Proposition for a Functional Design Method of Regional ICT By Using a Logic Model

Kenji OKAMURA*, Seigo NASU*, Yutaka KIKUCHI*
Kochi University of Technology*

***ABSTRACT*:** In this study, we proposed a method for a functional design of ICT for problem-solving. We also applied a method to a practical case. ICT has been actively expanding in various regions for revitalization. However, analyzing regional problems and requesting the functions of ICT are lacking in many regions. Therefore ICT has not been fully utilized. The proposed method is to build up the logic model in which regional issues are structured by civil awareness and phenomena. From the results, outcomes and outputs necessary for solving regional problems are logically explained by the proposed method. As well, it is possible to consider all ICT functions for outcomes. However, we found that the proposed method makes it difficult to select which functions should take priority. In the future, quantifying the logic model that fuses both the civil awareness model and the engineered effect model of measures will be needed to design ICT functions to solve regional problems.

KEYWORDS: logic model, management of regional ICT, problem-solving

1. INTRODUCTION

Regional information and communication technology policies (Regional ICT)" have been actively developed nationwide as a measure to support revitalized local economies and to solve various regional problems by utilizing ICTs.

Regional ICT is expected to be used as an economical, practical problem-solving measure, which can be prepared in a short time period, compared to upgrading of fixtures which consume high operating costs and take a long time for development. On the other hand, after the introduction of regional ICT, local governments and residents often complain about the unfamiliarity for elderly people, low usage rates and unclear effects. One of the reasons for these complaints is insufficient speculation by the project implementing body, on the functions and usages of regional ICT necessary for problem-solving.

Due to the complexity of regional issues, cross-cutting measures are sometimes required for a solution. However, it is difficult for the vertically-segmented administrative system to cope with such complicated, cross-cutting issues. Actually, operations that have been introduced tend to reach the resolution-examining process under the influence of effect models such as case examples or proposals from ICT specialists. Although this could bring partial phenomenon or effect, functions for problem-solving might be left behind. Moreover, in rural areas, ICT introduction and operation require a complicated examination process as there are, unlike in urban areas, many restrictions such as financial difficulties, small market sizes, aged users, and insufficient electricity and communication environments.

Given these factors, the important theme for the

solution of local problems is how to design an ICT function that works on such issues.

As a way to design measures for problem-solving, We propose the creation of a logic model for problem-solving in which phenomena of problems, regional consciousness and functions of measures are fused together. Currently, along with a local government, the methodology is practically applied to examine measures for keeping an eye on the elderly. This paper reports the methodology and applied situation of the project.

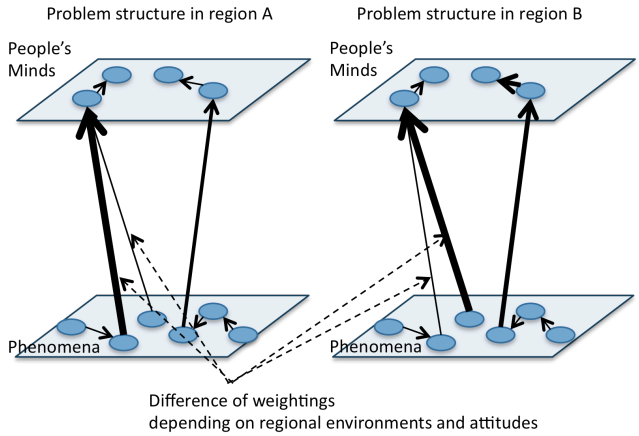

Figure 1 Elements of the problem structure

2. INTRODUCTION OF FUNCTIONAL DESIGN METHODOLOGY

A functional design method for solving regional issues is introduced here. An introduction of highly effective ICT is necessary for problem-solving. In order to structuring phenomena and minds for problems are also needed.

Problem is a gap between the existing state and a desired state. Local problems are influenced by regional characteristics such as local environments and attributes, and the diversity of stakeholders who recognize those as problems. In the same way, the problems are intricately structurized just as social problems are.

Thus problems are recognized by concern with minds and phenomena, also how much problems are recognized that depends on people's state and attitude.

Therefore we interpret as follows. Similar problems in various regions is not different from logical framework constructed by phenomena and people's minds, but regional characteristics such as local environments and attributes influence weight function of elements such as phenomena and people's mind which construct framework.

Next, a procedure for a functional design method is introduced.

Firstly the relations between the phenomenon of target problem, local characteristics and consciousness of stakeholders are clarified. Based on interviews with stakeholders, the problems and reasons they recognize are schematized and structurized as a cognitive map as shown in Figure 2-1. The reason for a problem is set as a point of origin, and from that point an arrowed line extends to the result of the problem.

Secondly, Regional characteristics are removed from cognitive map as shown in Figure 2-2, then concern with phenomena and people's mind for the problem is extracted.

Thirdly, a problem structure model constructed by phenomena and people's minds is developed to a multileveled tree chart. Then a function model of measures and ICT acting on a problem structure is organized as shown in Figure 2-3.

Finally, a logic model for problem-solving is organized with fusing a problem structure model and a function model of measures and ICT (Figure 4).

A logic model shows systematically schematized opinions about a program, such as the relations between utilizable resources, planned activities, expected changes and results. It is also an inferential, confirmable and modifiable chain model connecting

each factor of the program together.

Through such a function-design process, the structure of regional problems and the functions used in an attempt to solve them can be clearly specified.

3. SUMMARY OF RESEARCH

3.1 A case study

A proposed methodology is currently in the process of verification through an approach in Kuroshio town.

Kuroshio town has a population of approximately 13,000. One third of populations in this town are elderly peoples. It is estimated that elderly peoples will make up 40% of the population by the year 2016. Kuroshio town is composed of 41 settlements, many of them are situated in the mountains. For example, some elderly people who are living alone are not possible to do shopping and go to hospital without help. Thus the population of elderly peoples who are difficult to keep alive without someone's help is expected to increase.

In 2011, optic-fiber cables were built in all the houses in Kuroshio town, that broadband environments have been established throughout a town. Thus Kuroshio town have considered using ICT into the measures for keeping an eye on the elderly.

We applied a proposed mythology to measures for keeping an eye on the elderly in Kuroshio town. We also examined a possibility of proposed process

3.2 A method of research

Firstly, Persons related to the problems were interviewed about the problems and their causes as shown in Table 1. Results of interview survey were organized a cognitive map, that was hypothesized a perspective on the issue.

Secondly, local environments and attitudes were removed from a cognitive map, which was developed problem structure.

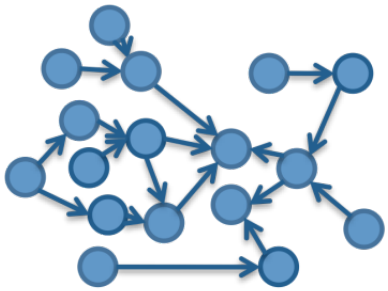

Figure 2-1 Cognitive map

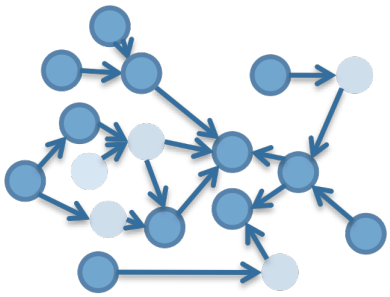

Figure 2-2 Cognitive map (removing environments and attributes)

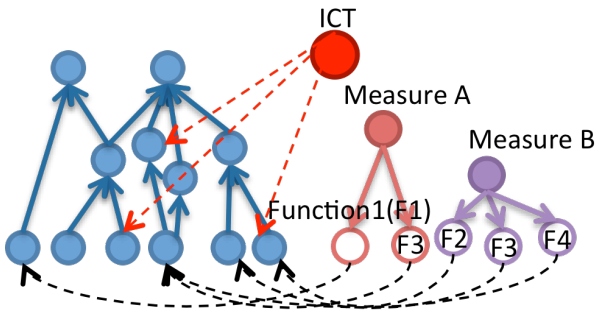

Figure 2-3 Function Model of Structure Problems (Left) and Measures (Right)

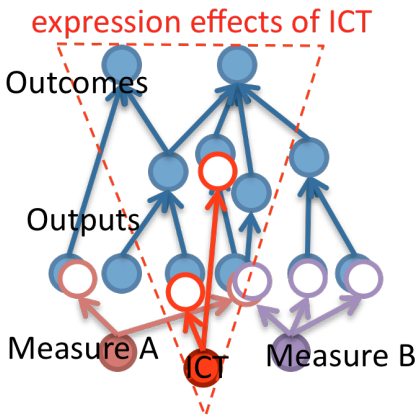

Figure 2-4 Logic model

Thirdly, we considered functions necessary for problem-solbving depending on its problem structure. In the same time it was organized the relation between the countermeasures currently performed in Kuroshio town and functions necessary for problem-solbving. On the basis of these results, functions of ICT was considered, that a proposed methodology was examined.

Table1 Summary of Research

Item	Content
Research Method	Interview
Term of Research	Kuroshio town ：January 2011
Target of Research	Town hall workers, workers at Community General Support Center, public health nurses, care managers, case workers, Council of Social Welfare, volunteers (12 respondents)
Content of Research	Contents or reasons for problems, Respondent's attributions and work contents, etc.

4. RESULTS

The cognitive map that schematizes the awareness of the parties concerned about the issues of keeping-an eye-system on elderly in Kuroshio town is shown in Figure 3. It shows that they have problems such as "No purpose in life", "Mortal danger", "Difficulty in Daily Life" and "Unhealthy". Some elderly peoples have not keep alive without someone's help, who were not able to take out the garbage and take a bath. They have being faced with living danger, including driving dangerous driving and falling ill with nobody noticing. They also have health problems, which they are not able to go to hospital and poor nutrition. Furthermore they have lived without a purpose. Thus the issues of keeping-an eye-system on elderly were recognized panoramic through surveys of interview with stakeholders.

Regional environments or subjects' attributes including regional depopulation, aged-related decreases in physical functions, poor road conditions, affect these problems. In particular, insufficient transportation for shopping or hospital visiting have a wide influenced on the purpose in life, health and

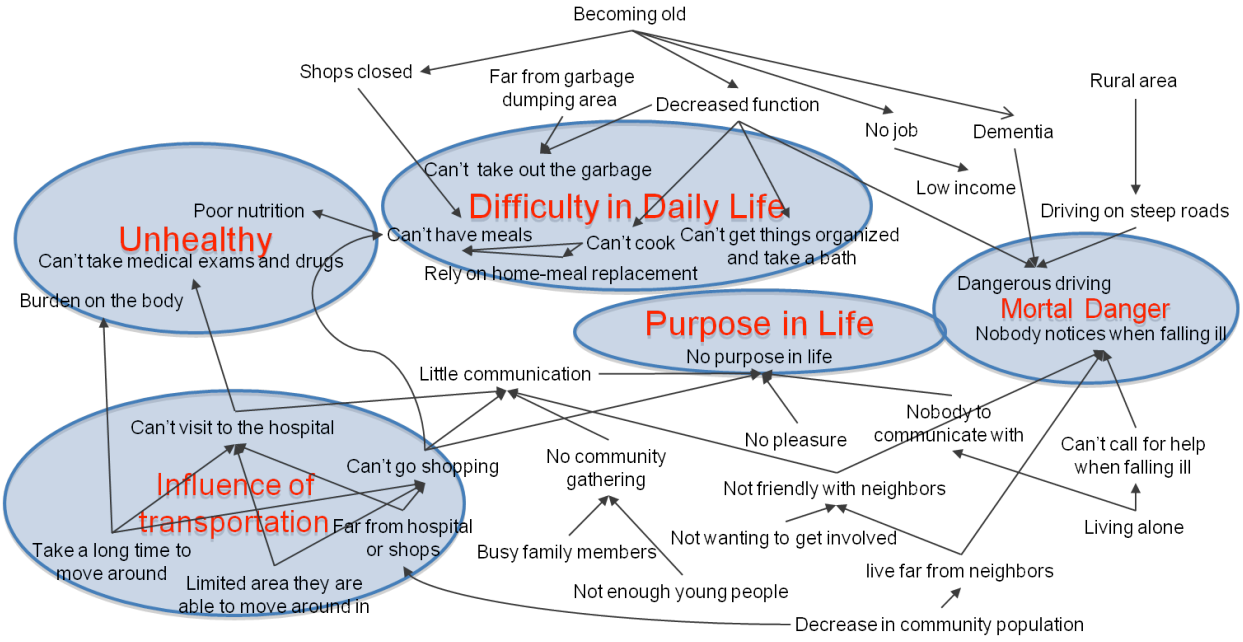

Figure 3. Cognitive map regarding the issues of keeping-an eye-system on elderly in Kuroshio town

mortal danger of the elderly, because they have less chance to communicate with others, lose the pleasure of shopping, do not take a medical examination, and are forced to drive on a narrow street.

Next, figure 4 expresses the logic model for the solution of the issues of keeping-an eye on-system. Logic model hierarchically lays out the cognitive map and studies the affectable functions. From the model, it is indicated that 15 of the functions (circled and connected with dotted lines in the middle of the figure), such as Shopping and Communication, to solve the problems of keeping-an eye-system consisting of 4 outcomes of "No purpose of life", "Mortal danger", "Difficulty in Daily Life" and "Unhealthy" and their problem structures (in the upper and middle parts of the figure) are needed.

In addition, Figure 4 schematizes the relation between the countermeasures currently performed in Kuroshio town and 15 functions (connected with black dotted lines in the bottom of the figure).

Thus, Cognitive map structurally shows phenomena of problem, consciousness, local environments and attributes.

The logic model shows that the countermeasures performed in Kuroshio town focus on function preservation, living and physical support and communication function, whereas the functions such as cognition preservation, improvement of driving environment, notification monitoring are not taken into account. Therefore, the installation of the regional ICT equipped with these functions will reduce the mortal danger and will work so well to solve the problems of keeping-an eye on-system for elderly people.

Meanwhile, it is difficult at the moment to study which function equipped with ICT among the15 functions led from the logic model can be an ideal portfolio for the solution. This may require the calculation of the logic model build the problem structure and the effects of countermeasures.

4. CONCLUSIONS

In this paper, we proposed to structurize the regional

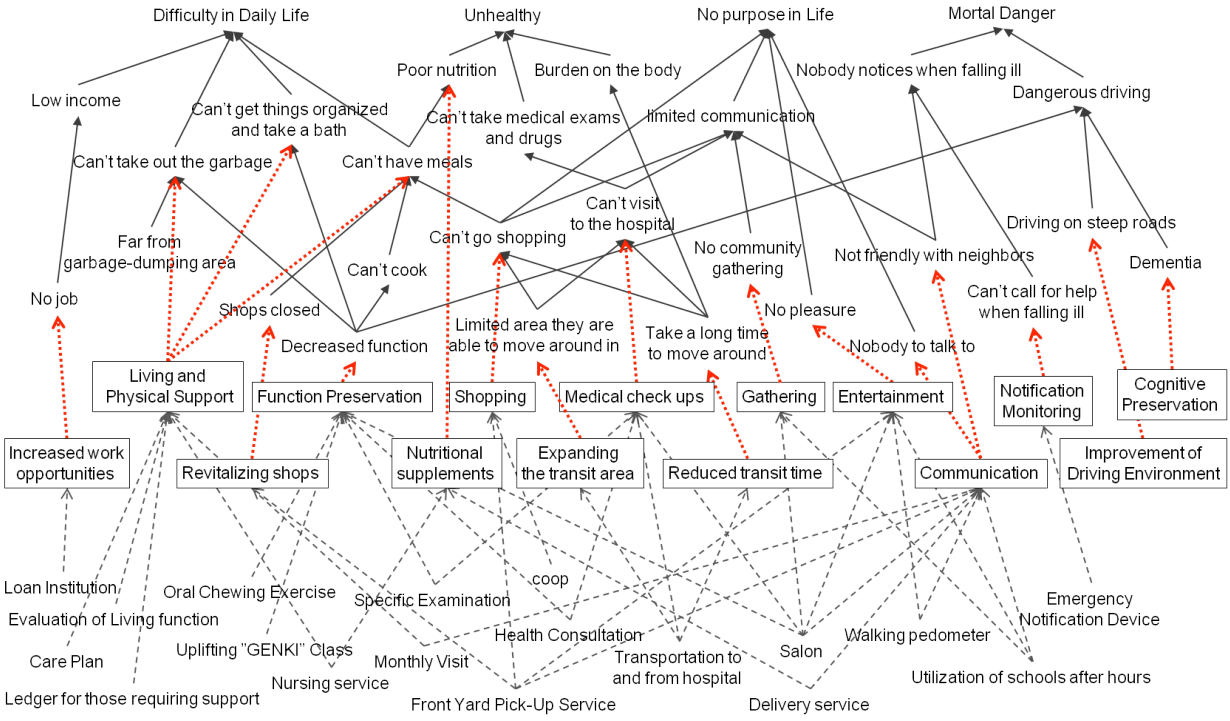

Figure 4. Logic model for the solution for the issues of keeping-an eye on-system

problems as a functional design method for regional ICT for the solution of regional problems and then to construct a logic model for the solution by studying the functions using the structures. Also the applied situation of this method is reported on.

As a result, the examination of the necessary functions for ICT by the logic model has revealed the potential of the functions designed for ICT that are logically needed for the solution. As well, we have received the comments from the person in charge in Kuroshio-cho that the logic model proposed by this method is effective for the visualization of the problems and the review and the evaluation of future measures.

However, challenges remain in the process to select the functions to be installed in ICT among the many functions necessary for the solution. Regional issues are intricately structurized and the solution requires a combination of the measures. It is essential to show a logic model and to specify the effect structure of outcomes and functions. In future, integrating a civil awareness model of the people and engineered effect model of the measure and quantifying a logic model will enable the selection of an ideal ICT function and the establishment of the solution model.

Acknowledgment

The approach introduced in this article was supported in part by a grant from the project for the partnership for industry and academia human resource development. We are also deeply grateful to Kuroshio-cho, Mr. Kusumi and many others for their support.

REFERENCES

Agriculture, Forestry and Fisheries Policy Research Institute, *Agriculture, Forestry and Fisheries Promotion Foundation. Guidance for development of a logic model, 2003.*

H. Horii, *Collaboration of intelligence beyond the "Social technical" field to solve problems*, Chuko shinsho. Japan, 2004

Kuroshio town, *Welfare plans for elderly in Kuroshio-cho*, pp8-9, 2010.

Shikoku Bureau of Economy, Trade and Industry, the Ministry of Economy, Trade and Industry and Kochi University of Technology. *A report of the project for the partnership for industry and academia human resource development "Task force on business administration human resource"*, 2011

Takeshi Kawase, Process of problem structuralizing. *Jounal of Operations Research,* Vol.20, No.Vol.1, Page.566-574. 1987.