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## **Abstract of Ph.D. Thesis in Agricultural Economics**

Title: *Economics of On-Farm Development: A Study of Major Irrigation Projects in Kerala*

Thesis submitted by P.K. Viswanathan, Research Fellow, Institute for Social and Economic Change, Bangalore, to the University of Mysore, Manasagangothri, Mysore in 2001 and approved in 2003.

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The study tries to examine the interface between the apparently divergent processes of irrigation and agricultural development in Kerala state and its implications on land use and water management practices, especially, adoption of on-farm development (OFD) both at the system as well as farm levels. The study is a pioneering attempt to offer a realistic explanation for the dismal performance of public water institutions (irrigation systems) in the state emanating from the agrarian changes characterised by tremendous decline in area under (irrigated) food crops, mainly, paddy to dry/ perennial cash crops, dominated by rubber. Specifically it tries to: (i) analyse the pattern and trends in irrigation development in Kerala and its impact on agricultural development; (ii) critically examine the institutional and organisational strategies in the irrigation commands to accomplish scientific OFD and water management practices; (iii) examine the factors determining adoption or non-adoption of OFD in irrigation projects; and (v) to bring out the institutional and operational level constraints in the development, distribution and management of water resources for irrigation. For micro level in-depth analysis, two major irrigation projects, viz., Kallada and Peechi, situated in the Kollam and Thrissur districts respectively have been considered covering a sample of 200 farmers from the Kallada project and 115 farmers from the Peechi project. While simple and descriptive statistical tools have been used to analyse the trends in irrigation infrastructure development and cropping pattern changes at the aggregate level as well as in the canal command areas, a multiple regression analysis has been used to determine the specific factors influencing the farm level adoption of OFD in the irrigation projects. Cobb-Douglas production function has been used to determine the scale economies of different cropping systems in the command areas. The concept of "Incidental Benefits" as discussed in Dhawan (1998) has been used to explain the externality of canal seepage induced groundwater utilisation by the farmers in the Peechi irrigation project. The conventional life cycle approach of project evaluation has been used to explain the sub-optimal performance of irrigation systems in the state. The analysis of returns to scale or relative profitability of various cropping systems as determined by the Cobb-Douglas production function showed that the returns to scale from cultivation of paddy has been the lowest compared to cultivation of coconut and banana in the Peechi irrigation project. However, the estimated higher returns arising from crop diversification has been the 'incidental benefit' of the canal seepage induced groundwater recharge, which motivated the farmers to make farm level secondary investments for installation of pumpsets and OFD for effective utilisation of groundwater.

The multi-variate regression analysis of the region-specific factors determining farm level adoption of OFD in the irrigation projects included important explanatory variables such as the extent of ground water recharge caused by the canal seepage, capacity of the pump set, proportion of dry area that could be brought under irrigation, occupational status of the farmer and the availability of family labour. The analysis indicated that farm level adoption of OFD in the Peechi project has been well explained by all the selected variables. The analytical model used for explaining the various factors determining adoption of OFD in the Kallada project identified factors such as: holding size, proportion of paddy area converted, extent of rubber area, the extent of groundwater recharged, age of the farmer, occupational status, effectiveness of the water distribution system, availability of pumpset, etc. It is found that the variables used in the analysis explain almost 73 per cent of the farm level adoption of OFD by the farmers. Among the important factors identified, the area under rubber has been found to be negatively influencing OFD. In other words, the farmers having higher proportion of area under rubber do not undertake OFD works, as they consider rubber as a rainfed crop. The variables such as extent of groundwater recharge, the availability of pumpset, the presence of effective water distribution systems, the share of paddy area converted into wet crops, the age of the farmer and the full time farming status have been found to be positively influencing the farm level adoption of OFD in the Kallada command area.

The various problems and operational constraints in the process of effective utilisation of land and water resources in Kerala have been broadly identified as: institutional, socio-economic, technological as well as water management related factors. These factors adequately explain the dynamics of land use changes in the state with serious implications on the under-performance of irrigation systems. The major institutional constraints are: (i) the declining size of operational holdings, leading to the failure of institutional intervention for promoting paddy cultivation, (ii) labour related problems, (iii) un-remunerative prices for paddy coupled with rising wage rates, and (v) large scale conversion of paddy lands for other crops and also for non-agricultural purposes. The important socio-economic factors identified are: (i) lack of interest in labour intensive farming operations, (ii) relegation of the status of farming into a secondary activity, and (iii) sociological reasons, including the growing share of elderly among the farmers as well as labourers. The major technical constraints for irrigation development in Kerala as brought out by the study are: (i) design of the projects exclusively for paddy cultivation; (ii) the inflexibility of water distribution networks so as to effect demand based supply of water; (iii) decaying of the irrigation infrastructure needing massive capital investment for revamping and rehabilitation of the canal systems; and (iv) improper design and alignment of some of the canals and field channels adversely affecting water distribution. The study throws open number of issues for research, based on the experience of Kerala. One of the issues need addressing is to examine the implications of crop conversion from paddy based food crops to commercial crops on the water balance and status of utilisation of water resources in the state. In the light of the emerging reforms in the water sector, it is important to study how the newly emerged local level planning could be effectively integrated in the process of governance of water institutions in the state, which are fraught with number of technical, operational and managerial problems.