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Studies on Analysis and Evaluation of Local Environment Utilizing Knowledge of Residents

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Abstract

The purpose of the research is to develop methods of knowledge science with which we investigate environmental conditions of the southern part of Ishikawa prefecture. The developed methods include

1. a hard system modeling technique based on statistical data,
2. two soft modeling techniques to evaluate local environment by opinions of residents,
3. an integrated modeling technique that utilizes statistical data and opinions of people complementarily.

Chapter **1** is devoted to introducing the thesis with a special emphasis on management and integration of different types and levels of knowledge. Measurement and statistical data on economy and environment of Ishikawa prefecture in the past forty years has been gathered to develop a comprehensive system model. Three questionnaire surveys were carried out to collect opinions of residents in Ishikawa prefecture to utilize the so-called tacit knowledge in the residents. The former data is called the hard data, while the latter is called the soft data in the thesis.

Chapter **2** presents an integrated assessment model, which is called the environment framework model (EFM). The model expresses the relationships between socio-economic conditions, amount of wastes, resulted environment, and their feedback to the society. Due to the complexity of relationships and the lack of accurate data, we quantify only the first part of the model using the past forty-year data in Ishikawa prefecture. Forecasts by the developed model suggest that it is necessary to change the industrial structure for sustainable development.

Chapter **3** first introduces a questionnaire survey concerning to environment in the Ishikawa prefecture. Among the data, the chapter treats water environment in the southern part of the prefecture. A data mining technique was used to classify local areas and extract knowledge as a set of if-then rules, which evaluates water environment based on several qualitative conditions of local areas. Then, adopting the concept of the context

model and the fuzzy set theory, a new model called the fuzzy concept model is proposed here, which is useful to express context-dependency of knowledge as well as to estimate evaluation of people.

Chapter 4 uses the data obtained two questionnaire surveys that focus on water quality of a number of points. The purpose here is to grasp how points are evaluated and to develop a soft model based on the soft data, that is, the model shows the average tendency of evaluation, and at the same time the vagueness in evaluation. The proposed technique is applied to the Hayashi's quantification theory type III. An idea of selecting important attributes in total evaluation is also proposed.

Chapter 5 considers how to integrate hard and soft data, especially to know what is needed for maintaining and improving environment. Results of hard modeling in Chapter 2 and soft modeling in Chapter 3 and 4 are applied to EFM to identify changes of the relation between environment and human activities.

Chapter 6 concludes the thesis. EFM has been treated only processes of human activities. Then, the thesis tried to run EFM with both hard and soft data. The thesis contributed to

1. utilizing EFM in Ishikawa (local authority),
2. proposing methods to extract people's knowledge,
3. combing hard and soft data on EFM.