

論文 / 著書情報
Article / Book Information

題目(和文)	水不足への施策に対する経済及び環境評価に関する研究
Title(English)	A Study on Economic and Environmental Assessment of Countermeasures against Water Scarcity
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学位種別(和文)	博士論文
Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

論文要旨

THESIS SUMMARY

専攻 : Department of	土木工学	専攻	申請学位 (専攻分野) : Academic Degree Requested	博士 (工学)
学生氏名 : Student's Name	コウ ロ		指導教員 (主) : Academic Supervisor(main)	鼎 信次郎
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要旨 (英文 800 語程度)

Thesis Summary (approx.800 English Words)

Title: "A Study on Economic and Environmental Assessment of Countermeasures against Water Scarcity"

This thesis is organized from four Chapters. The chapters of this thesis can be summarized as the following:

In Chapter 1, the background and motivations of the thesis are presented. Nowadays water availability is subject to shortages, given effects of climate change, economic development, and population growth worldwide. Therefore, many countries are already engaged in water demand management and looking for alternative renewable countermeasures. In the first chapter, the overview of the related works is conducted in order to explain the current situation of water scarcity and countermeasures for alleviating water scarcity. On the basis of the overview, the solutions and contributions of the thesis are summarized.

In Chapter 2, increasing water use efficiency is highlighted as the representative countermeasure of water demand management to deal with water scarcity. In detail, systematic methods are proposed to assess its economic and environmental change based on specific socioeconomic data and modeling techniques. China is one of the countries which is facing a growing water scarcity because of the rapid population growing and economic growth. One way to alleviate the water scarcity is to increase the efficiency of water use without developing additional water supplies. Therefore it is essential to develop a holistic policy tool which can help the policy-makers to decide the usage of water wisely. In this chapter, we choose the methodology by Data envelopment analysis (DEA) which has an economic rather than engineering meaning. This approach has been widely used in management science and economics. Researchers in the field of water resource management also utilizes DEA, for the static or comparatively static analysis. However, the efficiency change of the producers in different years cannot be expressed in detail due to these kinds of static analysis. Therefore, a dynamic DEA method named DEA Window Analysis is used in this study to evaluate the efficiency agriculture change for the period 1999-2011 when the rate of economic growth is high. 31 provinces in China are selected as the target areas. In terms of the agricultural water use efficiency, several major findings were obtained. First, agricultural water use efficiency trends to be lower in the regions where the water resource is sufficient. In

addition, the developed area has higher agricultural water use efficiency than the developing area and the efficiency of the less-developed area is the worst. It may be thought that the economic development mode of China causes the relatively low agricultural water use efficiency. Lastly, we estimated the effect of increasing agricultural water use efficiency on alleviating water scarcity in China. The results show that the application of improving agricultural water efficiency will significantly reduce the number of provinces with the water scarcity from whole 31 to 6 remaining provinces, clearly suggesting the usefulness of such approach in alleviating water scarcity. Nevertheless, water scarcity will still appear in some provinces due to the great increasing demand of agricultural water in future, which clearly necessitates the applying of both water management and increasing water supply in dealing with water scarcity.

In Chapter 3, seawater desalination is proposed as the representative countermeasure of water supply to deal with the water scarcity, coupling with its future potential evaluation. Seawater desalination is a promising adaptation measure to satisfy water demand in coastal countries suffering from water scarcity. Numerous studies have shown that production costs for desalination are decreasing and capacity is growing. Efforts have been made to incorporate desalinated water into various global hydrological models (GHMs). To improve the incorporation of desalinated water into GHMs, we proposed the use of a feasibility index (Fi) to analyze under which conditions developing desalination capacity is economically feasible for different countries. We considered both past and future periods and clarified in which countries seawater desalination might be economically feasible. The Fi index was defined in detail by comparing the production cost of desalination and conventional water prices simulated by two established statistical models. For historical validation, Fi was first evaluated for nine major desalination countries. The model achieved good agreement with the actual historical development of desalination in these countries on both spatial and temporal scales. We then simulated the period of 2015–2050. Our projected results suggested that desalination would become more cost-effective for further developing countries by 2050. The large spread of seawater desalination into yet more countries was mainly attributed to diminishing production cost and increasing water price in these countries under specific socioeconomic/climate scenarios. We predicted that, in determining the impact of seawater desalination over the period studied, water price would be overwhelmed by production cost.

In Chapter 4, the concluding remarks with a list of the principal results are summarized. The main contribution of this thesis are indicated. Based on these results, the future works are specified.

備考：論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。

Note：Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1 copy of 800 Words (English).

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