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Knowledge Acquisition for the Design of Flood Management Information System: Chi River Basin, Thailand

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Abstract

Thai people living along the Chi River Basin (CRB), an important river for economic and social development of the Northeast of Thailand, have long been affected by both flood and drought. These problems have not yet been solved due to a lack of knowledge sharing between responsible organizations and researchers who are the experts on CRB to monitor and control the water condition. The knowledge owned by these experts has not been captured, classified and integrated into an information system for decision making. This paper is a part of the research on the development of knowledge-based DSS for water resources management of CRB. It aimed to develop the knowledge domain and to design knowledge-based DSS architecture. The research methods included document analysis and qualitative methods by adopting Liou (1990)'s knowledge acquisition approach. Ten experts in the areas of Environmental engineering, Water resources engineering, and GIS were interviewed. The experts also took parts in the processes of developing the knowledge domain, classifying and structuring the knowledge for flood management of CRB.

The results of this research were the knowledge domain and the knowledge-based DSS architecture. The knowledge was structured by following three processes of disaster management cycle, consisting of 9 domains of forecasting, 10 domains of response, 9 domains of recovery, 16 domains of Historical, 30 domains of GeoInformatic, and 6 domains of Government policy and land use.

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Keywords: Flood management knowledge domain; Knowledge acquisition; Knowledge organization; Knowledge-based system; Chi river basin Thailand

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1. Introduction

Freshwater resources are an essential component of the Earth's hydrosphere and an indispensable part of all terrestrial ecosystems. The freshwater environment is characterized by the hydrological cycle, including floods and droughts, which in some regions have become more extreme and dramatic in their consequences [1]. The OECD Environmental Outlook to 2030 has identified water as one of the four critical environmental priorities for the coming two decades. On current trends, 47% of the world's population will live in areas of high water stress in 2030, and the Millennium Development Goals on water and sanitation will not be met [2].

Water resource decision-making can ultimately affect land use practices and resource allocation, and can identify a need for additional data collection. Scientific data and information have always been important for making decisions related to water resource management. Increasing demands for water have elevated the importance of reliable input data. The confidence with which the outputs of scientific assessments can be used in decision-making is directly related to the availability and quality of the data used [3]. It was found that earlier studies on water resources management system had rather emphasized on using classical approach based on mathematical formulae and models, so as the study of Mikulecky.

However, Mikulecky [4] noted that the system based on mathematical models and simulations was useful but merely playing a supporting role relating to knowledge application. As an ultimate goal, the system should be a complex knowledge-based system, accumulating the most important if not all the necessary that knowledge-based related to the water resources management. Such a system should be able to support the decision making process of river operators intensively, leaving just small margins for erroneous decision [4, 5].

Water Resources Management, or especially river basin management, to be efficiently applied in everyday practice, needs knowledge, as any other knowledge intensive activity. Knowledge is usually possessed only by a narrow group of specialists (experts in the area, e.g. river basin dispatchers) who know when, how, and what must be done in order to provide proper water supply, or to cope with a dramatic consequences of floods. This knowledge, as it happens with experts everywhere, may not be available whenever it is necessary for various reasons: experts need not be always available when necessary, experts can suffer from common human problems, or suddenly their knowledge can be lost because of their mortality, or retirement and experts can differ in their opinions on how to solve a particular situation, etc. [6]

Chi River Basin is an important river for economic and social development of the northeastern part of Thailand. It covers the areas of 49,477 square meters of seven provinces. People living along the basin have had problems affected by both flood and drought every year. Although there are responsible organizations and researchers who are recognized as the experts on the basin to monitoring and controlling the water condition, it is obvious that there is a lack of knowledge sharing between them. In addition, knowledge owned by the experts that shall be used for water resources management of the basin has not been captured, classified and integrated into an information system for decision making.

This paper is a part of the research on the development of knowledge-based decision support system for water resources management of Chi river basin. It aimed to develop the knowledge domain and to design knowledge-based decision support system architecture which integrating information from existing resources and knowledge from the experts in the fields. It is expected that the results will be able to support the decision making process of river operators intensively, help knowledge sharing among the experts, and use as a resource for researches and studies of the basin in the future.