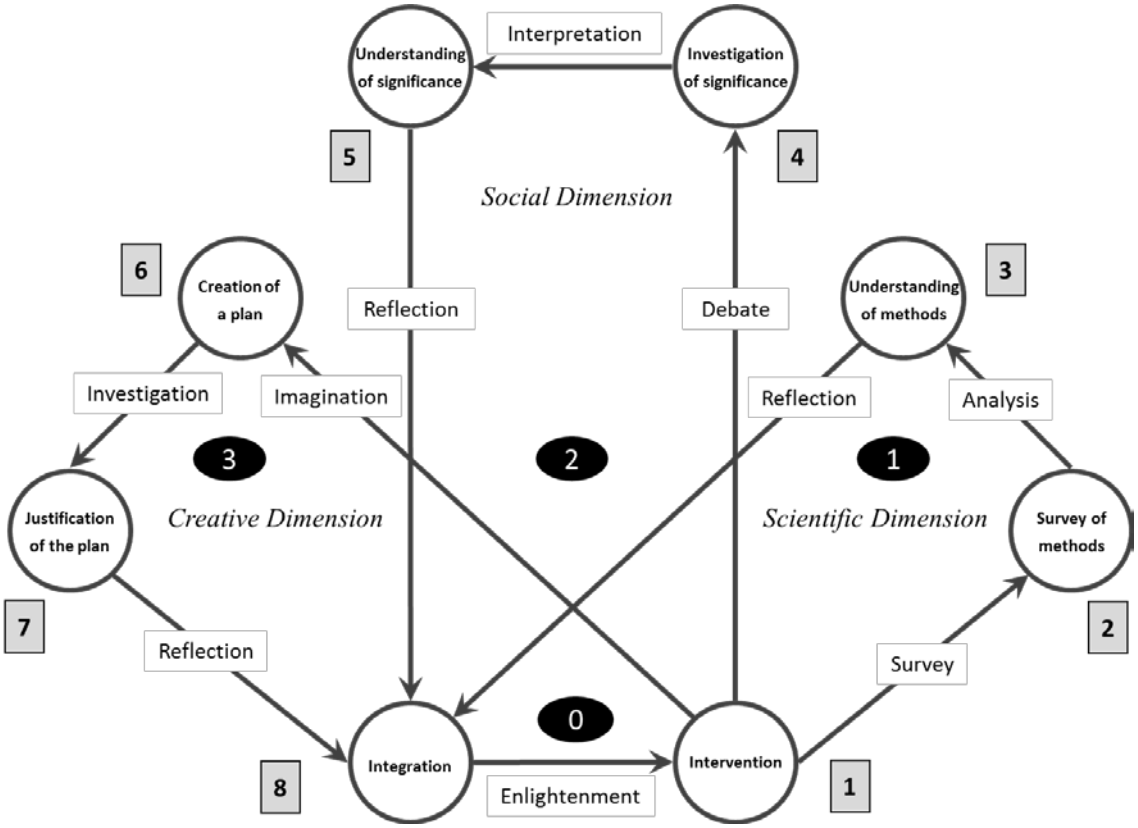


Fig.4.2 An evaluation model for knowledge creation.

4.3.1 Self-evaluation of activities

The following questions are used for the self-evaluation of the participants' activities:

A1: Did you study logical procedures for making a 'Care-Will Plan' sufficiently?

A2: Did you survey methods and examples of making a 'Care-Will Plan' sufficiently?

A3: Did you become able to explain the significance of methods of making a 'Care-Will Plan'?

A4: Did you collect information on social significance of 'Care-Will Plan' making sufficiently?

A5: Did you become able to explain the social significance of 'Care-Will Plan' making?

A6: Did you develop your ‘Care-Will Plan’ satisfactorily?

A7: Did you become able to explain the justifiability of your ‘Care-Will Plan’?

A8: Did you become able to make a feasible and significant ‘Care-Will Plan’?

Here, the five-grade answers are required from insufficient to sufficient. In addition, the participants are asked how important the respective actions are; for instance: Do you think that it is important to do so in making a ‘Care-Will Plan’? Also the five-grade answers are required from unimportant to important.

As mentioned earlier, the viewpoint of the evaluation is whether participants converted given information into their own knowledge or not:

In scientific dimension, A2: information → A3: knowledge

In social dimension, A4: information → A5: knowledge

In creative dimension, A6: information → A7: knowledge

This evaluation framework follows the doctrine of inseparability of knowledge and practice:

Intervention → Integration, or A1: Action → A8: Knowledge

4.3.2 Evaluation of the course

The following questions are used for the evaluation of the ‘Care-Will Course’:

B1: Did you receive enough instruction for planning to make a ‘Care-Will Plan’?

B2: Did you receive enough information on methods and examples of making a ‘Care-Will Plan’?

B3: Did you receive enough instruction to understand methods of making a ‘Care-Will Plan’?

B4: Did you receive enough information on social significance of ‘Care-Will Plan’?

B5: Did you receive enough instruction to understand the social significance of ‘Care-Will Plan’?

B6: Did you receive enough instruction to image your ‘Care-Will Plan’?

B7: Did you receive enough instruction to consider justifiability of your ‘Care-Will Plan’?

B8: Did you receive enough guidance to justify a ‘Care-Will Plan’?

Here, the five-grade answers are required from insufficient to sufficient. In addition, the participants are asked how necessary the respective environments are; for instance: Do you think that it is necessary to do so in making a ‘Care-Will Plan’? Also the five-grade answers are required from not necessary to necessary. Figure 4.3 to 4.6 are the evaluation sheets actually used in the questionnaire survey.

The viewpoint of evaluation is whether the course supported the participants to convert given information into their own knowledge or not:

In scientific dimension, B2: information → B3: knowledge

In social dimension, B4: information → B5: knowledge

In creative dimension, B6: information → B7: knowledge

Intervention and Integration

A1
- Did you study logical procedures for making a 'Care-Will Plan' sufficiently?
- Do you think that these are important for making a 'Care-Will Plan'?

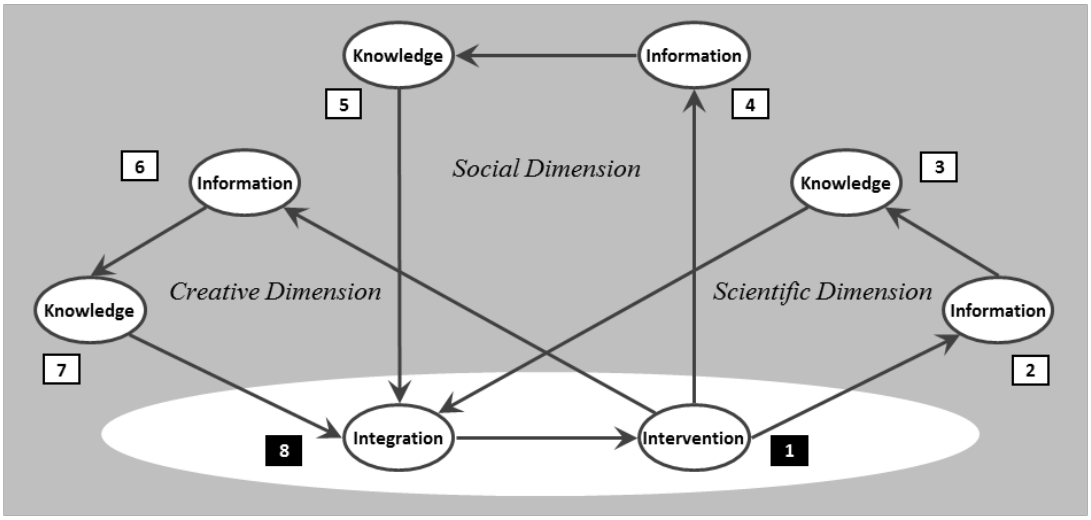
insufficient 1 2 3 4 5 sufficient

unimportant 1 2 3 4 5 important

A8
- Did you become able to make a feasible and significant 'Care-Will Plan'?
- Do you think that it is important to make a 'Care-Will Plan' in your second life?

insufficient 1 2 3 4 5 sufficient

unimportant 1 2 3 4 5 important



Intervention and Integration

B1
- Did you receive enough instruction for planning to make a 'Care-Will Plan'?
- Do you think that you need more such guidance?

insufficient 1 2 3 4 5 sufficient

unnecessary 1 2 3 4 5 necessary

B8
- Did you receive enough guidance to justify a 'Care-Will Plan'?
- Do you think that you need more such discussions and guidance?

insufficient 1 2 3 4 5 sufficient

unnecessary 1 2 3 4 5 necessary

Fig.4.3 The evaluation sheet for 'Intervention' and 'Integration'.

Agency=Intelligence

A2

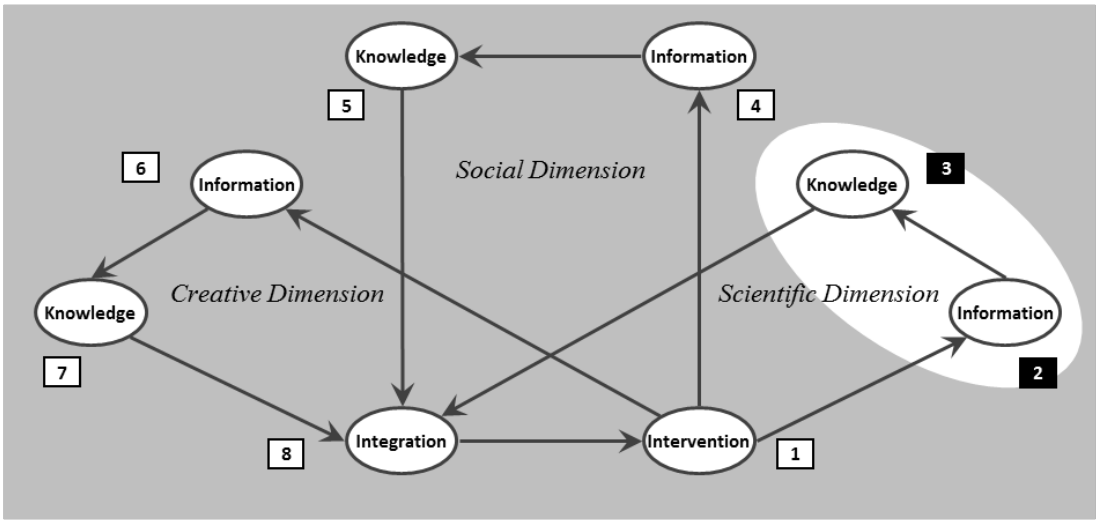
- Did you survey methods and examples of making a 'Care-Will Plan' sufficiently?
- Do you think that these are important for making a 'Care-Will Plan'?

insufficient	1	2	3	4	5	sufficient
unimportant	1	2	3	4	5	important

A3

- Did you become able to explain the significance of methods of plan making?
- Do you think that it is important to learn methods for making a plan?

insufficient	1	2	3	4	5	sufficient
unimportant	1	2	3	4	5	important



Agency=Intelligence

B2

- Did you receive enough information on methods/examples of making a plan?
- Do you think that you need such information in order to make a plan?

insufficient	1	2	3	4	5	sufficient
unnecessary	1	2	3	4	5	necessary

B3

- Did you receive enough instruction about methods of making a plan?
- Do you think that you need such instruction in order to make a plan?

insufficient	1	2	3	4	5	sufficient
unnecessary	1	2	3	4	5	necessary

Fig.4.4 The evaluation sheet for 'Intelligence'.

Agency=Involvement

A4
- Did you collect information on social significance for planning sufficiently?
- Do you think that such information is important for making a 'Care-Will Plan'?

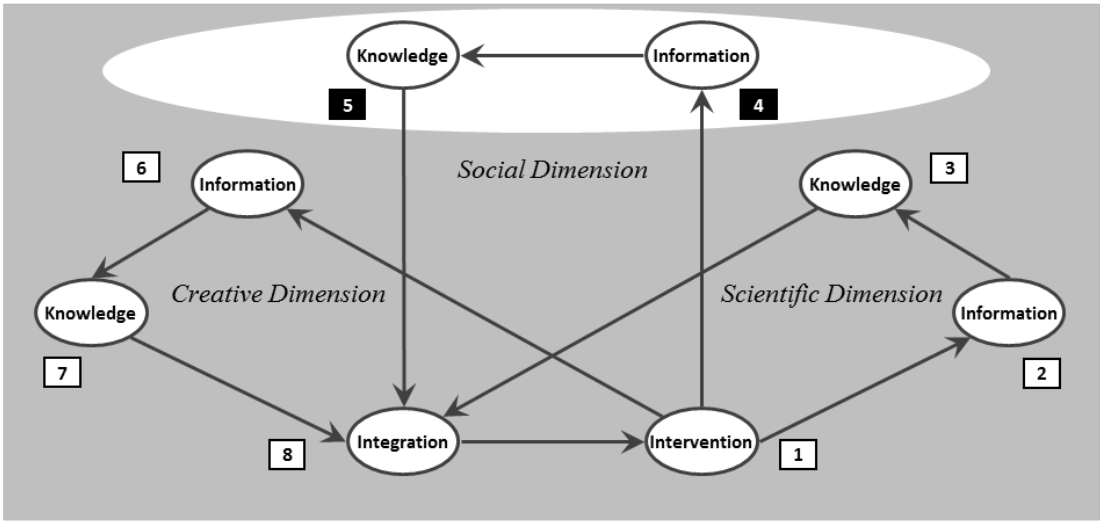
insufficient 1 2 3 4 5 sufficient

unimportant 1 2 3 4 5 important

A5
- Did you become able to explain the social significance of planning?
- Do you think that it is important to explain social significance for making a plan?

insufficient 1 2 3 4 5 sufficient

unimportant 1 2 3 4 5 important



Agency=Involvement

B4
- Did you receive enough information on social significance of planning?
- Do you think that you need more such information?

insufficient 1 2 3 4 5 sufficient

unnecessary 1 2 3 4 5 necessary

B5
- Did you receive enough instruction on the social significance of planning?
- Do you think that you need more such instruction?

insufficient 1 2 3 4 5 sufficient

unnecessary 1 2 3 4 5 necessary

Fig.4.5 The evaluation sheet for 'Involvement'.

Agency=Imagination

A6

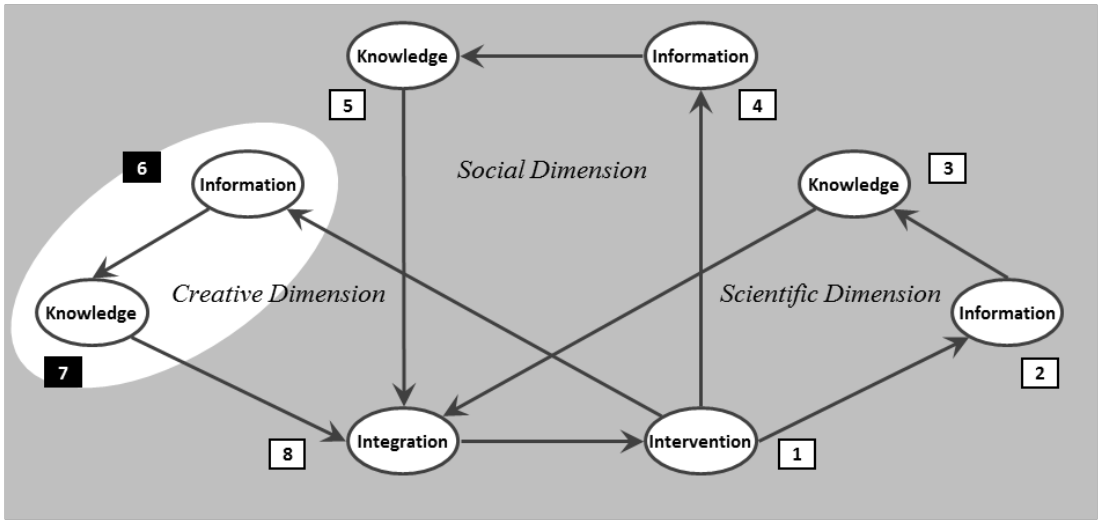
- Did you imagine your 'Care-Will Plan' satisfactorily?
- Do you think that imagination is important for making a 'Care-Will Plan'?

insufficient	1	2	3	4	5	sufficient
unimportant	1	2	3	4	5	important

A7

- Did you become able to explain the justifiability of your 'Care-Will Plan'?
- Do you think that it is important to explain the justifiability of the plan?

insufficient	1	2	3	4	5	sufficient
unimportant	1	2	3	4	5	important



Agency=Imagination

B6

- Did you receive enough instruction to imagine your 'Care-Will Plan'?
- Do you think that you need such instruction in order to make a plan?

insufficient	1	2	3	4	5	sufficient
unnecessary	1	2	3	4	5	necessary

B7

- Did you receive enough instruction to consider justifiability of your plan?
- Do you think that you need such instruction in order to make a plan?

insufficient	1	2	3	4	5	sufficient
unnecessary	1	2	3	4	5	necessary

Fig.4.6 The evaluation sheet for 'Imagination'.

4.3.3 Findings and interpretation

Figure 4.7 shows the self-evaluation and course evaluation by the first year participants. We got answers from 18 people among 23 students. The characteristics of the evaluation results are summarized below:

- *Self-evaluation*: Importance recognition of the result (A8) is slightly higher than others. The recognition of the social significance (A5) is slightly low. The participants seem to have much information on creating the plan (A6).
- *Course evaluation*: Recognition of the need of the result (B8) is slightly lower than others. There is room for the improvement of the course because evaluations are lower than the necessity in about one point.

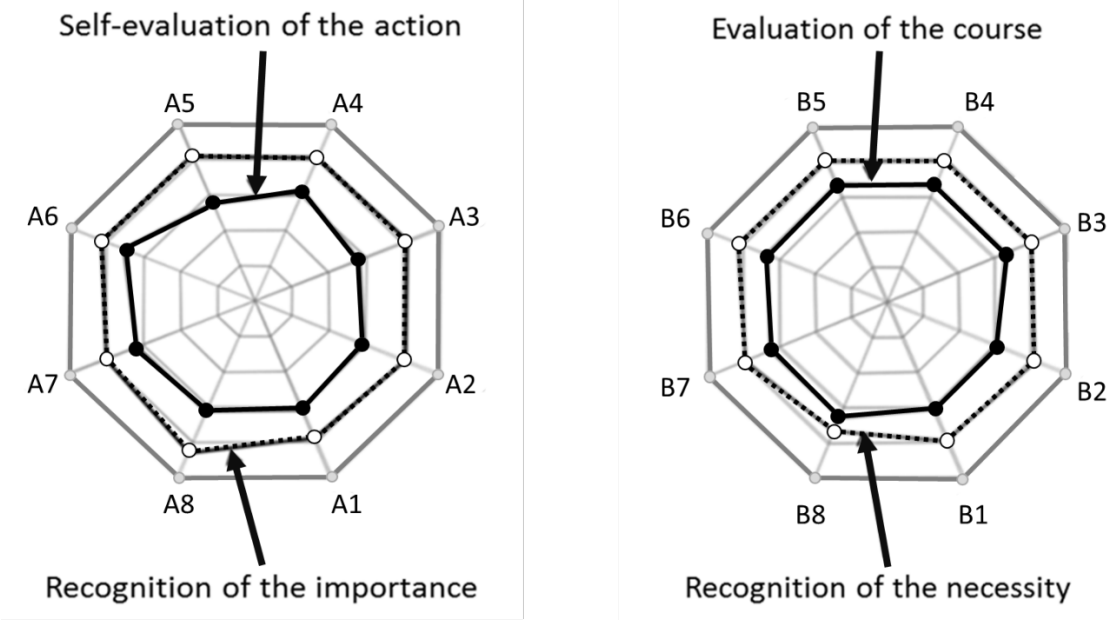


Fig.4.7 Average evaluation by the first year participants.

Figure 4.8 shows the self-evaluation and course evaluation by the second year participants. The tendency of the self-evaluation is the same as the first year evaluation. On the other hand, the course evaluation became considerably high, and the participants feel it more necessary. These are evidence that the course has been refined. The main finding from this analysis is that it might be difficult for participants to convert information into their own knowledge. Here we used the answers from 12 people among 18 students of the second year.

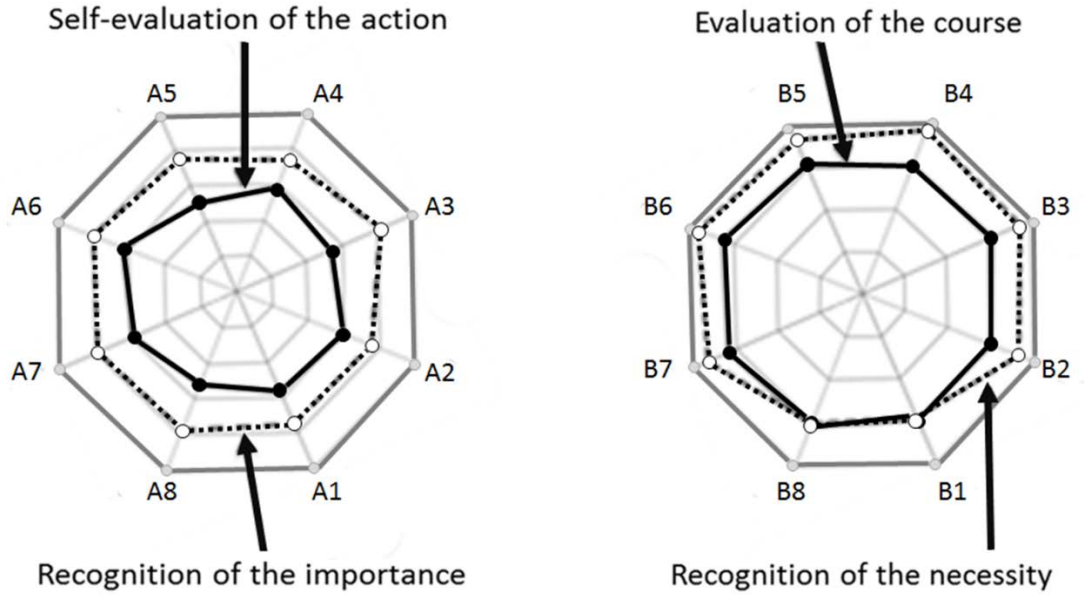


Fig.4.8 Average evaluation by the second year participants.

4.4 Evaluation from Viewpoint of Willingness Creation

When analyzing dimensions in the creative space, Wierzbicki and Nakamori (2006) found that binary logic is inadequate, and even rough, three-valued logic barely sufficient for a detailed analysis. The knowledge synthesis theory in Nakamori (2011) describes three levels of five nodes in the *i*-System as follows:

- Observe that the node *Intelligence*, together with all existing scientific knowledge, corresponds roughly to the basic epistemological dimension, with three levels: *Emotive Knowledge* - *Intuitive Knowledge* - *Rational Knowledge*, of *Creative Space*. The node *Involvement* stresses the social motivation and corresponds roughly to the basic social dimension (with three levels: *Individual* - *Group* - *Human Heritage*) of *Creative Space*. The node *Imagination* seems to be an essential element of only individual intuition; but it could include inter-subjective emotions and intuition. All creative processes can be related to three levels of imagination: *Routine* - *Diversity* – *Fantasy*.
- Concerning any creative activity, it is clear that the role of motivation, of the will to create new ideas, objects of art, technological devices, etc. is a central condition of success. Without *Drive*, *Determination*, and *Dedication*, no creative process

will be completed. *Drive* is understood here the basic fact that creativity is one of the most fundamental components of self-realization of mankind. *Determination* is the concentrated Nietzschean will to overcome obstacles in realizing the creative process. *Dedication* is a conviction that completing a creative process is right in terms of Kantian transcendental moral law.

- *Integration* in the original *i*-System is a node intended to represent the final stage, the systemic synthesis of the creative process. Thus, in this stage we should use all systemic knowledge; *application of systemic concepts to newly created knowledge is certainly the only explicit, rational knowledge tool that can be used in order to achieve integration*. Thus, any teaching of creative abilities must include a strong component of systems science. The apparently simplest is *Specialized Integration*, in which the task consists of integrating several elements of knowledge in some specialized field. But even this task can be very difficult as, for example, the task of integrating knowledge about the diverse functions of contemporary computer networks. The task becomes more complex when its character is *Interdisciplinary*, as in the case of the analysis of environmental policy models. However, the contemporary trends of globalization result today in new, even more complex challenges related to *Intercultural Integration*, as in the case of integration of diverse theories of knowledge and technology creation. In fact, the *Intercultural Integration* of knowledge might be considered a *defining feature of a new interpretation of systems science*.

We investigated the level of consciousness of the participants in the five nodes of the knowledge construction model. Assuming the level of consciousness of the three stages in each node (see Fig.4.9), we have created a self-assessment sheet, such as the following.

4.4.1 Items of evaluation

The following questions were prepared to evaluate the changes in willingness of the participants, which might indirectly evaluate the 'Care-Will Course'.

(1) Intervention to the problem: The participants are asked to select one of the following:

- *Drive*: You feel that it is better to make a plan though you do not have a strong will to implement it.

- *Determination*: You are gradually feeling that you make a plan and try to run it.
- *Dedication*: You have decided to make a good plan and run it surely.

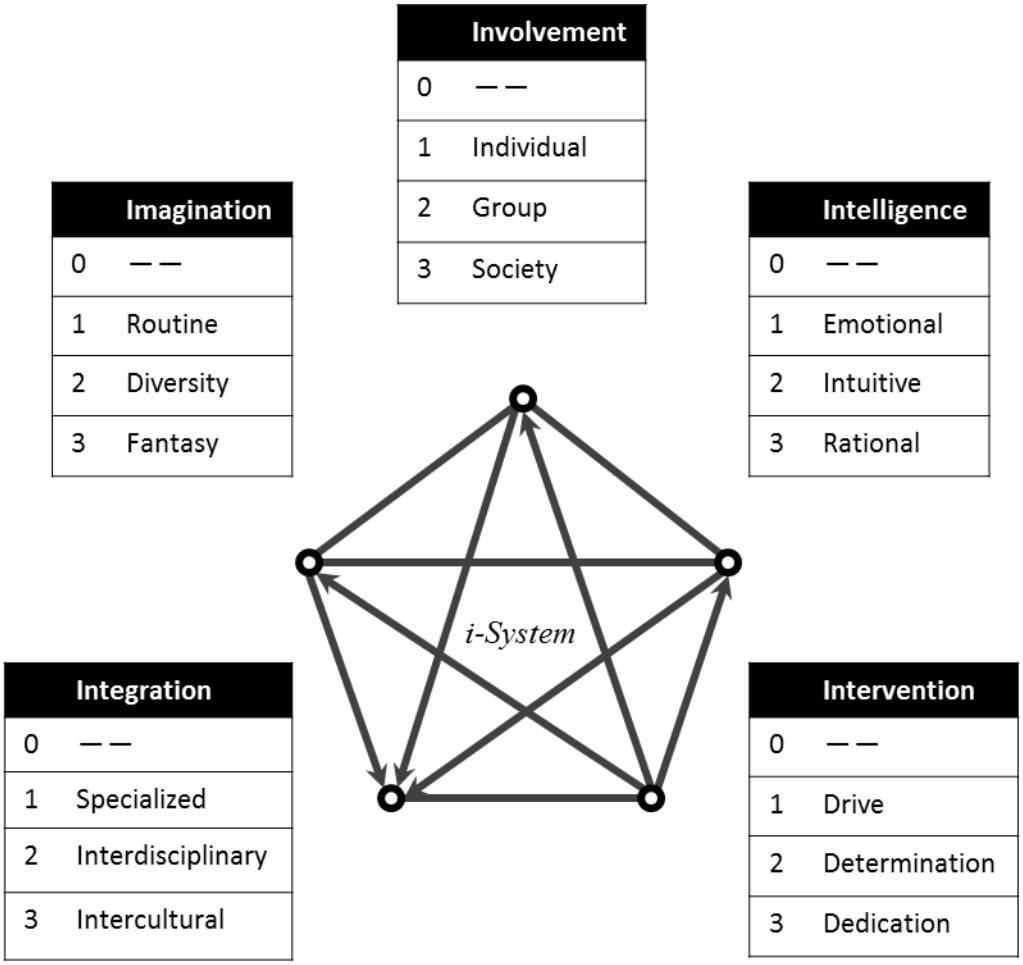


Fig.4.9 The level of willingness in each node.

(2) Knowledge integration: The participants are asked to select one of the following:

- *Specialized integration*: Integration of knowledge from the same field (The viewpoints of synthesis are novelty, usefulness, and logicality, etc.)
- *Interdisciplinary integration*: Integration of knowledge from plural fields (The viewpoint of synthesis is mutual complementarities.)
- *Intercultural integration*: Integration of knowledge from different cultures (The viewpoint of synthesis is new culture creation.)

(3) Collection and understanding of information: The participants are asked to select one of the following:

- *Emotional level of consciousness*: You are somehow anxious about the relevant information.
- *Intuitive level of consciousness*: You think that it is important to collect the relevant information.
- *Reasonable level of consciousness*: You can interpret associated information reasonably.

(4) Cooperation with the family and the community: The participants are asked to select one of the following:

- *Thinking in individuals*: You think about your future alone.
- *Talking in a group*: You evaluate ideas each other in a group.
- *Associating with society*: You have begun to talk about the future at home or in the community.

(5) Imagination: The participants are asked to select one of the following:

- *Established tactic ideas*: You talk about the idea that seems to be possible immediately.
- *Unique idea*: You talk about the idea with obstacles that you should get over.
- *Fantastic idea*: You talk about the idea that the consciousness change of people needs.

4.4.2 Contents of investigation

We asked the participants to evaluate themselves at the following time point:

- Before participating in the course;
- Just after the course finished;
- Half a year later after the course; and
- Future (aspirations).

Using the answers from the first year participants (16 persons), we analyzed difference in willingness before participation, just after the course, and half a year later. Using all answers from the first and second year participants (33 persons), we analyzed difference of willingness before participation, just after the course, and future (aspirations).

In Fig.4.9, the numbers 1, 2, 3 show the levels of willingness at each node. Here, 0 indicates that not reach any level. Because 0, 1, 2, 3 in the figure are categories, strictly speaking we cannot use the t-test. Nevertheless, we considered them to be preoccupation levels to the problem, and performed the t-test. We expected that:

The average value before the course < The average value just after the course

< The average value in the future

However, because some personal data were reversed, we used the two-sided t-test.

4.4.3 Change in willingness

Figure 4.10 shows the t-test results exploring differences in the average values of answers between before, just after the course, and the future aspirations. We used the answers by 33 respondents among 41 first- and second-year students. Significant difference can be seen in most of the combinations. There is one place where there is not much difference before and after the course. This is understandable because it is related to idea creativity. The significance difference before and after the course indicates that the participants feel meaning of the course. The significance difference with the future aspirations suggests that there was a certain significance in the course.

For reference, p-value in Fig.4.10 has the following meanings:

- $0.1 < p$ No significant difference
- $0.05 < p < 0.1$ Somewhat significant difference
- $0.01 < p < 0.05$ Significant difference
- $p < 0.01$ Significant difference with a high probability

Figure 4.11 shows the t-test results whether there are differences in the average values of answers among before, just after, six months after the course, using the answers by the first year participants. We used the answers by 16 respondents among 23 first-year students.

There is no significant difference in about half places. This indicates that the participants might not act to raise the level of willingness six months after the course. There is a need for further aftercare. It is necessary to promote the willingness of participants by collecting the graduates at appropriate timing.

In Fig.4.10 and 4.11, two numbers in the squares are the average and variance.

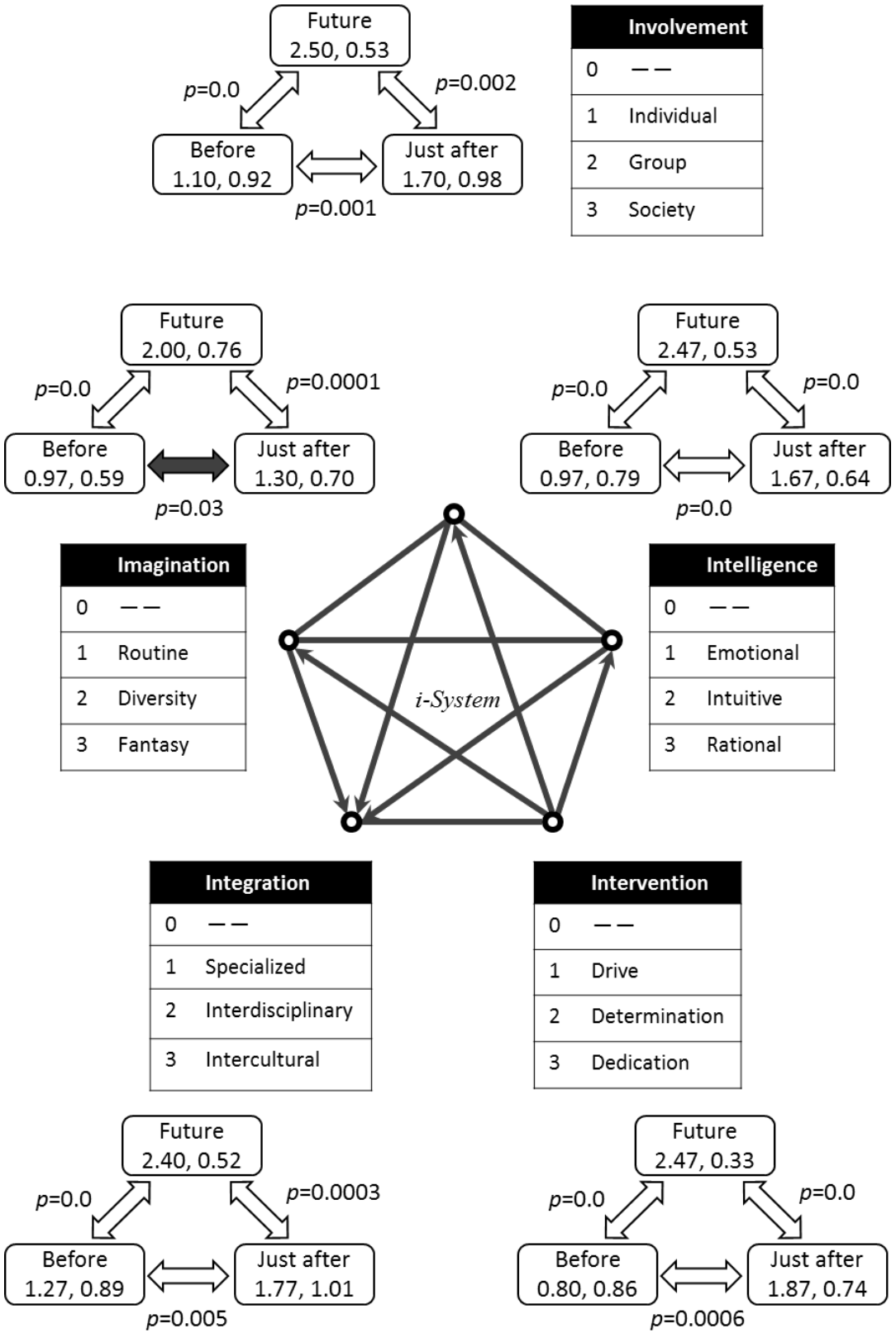


Fig.4.10 Differences in the level of willingness before, just after, and future aspirations.

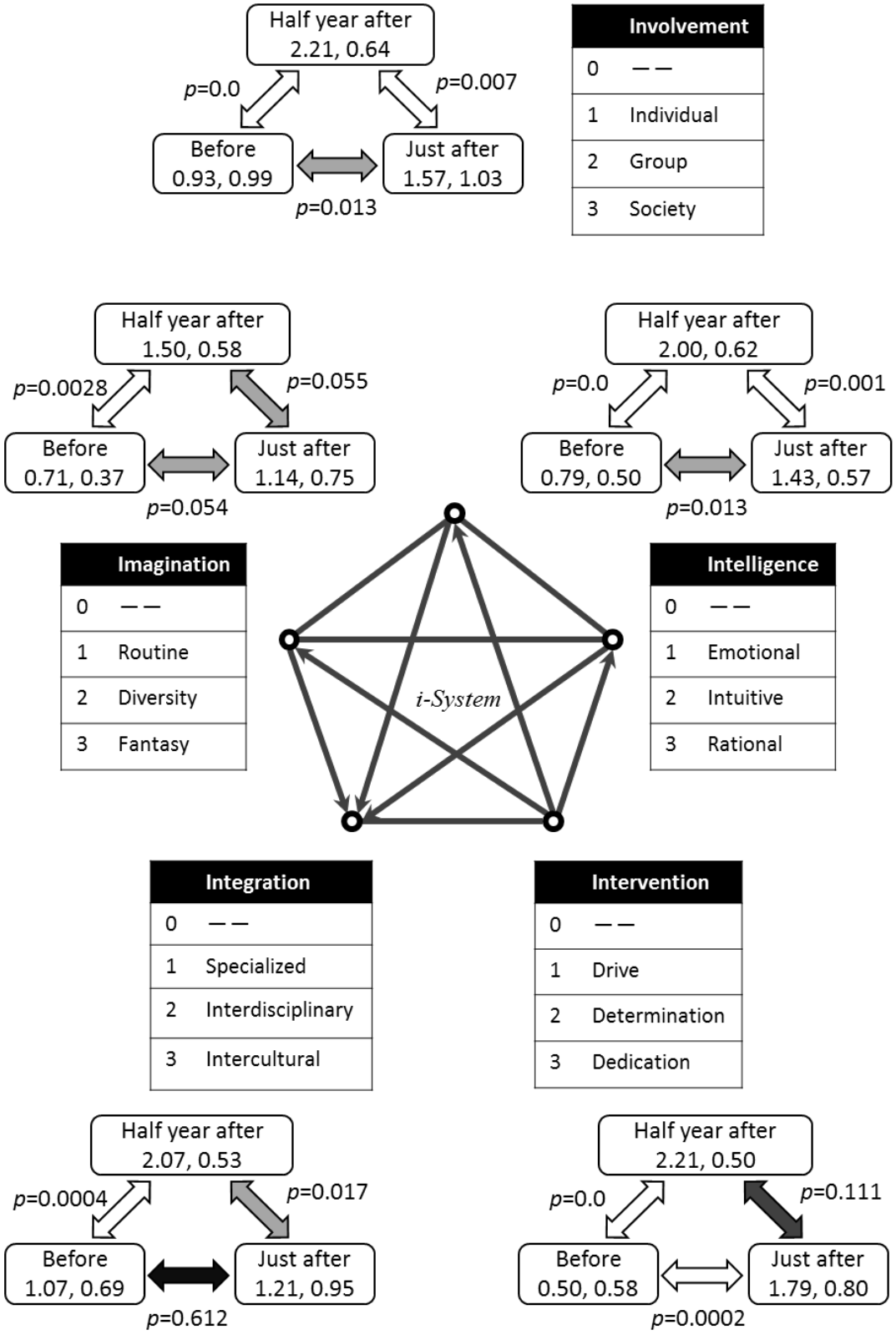


Fig.4.11 Difference between the level of willingness of participants before, just after, and six months after the course

4.5 Evaluation from Viewpoint of Value Creation

We can imagine many service systems such as restaurants, hotels, department stores, taxis, water and sewage, hospitals, schools, etc. It is not exaggeration even if we say that all economic activities are services. When considering the value of services, we can identify two groups:

- The customer pays money to the service that he/she receives, but he/she does not create value. This group includes restaurants or hotels. For a user, the value is considered equivalent with value of the charge.
- On the other hand, there are services in which big value cannot be created unless the user makes an effort. The English private supplementary school is a typical example. Even if the students pay high tuition, they cannot create value unless they make efforts. A hospital is another example. You will receive medical treatment repeatedly if you do not take care of health by yourself even if you receive appropriate medical treatment and advice from a doctor.

Value co-creating systems are the following systems:

- The system that value is not increased unless the system user's cooperation is obtained.
- Input elements (users) of the system constitute a part of the system temporarily.
- The user must try to co-create values by the interaction with the elements of the system.

'Care-Will System' is also a system providing service. But, it is a system that is not successful unless the user contributes to value creation by converting information into knowledge.

- Value is not created by only receiving a service because it is just information.
- Service value can be recognized when it becomes knowledge.
- Energy is necessary to convert information into knowledge or wisdom.
- The energy (capability) to convert information into knowledge is also (accumulated and examined) knowledge.

- However, such knowledge must be sharpened by using the context in question.

The value will be created by converting information into knowledge, by repeatedly visiting the scientific-actual front, the social-relational front, and the cognitive-mental front.

We carried out a questionnaire survey to participants (45 persons) as shown below:

- *Intelligence*: New information for you;
- *Involvement*: New relationships (incl. re-recognition);
- *Imagination*: New idea by yourself;
- *Integration*: Value of new proposal (report); and
- *Intervention*: Newly discovered problems.

The survey was carried out for all participants of the past three years. Although there are some variation in the content from year to year, we show the common answers below.

(1) *Integration*: Value of new proposal

- For yourself: Got the opportunity to reconsider own (but not yet making new proposals).
- For family: Re-recognized the importance of respecting each other (concreteness is still poor).
- For society: Recognized the importance of contributing to the society (concreteness is still poor).
- For course: Recognized the importance of maintaining the course (but not reaching that level).

(2) *Intervention*: Newly discovered problems

- Goal setting: To create a goal is a big challenge (finding a purpose in life).
- Building relationships: To reconstruct relationships in the family as well as in the community.
- Health management: To maintain a healthy body (to improve the physical fitness, to activate the brain).

(3) *Intelligence*: New information for you

- For health: Social analysis in addition to the medical point of view.
- For mental: Mental improvement that contributes to resolve health and economic problems.
- For social: Importance of participation in the fellow making and social activities.

(4) *Involvement*: New relationships

- About family: Re-recognition of the importance of relationship with the spouse.
- About community: Importance of building new relationships with local residents.
- For fellow: Necessity for companion to share the value.

(5) *Imagination*: New idea by yourself

- To create a goal: Most participants became aware that they must create a goal.
- To maintain a healthy: Most participants started to think about action for health maintenance.
- To construct relationships: Some started to think about fellow building, making NPO, etc.

We have carried out the qualitative evaluation in this chapter, and the quantitative evaluation is left for future study.

4.6 Conclusion of Chapter 4

After reviewing the project of educating retired men to search purposes of their second lives, this chapter reported the evaluation of this project from the viewpoint of knowledge creation, from the view point of willingness creation, and from the viewpoint of value creation. These were developed as the action research in three years, based on the knowledge construction model.

Conscious level improved definitely by participating in the ‘Care-Will Course’. But it is difficult for the participant to set a concrete goal by just participating in the course. There is a possibility that they cannot create new knowledge (new value), although they obtained a lot of information. It is necessary for the graduates to continue the ‘Care-Will Study’ for goal setting, implementation, and improvement, repeatedly. In fact, unless we develop success stories, it is difficult to make people recognize the value of ‘Care-Will Course’.

From the above discussion, it might be necessary to modify the course such that we teach the methodology to create goals, and give enough time to participants to make their goals. Based on such reform of the course, there is a need to re-start the next level of 'Care-Will Course'. In doing so, it is important to ask the graduates to participate in the new course again. It is necessary to convert the quantity to the quality by inviting repeatedly people who have similar aspirations. Then information is gradually converted into knowledge, and people will recognize the value of the course.

This chapter proposed a knowledge-scientific approach to evaluation of social activation systems from the viewpoints of knowledge creation, willingness creation, and value creation. This chapter showed the effectiveness of this approach when evaluating social activation systems in addition to the traditional psychological approach. The future study must include the establishment of evaluation framework for social activation systems based on this empirical research.

Chapter 5

An Evaluation Framework of Social Activation Systems by an As-is/To-be Rating Scale Method

Summary: This chapter proposes an evaluation framework of social activation systems in order to support participants to create new knowledge and value. The main proposal is a rating scale method that can evaluate the current level (as-is) and the future desire (to-be) of participants, and with which we can analyze achievements of individuals. By using a concrete example of an education program which is a worth living discovery seminar for retired men, this chapter reports the results of hypothetical tests on the relationships among items of evaluation, and an interesting finding related to the reason of differences in the attitude of participants.

5.1 Introduction to Chapter 5

The social activation system called the 'Care-Will Course' was finished in March, 2014. Then, about 10 of the graduates have been autonomously operate a seminar called 'Care-Will Study'. Two questions arose: why some graduates wanted to continue this projects, and whether the graduates are running their 'Care-Will Plan' steadily or not. Then, the authors decided to perform an ex-post evaluation of the project and graduates one year after the course completed. For this purpose, a new rating scale method to answer the above questions was created.

This chapter first introduces a new method called the 'as-is/to-be rating scale method', and an ex-post evaluation of the project which was again supported by Ms. Fujimori, the leader of the project in Section 5.2. The chapter then reports the results of hypothesis testing on knowledge, willingness, and value creation, and the results of path analysis on the relationships between items of evaluation in Section 5.3 and 5.4. These analysis lead to two interesting findings related to the above questions. This new rating scale method has a high possibility to be used to evaluate more general social service systems, which will be discussed later in Chapter 6. See Fig. 5.1.

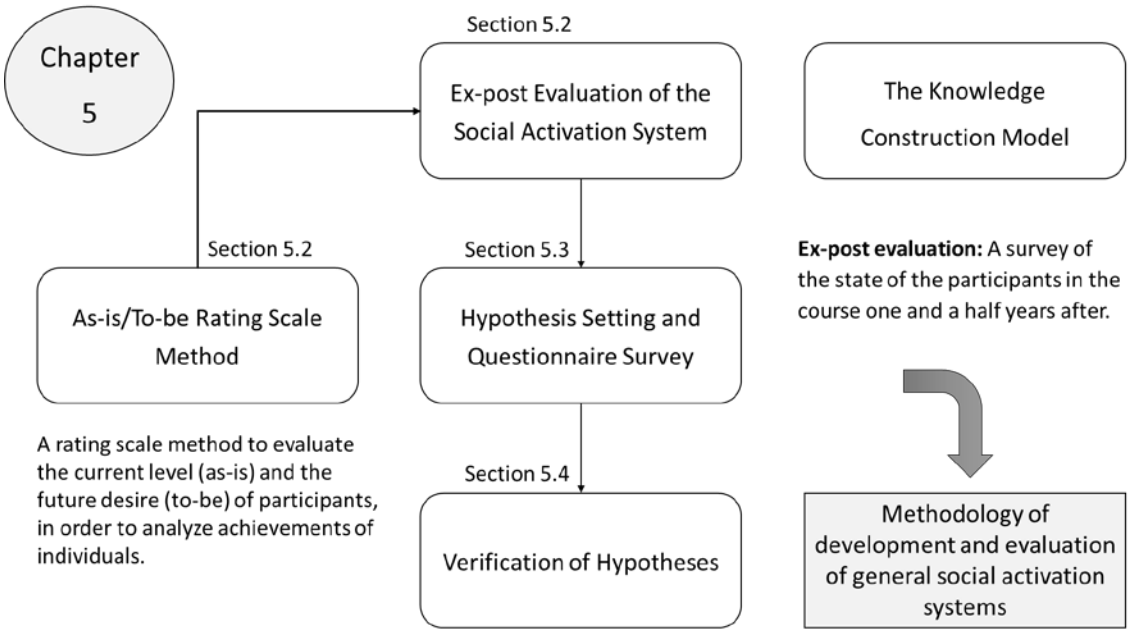


Fig.5.1 The structure of Chapter 5.

5.2 An As-is/To-be Rating Scale Method

Similar to the work of Meng et al. (2015), this chapter is also based on the knowledge synthesis theory (Nakamori, Wierzbicki and Zhu, 2011). The main model in this theory is the knowledge construction model (Nakamori, 2000; Nakamori, 2003), which is a procedural, but virtually systemic approach to knowledge creation.

As shown in Fig.3.2, if you face a problematic situation, you have to identify problems at *Intervention*, which includes requirements and perspectives, as well as ideas on how to collect knowledge, how to create knowledge, how to integrate knowledge, and how to justify knowledge. At *Intelligence* you collect objective knowledge, and at *Involvement* and *Imagination* you collect experience-based, wisdom-based, or insight-based knowledge, and finally at *Integration* you synthesize knowledge and justify the created knowledge. Here, in addition to solutions to the problem, you usually find new problems by enlightenment.

In respective nodes of the knowledge construction model (*Intervention*, *Intelligence*, *Involvement*, *Imagination*, *Integration*), we consider three aspects of evaluation (*knowledge creation*, *willingness creation*, *value creation*) as shown in Table 5.1.

5.2.1 Evaluation framework

Total 15 questions have been generated in accordance with Table 5.1.

- In the column of '*Knowledge Creation*', we ask the subject how he is dealing with the collected data, summarized information, and created knowledge.
- In the column of '*Willingness Creation*', we consider the three levels of activity at respective nodes (Nakamori, 2011):

    - Intervention: Drive → Determination → Dedication
    - Intelligence: Emotional → Intuitive → Rational
    - Involvement: Individual → Group → Society
    - Imagination: Routine → Diversity → Fantasy
    - Integration: Specialized → Interdisciplinary → Intercultural

- In the column of '*Value Creation*', we ask the subject whether the created value is for himself, for his family/friends, or for the society/local community.

Table 5.1 Evaluation framework for social service systems.

	Knowledge Creation	Willingness Creation	Value Creation
Intervention	(A-1) Mastery of plan creation methods (Data → Information → Knowledge)	(B-1) Strength of enthusiasm (Drive → Determination → Dedication)	(C-1) Value of making a plan (Individual < Group < Society)
Intelligence	(A-2) Collection and understanding of objective information (Data → Information → Knowledge)	(B-2) Accuracy of information (Emotional → Intuitive → Rational)	(C-2) Value of the collected information (Individual < Group < Society)
Involvement	(A-3) Information from the family and friends (Data → Information → Knowledge)	(B-3) Spread of collaboration (Individual → Group → Society)	(C-3) Value of the constructed relationships (Individual < Group < Society)
Imagination	(A-4) Creation of personal ideas (Data → Information → Knowledge)	(B-4) Expansion of imagination (Routine → Diversity → Fantasy)	(C-4) Value of the created ideas (Individual < Group < Society)
Integration	(A-5) Plan creation and evaluation (Data → Information → Knowledge)	(B-5) Complexity of integration (Specialized → Interdisciplinary → Intercultural)	(C-5) Value of the plan execution (Individual < Group < Society)

Here, let us introduce the most important proposal in this chapter, which is an as-is/to-be rating scale method. Three examples are shown in Fig.5.2, Fig.5.3 and Fig.5.4, in which the subject is asked for an answer in five levels evaluation of current situation as well as goal in the future. The five-level evaluation allows a vague answer between data and information, information and knowledge. All of the questionnaires: (A-1) to (A-5), (B-1) to (B-5), and (C-1) to (C-5) will be presented in the appendix.

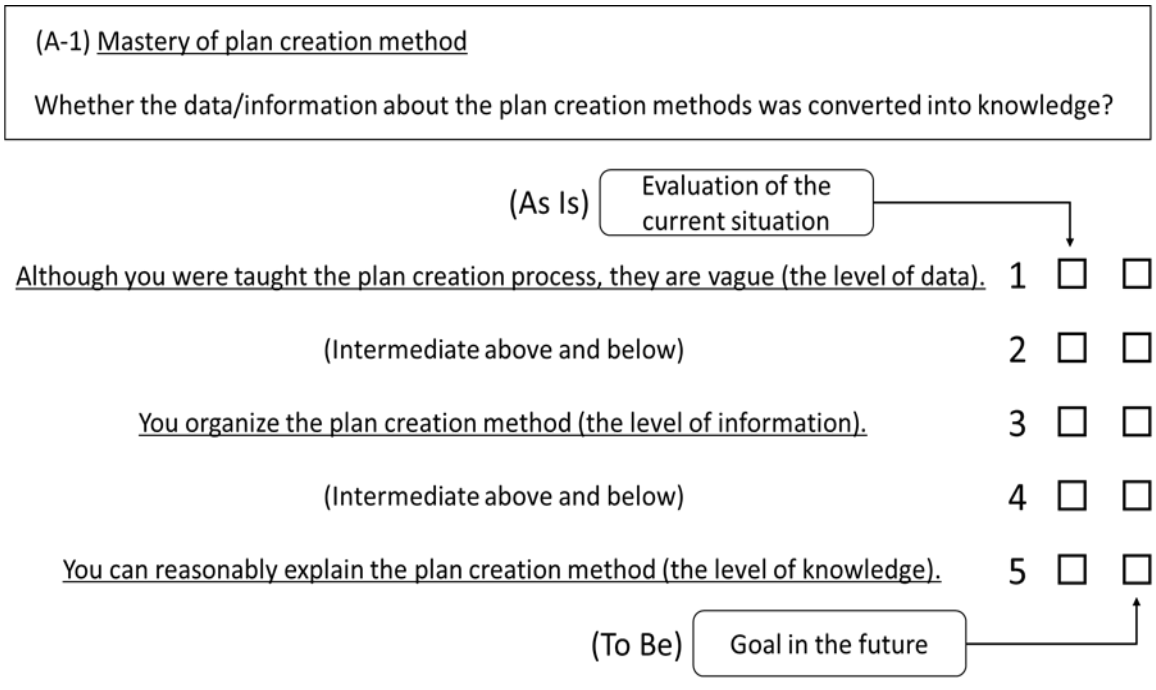


Fig.5.2 A questionnaire on knowledge creation using the as-is/to-be rating scale.

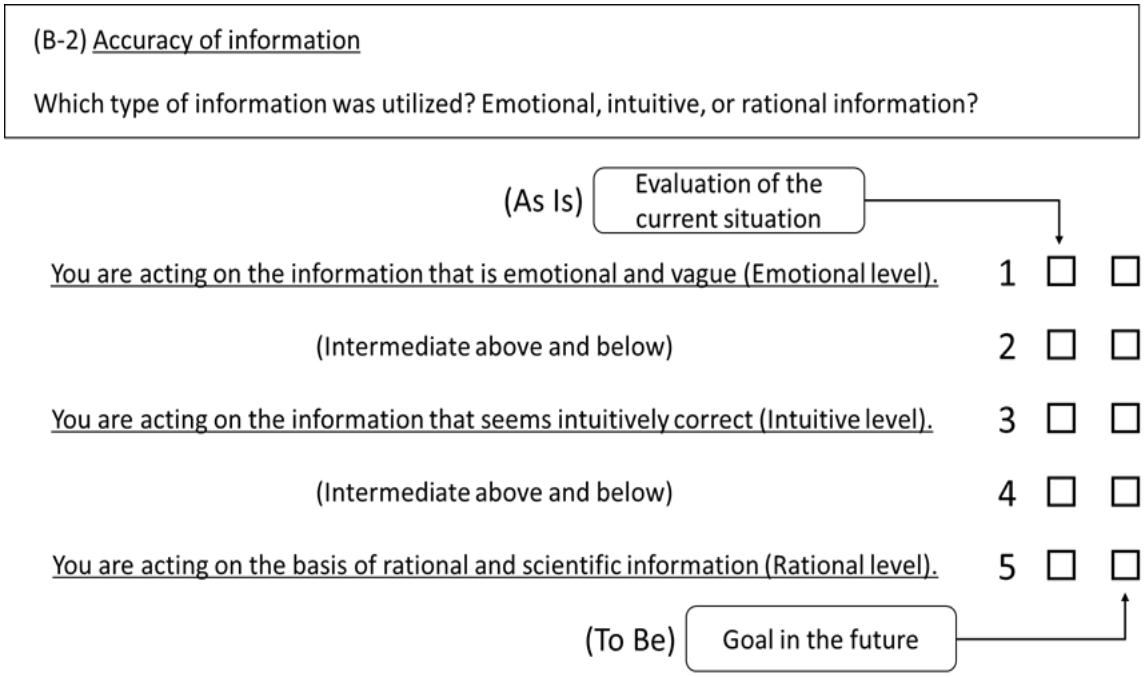


Fig.5.3 A questionnaire on willingness creation using the as-is/to-be rating scale.

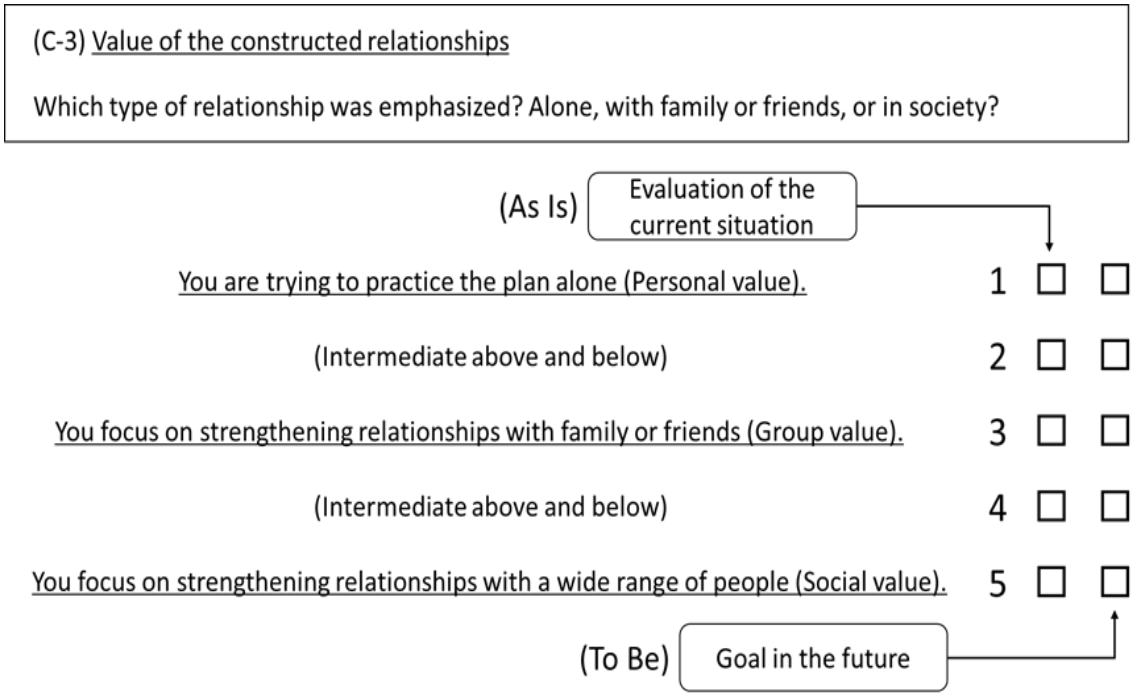


Fig.5.4 A questionnaire on value creation using the as-is/to-be rating scale.

5.2.2 Mathematical notations

Let us denote the scores of current status [c] of a subject [s] by

(A-k)[c, s], (B-k)[c, s], (C-k)[c, s],

and the scores of goal [g] of a subject [s] in the future by

(A-k)[g, s], (B-k)[g, s], (C-k)[g, s].

Recall that the symbol (A), (B) and (C) mean 'knowledge creation', 'willingness creation', and 'value creation', respectively. The symbol (k) indicates one of the nodes from '*Intervention*' to '*Integration*' in the knowledge construction model in Fig.3.2. The symbols [c] and [g] indicate the 'current status' and 'goal', respectively.

The above six functions from (A-k)[c, s] to (C-k)[g, s] take values 1, 2, 3, 4, or 5. A basic assumption in this chapter is that *these figures are obtained from the interval scale*. To this end, we have to strongly suggest the subjects that 1 to 5 are equally spaced.

Achievement levels can be defined by

(A-k)[a, s] = (A-k)[c, s] / (A-k)[g, s].

This function takes the value between 0 and 1. If a subject has scored such as the following

(A-k)[c, s] > (A-k)[g, s],

then let

(A-k)[g, s] = (A-k)[c, s]

from the assumption that this person raised the target.

As mentioned earlier, Ms. Fujimori has been organizing the '*Care-Will Study*', a seminar held once a month since April 2014 for aftercare of participants. Let us introduce the notations of two groups:

- PS: the group of people who are participating in this seminar. This group

consists of about one third of the course participants.

- NPS: the group of people who are not participating in this seminar. We do not know whether people in this group are successfully running their plans or not.

When we use the average scores in the analysis below, we use the notations such as

(A-k)[c, PS], (A-k)[g, PS], (A-k)[a, PS];

(A-k)[c, NPS], (A-k)[g, NPS], (A-k)[a, NPS].

We introduce further notations such as

(A)[c, PS]: the average of (A-k)[c, PS] with respect to the nodes (k).
(A)[c, NPS]: the average of (A-k)[c, NPS] with respect to the nodes (k).

5.2.3 Objective variable

We prepared an additional special question, which could be an objective variable in the analysis:

(D) Situation of the plan creation and execution:

1: You have not created any plan.

2: You created a plan, but you are reconsidering it.

3: You created a plan, but have not yet practiced.

4: You created a plan and practiced it, but now you are improving it.

5: You created a plan and now you are steadily practicing it.

Let us denote the current status, the goal, and the achievement level of this extra question scored by the subject [s] by (D)[c, s], and (D)[g, s], and (D)[a, s], respectively. But here we assume:

(D)[g, s] = 5 for all subjects [s].

5.3 Hypothesis Setting and Questionnaire Survey

Prior to sending questionnaires, we set the hypotheses as follows:

H1: Differences between participants and non-participants in the 'Care-Will Study':

H1a: Participants (PS) are promoting the 'Care-Will Plan' more than non-participants (NPS).

H1b: Participants (PS) are creating more knowledge than non-participants (NPS);

Participants (PS) are creating more willingness than non-participants (NPS); and

Participants (PS) are creating more value than non-participants (NPS).

H2: With respect to the causal relationships between the evaluation items (in the current assessment)

H2a: (A-1) has a great influence on (A-2), (A-3) and (A-4); and

(A-2), (A-3) and (A-4) affect (A-5) significantly.

H2b: (B-1) has a great influence on (B-2), (B-3) and (B-4); and

(B-2), (B-3) and (B-4) affect (B-5) significantly.

H2c: (C-1) has a great influence on (C-2), (C-3) and (C-4); and

(C-2), (C-3) and (C-4) affect (C-5) significantly.

H3: With respect to the causal relationships between plans and results (in achievement level)

H3a: (A-1) and (A-5) significantly affect (B-1) and (B-5).

H3b: (B-1) and (B-5) significantly affect (C-1) and (C-5).

H3c: (C-1) and (C-5) significantly affect (D).

We carried out a questionnaire survey in July and August 2015 for the students of the 'Care-Will Course'. The number of students during three years is 53 in total. We sent the survey form to all these students, but we received only 24 answer letters. Among them the number of valid responses is 21, and

$$|PS| = 7, |NPS| = 14.$$

That is, the number of respondents who are the members of the 'Care-Will Study' is 7, and who are not the members is 14.

From the survey, we have noticed the following strange match:

$$(D)[c, PS] = (D)[c, NPS] = 3.714;$$

$$(D)[a, PS] = (D)[a, NPS] = 0.743.$$

Thus, the averages of achievement levels of plan creation and execution are the same between the participants (PS) and non-participants (NPS) in the 'Care-Will Study', the aftercare seminar. Then, a question arises: why were they divided into participation and nonparticipation in the 'Care-Will Study'? Anyway, at this point, the hypothesis H1a was rejected.

5.4 Verification of Hypotheses

5.4.1 Verification of hypothesis H1b

We carried out the t-test for verification of the hypothesis H1b. Here we define:

PS = Experimental group (participants in 'Care-Will Study');

NPS = Control group (non-participants in 'Care-Will Study').

Using the t-test, we examined whether there are significant differences between average values in several evaluation items. This chapter used R-language (Ihaka and Gentleman, 1996) for statistical analysis. Table 5.2, 5.3 and 5.4 show the results of the t-test. But, before the t-test we ran the equal variance check between every two data sets by the

F-test. For the data sets the equal variance cannot be assumed, we wrote (var. equal = F) in the table (Table 5.4), and have run the appropriate t-test.

Table 5.2 Verification by the t-test for knowledge creation.

	Average	Statistic	Judgment
Current Status	(A)[c, PS] =3.17 (A)[c, NPS]=2.60	t-value =2.4549 p-value=0.0396	(A)[c, PS] > (A)[c, NPS] Significant difference in the level of 5%
Goal	(A)[g, PS] =3.97 (A)[g, NPS]=3.50	t-value =2.6811 p-value=0.0279	(A)[g, PS] > (A)[g, NPS] Significant difference in the level of 5%
Achievement	(A)[a, PS] =0.808 (A)[a, NPS]=0.752	t-value =1.2572 p-value=0.2441	No significant difference

Table 5.3 Verification by the t-test for willingness creation.

	Average	Statistic	Judgment
Current Status	(B)[c, PS] =2.43 (B)[c, NPS]=2.51	t-value =0.4460 p-value=0.6674	No significant difference
Goal	(B)[g, PS] =3.57 (B)[g, NPS]=3.24	t-value =2.8204 p-value=0.0225	(B)[g, PS] > (B)[g, NPS] Significant difference in the level of 5%
Achievement	(B)[a, PS] =0.687 (B)[a, NPS]=0.788	t-value =2.5052 p-value=0.0366	(B)[a, PS] < (B)[a, NPS] Significant difference in the level of 5%

Table 5.4 Verification by the t-test for value creation.

	Average	Statistic	Judgment
Current Status (var. equal = F)	(C)[c, PS] =2.40 (C)[c, NPS] =2.57	t-value =1.0271 p-value=0.3605	No significant difference
Goal	(C)[g, PS] =3.66 (C)[g, NPS] =3.14	t-value =3.4966 p-value=0.0081	(C)[g, PS] > (C)[g, NPS] Significant difference in the level of 1%
Achievement (var. equal = F)	(C)[a, PS] =0.646 (C)[a, NPS] =0.845	t-value =5.3785 p-value=0.0037	(C)[a, PS] < (C)[a, NPS] Significant difference in the level of 1%

Looking at Table 5.2, 5.3 and 5.4, we can summarize the comparison of participants and non-participants in 'Care-Will Study' as follows:

1. Participants are getting more information than non-participants, and might be continuously creating new ideas. However, the goals of participants are higher

than those of non-participants. Therefore there is no significant difference between two groups in the achievement level.

2. There are no significant differences between two groups in the current status of willingness creation and value creation. However, the level of non-participants' goals is lower than that of participants, therefore, the achievement level of non-participants is higher than that of participants.
3. Especially, from the viewpoint of value creation, non-participants might consider that they almost reached their targets in the 'Care-Will Course' and might judge that they do not need to participate in the aftercare 'Care-Will Study'.
4. On the other hand, since participants might be those who are not yet satisfied, we should consider the care for them more carefully.

As to the verification of the hypothesis H1b, we conclude that the participants (PS) are creating more knowledge than non-participants (NPS), but there is no difference in willingness and value creation between two groups. That is, the hypothesis H1b is partially valid.

We would like to repeat that the goals of non-participants in the aftercare seminar are rather low compared with those of participants, therefore, their achievement (satisfaction) levels are high. This is the reason why they are not participating in the aftercare seminar 'Care-Will Study'. This finding is due to using the new evaluation method: the as-is/to-be rating scale method.

5.4.2 Verification of hypothesis H2

This section explores the relationships between items of evaluation using the data of *current status*. The method used here is the structural equation approach that assumes the effect relationships between measured variables, which is in the class of the covariance structure analysis. Among this approach, we use the path analysis which tries to explain plural dependent variables by plural independent variables. We use the recursive model in the path analysis, especially, the multivariate regression analysis for determining the correlation between the dependent variables after removing the effect of independent variables.

Figures 5.5, 5.6 and 5.7 are the results of the path analysis for knowledge creation, willingness creation, and value creation, using the data of *current status*. In these figures, the coefficient (standardized solution) with an asterisk indicates that the null hypothesis

"the coefficient is zero" cannot be rejected in the level of 5%; the coefficient written in bold letter indicates that the null hypothesis can be rejected strongly; and the coefficient written in normal letter indicates that it is in the border to reject the null hypothesis.

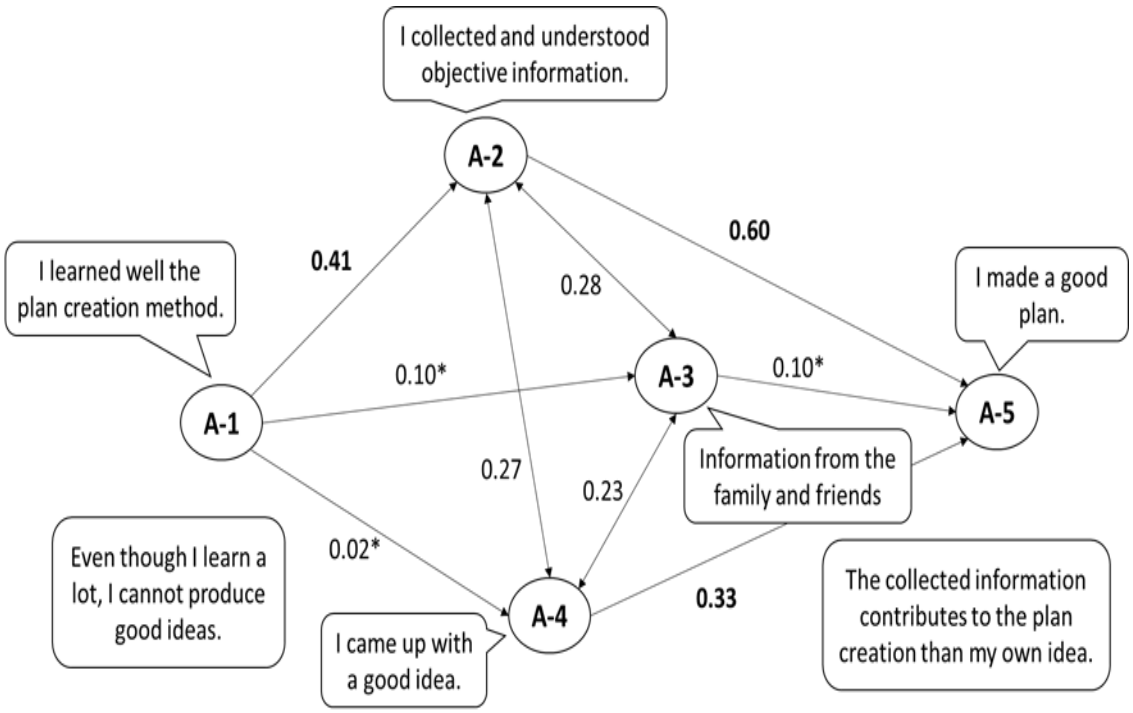


Fig.5.5 The path analysis for knowledge creation.

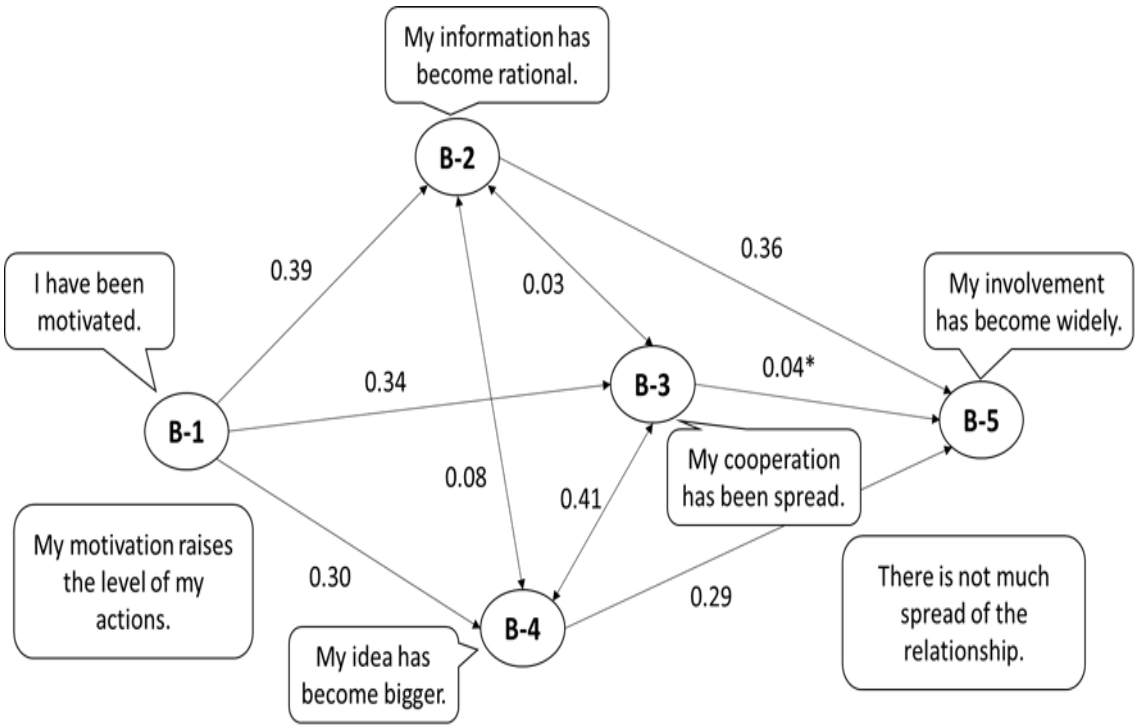


Fig.5.6 The path analysis for willingness creation.

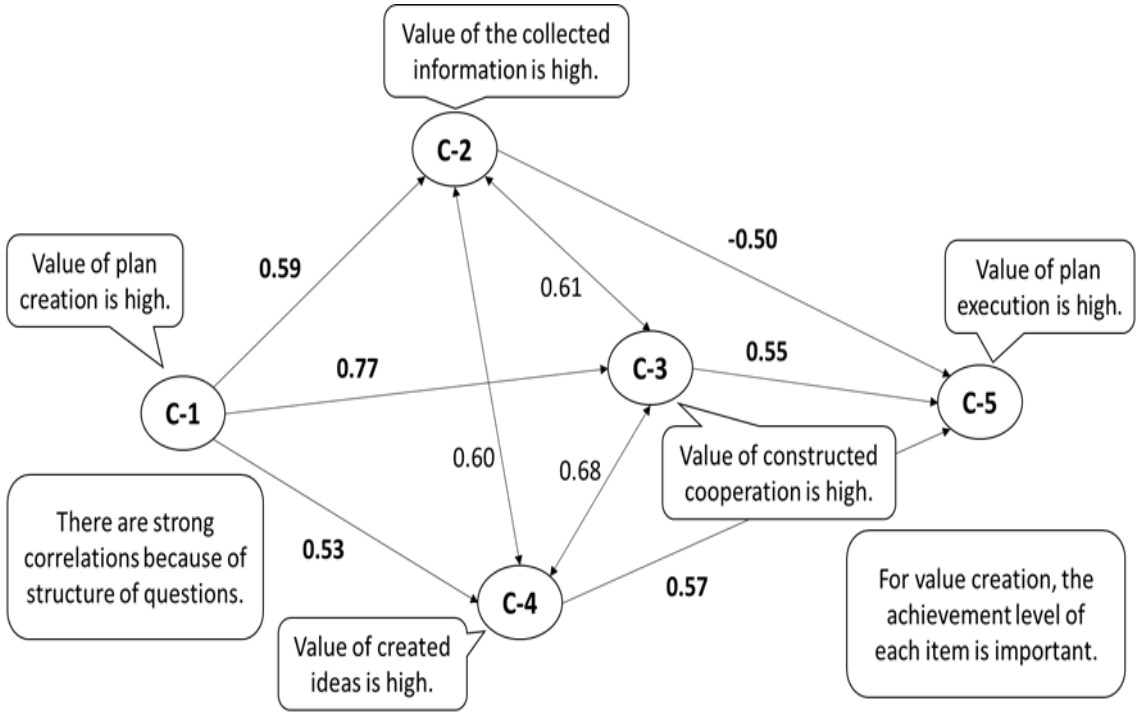


Fig5.7 The path analysis for value creation.

From the above path analysis we found some important points that we should improve in the 'Care-Will Course' as follows:

1. For the knowledge creation (Fig.5.5), a good plan (A-5) can be created by learning the method hard (A-1). The plan creation (A-5) depends on the idea creation (A-4) to some extent. Therefore, we should prepare lectures on knowledge creation by individuals. Since the result (A-5) is highly dependent on the collected information (A-2), the selection of information is very important.
2. In willingness creation (Fig.5.6), the strength of enthusiasm (B-1) affects weakly other activities of making the plan. We have to run, in parallel, some regional contribution projects and ask the students to contribute to one of the projects in order to broaden the range of activities (complexity of integration) (B-5).
3. In value creation (Fig.5.7), since questions are if the value is worth to you, your group, or the society in all evaluation items, the correlation coefficients between items are rather high. Therefore, the achievement level of each item is important. However, in the current investigation, we could not find the evidence that the students created big value since the average of (C-5) is about 2.4 in the 5-point scale. This suggests the need of further aftercare.

As to the verification of hypothesis H2, the following relationships were *not* verified:

H2a: (A-1) Mastery of plan creation methods → (A-3) Information from the family and friends

(A-1) Mastery of plan creation methods → (A-4) Creation of personal idea

(A-3) Information from the family and friends → (A-5) Plan creation and evaluation

H2b: (B-3) Spread of collaboration → (B-5) Complexity of integration

H2c: (C-2) Value of the collected information → (C-5) Value of the plan execution

5.4.3 Verification of hypothesis H3

It is quite important to find the relationships between some items in knowledge creation, willingness creation, and value creation in order to elaborate the 'Care-Will Course'. Here we consider the causal relationships among items (A-1), (A-5), (B-1), (B-5), (C-1),

(C-5), and (D), using the *achievement data*. Figure 5.8 shows the result of the path analysis. Recall that the coefficient (standardized solution) with an asterisk indicates that the null hypothesis "the coefficient is zero" cannot be rejected.

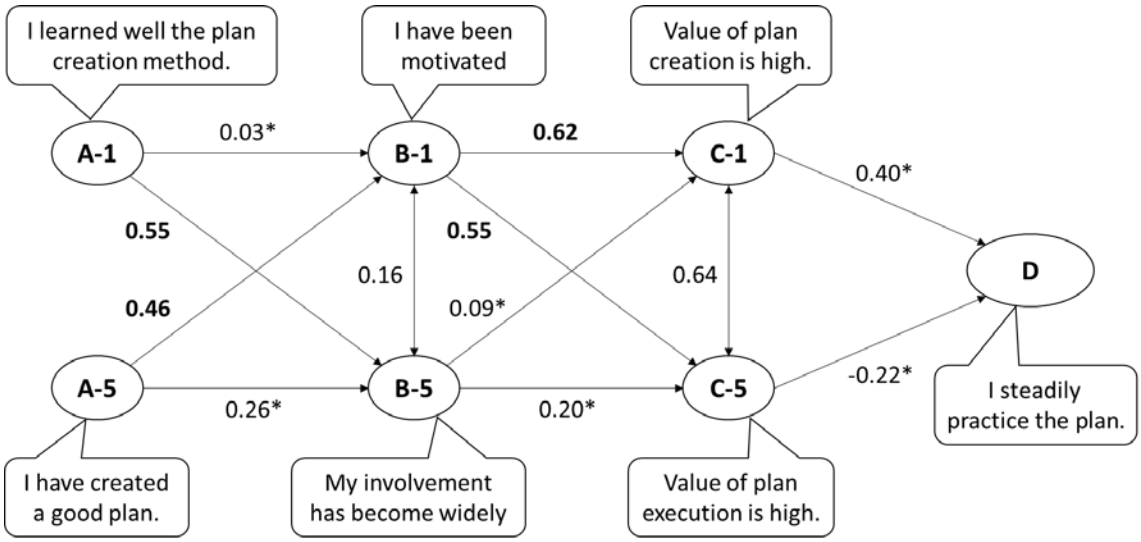


Fig.5.8 The path analysis between important variables.

From Fig.5.8 we can conclude:

1. To learn the plan creation method (A-1) is important to broaden the range of activities (complexity of integration) (B-5).
2. To create the plan actually (A-5) is important to raise the willingness (strength of enthusiasm) (B-1).
3. To raise willingness (B-1) is quite important to create value in making the plan (C-1) and also in executing the plan (C-5).
4. Actual 'Care-Will Plan' practice (D) is *not* correlated with value creation (C-1) and (C-5) strongly. This is a quite important finding in this investigation because we found that *there must be personal circumstances which should be overcome to perform the plan actually*.

In the hypothesis H3, we assumed:

H3a: (A-1) and (A-5) significantly affect (B-1) and (B-5).

H3b: (B-1) and (B-5) significantly affect (C-1) and (C-5).

H3c: (C-1) and (C-5) significantly affect (D).

From Fig.5.8 we can see that H3a and H3b are valid partially, but H3c is *not* valid in this investigation.

5.5 Conclusion of Chapter 5

This chapter proposed an evaluation framework of social activation systems and a new evaluation method called as-is/to-be rating scale method, which derived some important findings. This method has the possibility to be used for evaluation of any educational system by considering suitable items of evaluation. Therefore, the future study must include the development of an evaluation framework of more general social activation systems.

The future study also includes the improvement of the 'Care-Will Course' based on the results of this study, such as the following:

1. The average values of plan execution were the same between participants and non-participants in the aftercare seminar 'Care-Will Study'. We tried to find the reason why the students were divided into participants and non-participants in the aftercare seminar. This was explained that the goals of the non-participants were rather low and they might achieve their plans already. Conversely, there is a need to take care of those who have not been satisfied.
2. We found that there is little correlation between 'plan execution' and 'plan creation'. There might be personal problems to practice the plan actually. There is a need to develop a lecture in order to fill the gap of plan creation and plan execution.

5.6 Appendix: List of Questionnaires

This appendix gives the list of all questionnaires used in this research.

(A-1) Mastery of plan creation method

1: Although you were taught the plan creation process, they are vague (the level of

data).

3: You organize the plan creation method (the level of information).

5: You can reasonably explain the plan creation method (the level of knowledge).

(A-2) Collection and understanding of objective information

1: Although you have a lot of objective information, they are chaotic (the level of data).

3: You are collecting and organizing useful information (the level of information).

5: You are utilizing the collected information to create the plan (the level of knowledge).

(A-3) Information from the family and friends

1: You sometimes talk with your family or friends about the plan (the level of data).

3: You organize your thoughts by listening to the opinions of family or acquaintances (the level of information).

5: You utilize diverse opinions for plan creation (the level of knowledge).

(A-4) Creation of personal ideas

1: Your idea is still very vague (the level of data).

3: You organize some interesting ideas (the level of information).

5: You are utilizing your ideas for plan creation (the level of knowledge).

(A-5) Plan creation and its evaluation

1: Your idea is not yet organized (the level of data).

3: You announced your plan and received evaluation (the level of information).

5: You are promoting the plan (including in the run-up) (the level of knowledge).

(B-1) Strength of enthusiasm

1: You are creating a plan in carefree feeling (Drive level).

3: Plan creation is a big decision for you (Determination level).

5: You are dedicated to create and run your plan (Dedication level).

(B-2) Accuracy of information

1: You are acting on the information that is emotional and vague (Emotional level).

3: You are acting on the information that seems intuitively correct (Intuitive level).

5: You are acting on the basis of rational and scientific information (Rational level).

(B-3) Spread of collaboration

1: You practice the plan alone (Individual level).

3: You practice the plan with family, local people, or acquaintances (Group level).

5: Your plan involves a wide range of people (Society level).

(B-4) Expansion of imagination

1: You have an idea that could be run reliably (Routine level).

3: You have an interesting idea if it is realized (Diversity level).

5: You have an idea that is difficult to realize as a dream (Fantasy level).

(B-5) Complexity of integration

1: You are dealing with knowledge in the range of one field (Specialized level).

3: You are dealing with knowledge that spans multiple areas of expertise (Interdisciplinary level).

5: You are dealing with knowledge of a variety of people with different cultures (Intercultural level).

(C-1) Value of making a plan

1: You think about the way of your own life in the plan (Personal value).

3: You think happiness of the family or development of the local community (Group value).

5: You are thinking to contribute to the society (Social value).

(C-2) Value of the collected information

1: You found the value in your own health and economic information (Personal value).

3: You found the value in the information related to happiness of the family or development of the local community (Group value).

5: You found the value in the general information about the society (Social value).

(C-3) Value of the constructed relationships

1: You are trying to practice the plan alone (Personal value).

3: You focus on strengthening relationships with family or friends (Group value).

5: You focus on strengthening relationships with a wide range of people (Social value).

(C-4) Value of created ideas

1: You are creating ideas that can be run personally (Personal value).

3: You are creating ideas that can be run by the family, local people, or acquaintances (Group value).

5: You are creating ideas that can be run socially (Social value).

(C-5) Value of plan execution

1: Execution of the plan has a significant value to you (Personal value).

3: Execution of the plan has a significant value to the family, local people, or

acquaintances (Group value).

5: Execution of the plan has a significant value to the society (Social value).

Chapter 6

Conclusion of the Dissertation

Summary: This final chapter first summarizes this dissertation by looking back each chapter. Then it describes the academic contribution and social contribution of this research. After summarizing the future challenges of the research, it refers to the contribution of the present study to the development of knowledge science.

6.1 Summary of the Dissertation

This dissertation reported several new proposals and remarkable findings, developed through participating actual projects, regarding the evaluation of the social activation system. Chapter 1 first provided the definitions of technical terminologies used in this dissertation. Then it provided the summary of each chapter: the background and motivation of research on evaluation of social service systems, the activation system development based on the knowledge construction model, the evaluation of a social activation system based on participant observation, and a knowledge-scientific evaluation framework by an as-is/to-be rating scale method.

Chapter 2 explained the background and motivation of this research. First, an open lecture held at JAIST named regional revitalization systems theory, and some regional vitalization projects were introduced, which gave the background and motivation of this research. Then, this chapter introduced the case project in the dissertation, which is an education system for retired men to search the purpose of their second lives. The role of this chapter included the survey of existing evaluation methods to explain that the proposed method is novel and useful.

Chapter 3 presented an approach to social activation system development based on the knowledge construction model, emphasizing service value co-creation between providers and participants. As a concrete example of this approach, this chapter introduced a social experiment of developing a remote health management system, which required not only information management but also knowledge management for the success. This chapter described an important opportunity that made the author aware of the need of knowledge-scientific evaluation methods for activation service systems, such as those introduced in the subsequent chapters.

Chapter 4 introduced a knowledge-scientific approach to evaluation of social activation systems from the viewpoints of knowledge creation, willingness creation, and value creation. A concrete example of the social activation system treated here was an education program for old men to find their reason for living after the retirement. After reviewing this program and the traditional evaluation methods for such program, this chapter proposed a new evaluation framework and reports an actual evaluation result using the interview data from the participants in that program.

This chapter introduced some trials of developing evaluation methods for social activation systems based on the three-year participant observation. These evaluation trials formed the basis of the main result of this study, which was discussed in Chapter 5.

Chapter 5 proposed a new evaluation method for social activation systems in order to support participants to create new knowledge and value. The main proposal was a rating scale method that can evaluate the current level (as-is) and the future desire (to-be) of participants, and with which we can analyze achievements of individuals. By using a concrete example of an education program which is a worth living discovery seminar for retired men, this chapter reported the results of hypothetical tests on the relationships between items of evaluation, and an interesting finding related to the reason of differences in attitude of participants.

This chapter is the main part of this dissertation, which is a knowledge-scientific approach to evaluation of social activation systems using an as-is/to-be rating scale method. After the four-year research, participating in the project of an education program which is a worth living discovery seminar for retired men, this research finally developed a useful evaluation framework.

6.2 Academic Contribution

The author participated in a social activation system (an education course for retired men to search their purposes of second life) as a supporting staff, proposed a new evaluation method and performed the questionnaire survey after the course every year.

In the first year we developed an evaluation list from the viewpoint of knowledge creation. This is a knowledge-scientific evaluation method that measures how the participants convert given information into own knowledge. This is the first academic contribution in this dissertation because it clearly added the viewpoint of knowledge creation to the traditional education system evaluation approach, in which the central concern is knowledge acquisition.

In the second year we proposed an evaluation method to measure the changes in willingness of participants, which cannot be captured satisfactory by the traditional psychological approach. Here, we adopted the three-valued logic used in the knowledge

construction model. This might be the first trial to evaluate a social activation system, and we concluded this approach is quite useful.

In the third year we developed an evaluation scheme on value creation, recognizing the above course as a kind of service system. We tried to survey what kinds of value were created in the five elements of the knowledge construction model. However, it was difficult to develop such measure when taking into account that individuals have different values. Therefore, we developed a quantitative evaluation list to ask the participants what kinds of value were created.

We have developed knowledge scientific evaluation methods for a social activation system over a period of three years as described above. The author got a chance to ex-post evaluation one year after the course completed, then created an evaluation framework by the culmination of the achievements so far. We added the following improvements.

We introduced the three-valued logic: data, information, and knowledge at the five elements in the knowledge construction model. As to willingness creation, the three-valued logic is the same as before, but for value creation we introduced personal value, family or community value, and social value. Thus, we developed quantitative measures for all knowledge, willingness, and value creation.

The highlight of this new evaluation system is, in addition to the evaluation of the current situation, the introduction of an evaluation method to fill their goals. By this evaluation method, we can fine-grained care in accordance with the personal goal. That is, by the achievement evaluation value obtained by normalizing the current situation using the target, we can understand the status of individual participant after the completion of the course more.

In addition, it is possible to analyze the relationship between evaluation items in total evaluation system, using methods such as the path analysis. That is, it is possible to hypothesis testing assuming causal relationships between variables.

The author convinces that the evaluation system from the perspective of knowledge creation is a novel proposal, that the proposed approach is novel and useful to measure willingness of participants in a social activation system, and that it has a great potential as an effective evaluation of value creation.

6.3 Social Contribution

During the period of action research we proposed a new evaluation method every year, and by the questionnaire survey to the participants we contributed to the project improvement using the following findings.

By the survey from the perspective of knowledge creation, it became clear that the participants could not sufficiently internalized the given information to their knowledge. In the survey on willingness creation, their willingness increased after the course, but after six months it was back to the level before the course.

In the survey of value creation, most of the participants did not reach the level of value creation, therefore it became clear that aftercare is required. It was also revealed that most of them aimed at the pursuit of personal value.

Based on the above action research we developed an evaluation framework in Chapter 5, in which we tried the quantification of value creation. This was able to recognize the participants that retired men should contribute to the aging society with fewer children. The following facts were found by the ex-post evaluation using this evaluation system.

Looking at the normalized achievement values, we found the differences between the participants and the non-participants in the aftercare seminar held once a month. It was found that while the target of most of the non-participants is the level of individual, most of the participants were thinking to society level. That is, we found an interesting fact that the achievement levels of participants are lower than those of the non-participants in willingness and value creation.

Another important finding is that the variables related to value creation cannot explain the variable of how they are running plans, which was specially prepared questionnaire. This suggests that even a good plan is created, execution might be inhibited by personal or family reasons. Or, there is a possibility that the social structure might suppress the plan execution if the plan is trying to success in society. This is an important finding to consider the improvement of the contents of the course.

As described above, various facts became clear by the proposed evaluation system, which are used to improve the course. By changing the question contents, it would be available for the evaluation of any social services system in which knowledge creation

is required.

6.4 Future Works

First of all, the current three-valued logic for analyzing the level of knowledge, willingness, and value creation should be examined in applications.

Knowledge creation: Three-valued logic of data, information and knowledge in the epistemological dimension might be acceptable, but some respondents may be confused by their differences. It is necessary to carefully explain the differences. Or, it is necessary to reconsider the evaluation sentences.

Willingness creation: This evaluation scheme was developed by referring to the three-valued logic in the original knowledge construction model. But, the relationships between the items of evaluation are a little difficult to understand. It might be necessary to reconsider the contents of three-values depending on the purpose.

Value creation: The three levels in all questionnaires are the value for individual, for group, and for the society. It might be difficult for respondents to distinguish value they want to create into such three levels. Furthermore, it is not bad even if the level is low, because it is just due to the values of the individual. Anyway, we should reconsider the contents of three levels in this questionnaire.

The as-is/to-be rating scale method introduced in Chapter 5 got a good reputation from the respondents. This method allows us to analyze the status of participants and give them more detailed guidance. But for the analysts, it is necessary to develop a guideline that shows how to carry out hypothesis testing and path analysis in order to convert the data from questionnaire to their knowledge.

6.5 Contribution to Knowledge Science

The theme of the dissertation is ‘knowledge-scientific evaluation of social activation systems’, which is a kind of social service system in a wide sense. The service system has been actively discussed recently in terms of activation of product sales of enterprises. But this dissertation focuses on the service that activates social activities of people. In particular, it deals with the educational service system which helps the

retirees create and execute the idea of their second lives. Such an educational service system has a common way of thinking with the recently discussed service system in that value is created by the cooperation of the service providers and service consumers.

In addition, the retirees are expected to contribute to solving the social problems such as aging population, rural decline, etc. Therefore, the activation system treated in this dissertation must be linked with regional activation systems. Such activation system must firstly be a 'BA' for 'knowledge creation' of the second life including the contribution to families and communities. Secondly, it must encourage 'willingness creation' of executing the created plan. And, thirdly, it must promote 'value creation' since 'creation and action' must be meaningful to themselves or the society.

Knowledge science is considered as a discipline to provide the guideline of a series of actions from knowledge creation to value creation. It is quite important academically and socially to evaluate such social systems or to establish a system of evaluation methods from the point of view of knowledge science. Two main proposals of the dissertation, 'an evaluation framework' and 'the as-is/to-be rating scale', enabled us to perform a detailed evaluation of individuals from the viewpoints of knowledge creation, willingness creation, and value creation.

By the way, the dissertation considered a concept of 'the social service system', and defined it as the service system that aims to activate people mentally as well as economically in the society. Although such system has existed until now, the dissertation newly proposes the concept of a community version of the service system that creates value cooperatively. On the other hand, this new concept has different aspects from the recently discussed service systems related to economic activities because it emphasizes not only 'value creation' but also 'knowledge creation' and 'willingness creation'.

The research results are divided into several parts and published as research papers listed below. Among them, papers [4][5][7] discuss 'the construction of social activation systems' from the viewpoint of knowledge science, and papers [2][3][6] focus on 'the evaluation of social activation systems'. The latter research was performed by the participant observation of 'the seminars for retirement male workers' which was carried out in the University of Toyama for three years with the support of the Ministry of Health, Labor and Welfare.

After completion of the above project, the activities referred to as 'the study session' by ambitious participants are followed. While participant observation of these activities, the author has promoted the systematization of evaluation methods for such 'educational service system', and has reached the above-mentioned as-is/to-be rating scale method. The University of Toyama started a new project stimulated by this study, which shows the social usefulness of this dissertation. A related paper [1] has just accepted an international journal. The title of this paper became similar with the paper [2] due to the strong suggestion by the reviewer, but they are different in that the paper [2] corresponds to Chapter 4 while the paper [1] corresponds to Chapter 5 in the dissertation.

Research Performance (Main Theme)

(Journal Papers [1][2])

[1] Fei Meng, Y. Nakamori, V.N. Huynh, Knowledge-scientific evaluation of a social service system, *International Journal of Knowledge and Systems Science*, IGI Global. (Peer-reviewed), in press (accepted on December 28, 2015), 18 pages.

[2] Fei Meng, Y. Nakamori, Knowledge-scientific evaluation of community service systems, *Journal of Systems Science and Systems Engineering*, Springer. (Peer-reviewed), in press (accepted on September 10, 2015), 15 pages.

(International Conference Papers [3][4][5]）

[3] Fei Meng, V.N. Huynh, Y. Nakamori, J. Fujimori, T. Tatsuse, Development and evaluation of a social service system, *Proceedings of the 16th International Symposium on Knowledge and Systems Sciences*, pp.155-165, September 24-26, 2015, Xi'an, China. (Peer-reviewed)

[4] Y. Nakamori, Fei Meng, M. Kosaka, J. Tian, J.W. Xiang, Service systems development based on a knowledge synthesis methodology, *Proceedings of the 2015 IEEE International Conference on Software Quality, Reliability and Security Companion*, pp.245-250, August 3-5, 2015, Vancouver, Canada. (Peer-reviewed)

[5] Fei Meng, Y. Nakamori, Knowledge management for regional revitalization, *Proceedings of the 1st International Conference on Interdisciplinary Studies of Natural and Social Sciences*, pp.205-206, December 14-15, 2012, Beijing, China. (Peer-reviewed)

(International Conference Oral Presentations: 1 page abstract [6][7])

[6] Fei Meng, Y. Nakamori, Evaluation of a community service system, *Abstracts of the 14th Workshop of the IFIP Working Group 7.6*, May 4, 2015, Shanghai, China.

[7] Fei Meng, Y. Nakamori, Knowledge management for regional revitalization, *Abstracts of the 12th Workshop of the IFIP Working Group 7.6*, August 29-31, 2012, Aachen, Germany.

Research Performance (Sub Theme)

(International Conference Paper [8])

[8] Fei Meng, Y. Nakamori, A study on relationship between kansei marketing and sales volume, *Proceedings of the 14th International Symposium on Knowledge and Systems Sciences*, pp.115-120, October 25-27, 2013, Ningbo, China. (Peer-reviewed)

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