Shiraz University

Faculty of Agriculture

PhD Dissertation in Agricultural Economics

A SYSTEM APPROACH FOR ANALYZING ALTERNATIVE WATER POLICIES ON ENHANCING IRRIGATION WATER DEMAND MANAGEMENT IN DOROODZAN DAM IRRIGATED AREAS

BY

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S. Shajari

ABSTRACT

A system approach for analyzing alternative water policies on enhancing irrigation water demand management in Doroodzan dam irrigated areas

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One of the main purposes of this study is to simulate farmers' behavior and a spot market for irrigation water at both farm and basin levels in order to analyze the economic, social and environmental impacts of alternative water policies. Ranking alternative water policies (options) for improving system sustainability dimensions (Economic, Social and Environment) is another purpose of this study. With respect to above issues, the first main contribution of this study is developing a Modified Multi-Attribute Utility Technique (MMAUT) that corresponds to the first purpose. In addition, designing a Decision Support System (DSS), which adopts the DPSIR (Driving Force – Pressure – State – Impact - Response) framework and simulation model and therefore offers an analysis base of the economic, social and environmental effects of combined water pricing, water policy scenarios and other decision factors at both farm and basin levels to assist water authorities in the irrigation water demand management, is the second main contribution of this study. The developed methodology is empirically applied for the Doroodzan dam irrigated areas in Fars province in Southern Iran. Farm-level data were collected from a sample of 310 farms located in the mentioned area selected by a multi-stage cluster sampling and appropriate questionnaires completed through interviewing the farmers. In accordance with cluster analysis, nine groups of farmers or farm-types were recognized and analyzed by means of a unique model for each of these groups. The results reveal that although the Positive Mathematical Programming (PMP) approach performs well, it has limitations such as excluding crops that are not presented in the base year and therefore results perform in a poor prediction of the policy impact. The results show that the best prediction corresponds to Modified MAUF approach that performs well and yields satisfactory predictions and therefore, it is basis model for

analyzing in this study. Based on the main findings of this study, at the current water tariff, the risk-averse farmers (cluster 1) consumes a substantially higher volume of water (24208.31 m^3/ha) than other clusters such as cluster 4 and 7 that consume the lower volume of water. Moreover, patterns of water consumption vary along the demand curves as a result of increases in the water price. However, it would be necessary to apply tariffs higher than threshold price in the elastic segment of water demand curve. Although enhancing irrigation water use efficiency scenario is expected to reduce irrigation water consumption by each crop, findings of this study indicate that it does not lead to reduction in total water consumption. Findings also indicate that water trade possibility in local water market increases water consumption at different price levels in most representative farms compare to current situation. Of course, such an institutional reform makes economic water use efficiencies far from its fully economic efficient compared with the current situation in most of representative farms. The results highlight the fact that alternative water policies each alone do not have suitable performance and need to be closely coordinated of the simultaneous application of all of them in order to meet the public policy objectives of water demand management in agriculture. Results obtained from the implementation of DSS indicate that integration across disciplines and communication between scientists and decision makers are beneficial in dealing with the complexity of local water use management problems. The results of options ranking, using different decision rules of suggested options in this study for most of representative farms, indicate that simultaneous application of all of alternative mentioned water policies together is preferred at both farm and basin levels. The findings reveal that although the scenario about objective of maximization of net social profits increases the total crops acreage and net social profits but it decreases irrigation water use compare to the current situation at basin level. In general, the results of the model at basin level refer to encouraging specialization and the re-allocation of resources towards those activities that reflect both basin's comparative advantage and maximization of net social profits.

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