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EFFECTS OF THE IRRIGATION MANAGEMENT PROGRAMME ON BORO RICE PRODUCTIVITY AND AGRARIAN INCOME INEQUALITY IN NORTH-WEST BANGLADESH

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by

Md. Taufiqul Arif

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Dedicated to my

respected parents:

Mohammad Golam Abedin
Begum Khaleda Rowshan Ara

beloved wife:

Begum Farida Easmin Arif

loving daughter and sons:

Tahmina Farah Arif
Mohammad Faisal Deen Arif
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LIST OF ABBREVIATIONS

BADC	Bangladesh Agricultural Development Corporation
BASR	Bangladesh Agriculture Sector Review
BBS	Bangladesh Bureau of Statistics
BKB	Bangladesh Agricultural Bank
BRDB	Bangladesh Rural Development Board
BWDB	Bangladesh Water Development Board
CD	Cobb-Douglas
CDS	Centre for Development Studies
CES	Constant Elasticity of Substitution
DTW	Deep Tubewell
IMP	Irrigation Management Programme
KSS	Farmers' Co-operative Society
LCD	Log-linear Cobb-Douglas
LLP	Low-Lift Pump
MV	Modern Variety
RDA	Rural Development Academy
STW	Shallow Tubewell
TL	Transcendental Logarithmic (or Translog)
UCCA	*Upazila* (Subdistrict) Central Cooperative Association
UIT	*Upazila* (Subdistrict) Irrigation Team
WLS	Weighted Least Square

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Supervisor : Prof. Ahmad Mahdzan Ayob Ph.D.

Faculty : Economics and Management

Rice is the staple food of the people of Bangladesh. The importance of rice in the country's social, economic and political life cannot be overemphasized; yet the country has foodgrain deficit.

Boro rice is mainly grown in modern varieties (MV) during the winter season under full-scale irrigation. The existing irrigation facilities and the winter cropping intensity together offer good scope for expanding the cultivation of *boro* rice which may lead to foodgrain self-sufficiency.

However, a large number of installed deep tubewells (DTW) are reportedly not being utilized properly in the north-western part of the country. It is claimed that a majority of the marginal and small farmers have been deprived of these irrigation facilities by the small minority of the large

farmers. Present trend indicates a decrease in foodgrain productivity and an increase in agrarian income inequality. The landless population is ever-increasing and poverty is spreading steadily.

An Irrigation Management Programme (IMP) is introduced to increase the foodgrain productivity, and reduce the agrarian income inequality. This should expand the DTW command area, and encourage the marginal and small farmers in *boro* rice growing activities. It is important to assess whether IMP has increased the *boro* rice productivity and reduced the income inequality.

For this purpose, two models are used, one to analyze the *boro* rice productivity, and another to measure the agrarian income inequality. The former is a log-linear Cobb-Douglas (LCD) regression model, while the latter comprises Theil's first and second entropy measures. Fourteen explanatory variables are used in the productivity model, land, labour, capital and management being the major ones. The management variable is directly measured as a composite of the social, economic and technological factors influencing scheme management performance levels. The inequality models are used to measure both inter-scheme and intra-scheme income inequality arising from the net *boro* rice income, all other incomes, and the total income.

The results indicate that IMP has significantly contributed to increasing the *boro* rice productivity and the overall resource use efficiency, but it has not been able to

change the income inequality. The IMP schemes have significantly larger command area and better management performance level than the non-IMPs. Because of IMP, the inequality within the privileged groups has decreased, but that within the underprivileged has increased. The group size of the owner-cum-tenants is likely to be squeezed.

However, the IMP is expected to increase the demand for labour, causing their wage rate to increase. All different groups will have more income. The land-rich will be richer, but the poor might not become poorer. This is likely to improve the overall living standard in the rural society.

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KESAN PROGRAM PENGURUSAN PENGAIRAN KE ATAS PRODUKTIVITI BERAS BERMUSIM KERING DAN KETAKSAMAAN PENDAPATAN DI BARAT LAUT BANGLADESH

Oleh

Md. Taufiqul Arif

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Beras merupakan makanan utama bagi penduduk Bangladesh. Beras memainkan peranan penting dalam berbagai segi - sosial, ekonomi dan politik di negara ini. Bagaimanapun, negara ini mengalami kekurangan sumber makanan bijirin. Beras jenis *boro* kebanyakannya ditanam secara moden pada musim sejuk di bawah sistem pengairan penuh. Kewujudan berbagai-bagai kemudahan dalam sistem pengairan dan penanaman di musim sejuk secara intensif membolehkan beras jenis ini ditanam secara meluas dan dapat menolong mengatasi masalah kekurangan bijiran makanan.

Sebahagian besar daripada telaga bertiub dalam (DTW) yang ada di bahagian Barat Laut negara ini dilaporkan tidak digunakan secara yang sebaik-baiknya. Sebahagian besar daripada petani-petani kecil tidak dapat menggunakan kemudahan pengairan ini kerana dihalang oleh sebilangan kecil petani-petani yang mempunyai kuasa yang besar. Arahaliran

pertumbuhan makanan bijiran menunjukkan pengurangan pengeluaran dan peningkatan ketaksamaan pendapatan di bidang pertanian. Jumlah penduduk yang tidak bertanah semakin bertambah dan kemiskinan pula merebak begitu cepat.

Program Pengurusan Pengairan (IMP) telah diperkenalkan untuk meningkatkan produktiviti makanan bijiran dan mengurangkan ketaksamaan pendapatan dalam sektor pertanian. Kesemua ini sepatutnya menambahkan lagi kawasan yang menggunakan DTW atau menggalakkan petani-petani kecil untuk melibatkan diri dengan aktiviti penanaman beras jenis *boro*. Adalah penting sekali dilakukan penilaian ke atas IMP untuk melihat sama ada ia telah meningkatkan produktiviti dan mengurangkan ketaksamaan pendapatan.

Bagi tujuan ini, dua model telah digunakan, satu untuk menganalisis daya pengeluaran beras jenis *boro*, dan yang keduanya untuk mengukur perbezaan pendapatan dalam sektor pertanian. Jenis model yang pertama ialah model regresi Log-linear Cobb-Douglas (LCD), manakala jenis yang yang kedua mengandungi pengukuran entropi pertama dan kedua Theil. Terdapat 14 angkubah penerang dalam model produktiviti, dan di antara angkubah-angkubah utama ialah tanah, buruh, modal dan pengurusan. Angkubah pengurusan telah diukur sebagai komposit faktor-faktor sosial, ekonomi dan teknologi yang mempengaruhi prestasi pengurusan. Model ketaksamaan digunakan untuk mengukur kedua-dua ketaksamaan pendapatan dalam skim dan antara

skim yang terbit daripada pendapatan bersih beras *boro*, pendapatan-pendapatan lain dan juga keseluruhan pendapatan.

Keputusan menunjukkan bahawa IMP telah memberikan sumbangan yang signifikan sekali dalam produktiviti beras *boro* dan keseluruhan kecekapan penggunaan sumber, tetapi ia tidak berupaya memperbaiki ketaksamaan pendapatan. Skim IMP jelas menggunakan kawasan yang lebih luas dan mempunyai prestasi pengurusan yang lebih baik berbanding dengan yang bukan IMP. IMP telah menyebabkan ketaksamaan di kalangan golongan yang telah diberikan kemudahan berkurangan, tetapi telah menyebabkan ketaksamaan meningkat di kalangan mereka yang tidak diberi kemudahan yang sama. Saiz kumpulan pemilik-penyewa dijangka akan menjadi semakin kecil.

Bagaimanapun, IMP dijangka akan meningkatkan permintaan terhadap buruh, menyebabkan kadar upah meningkat sama. Kesemua kumpulan akan mendapat pendapatan yang lebih. Pemilik tanah yang kaya menjadi semakin kaya tetapi golongan miskin tidak semestinya semakin miskin. Ini mungkin dapat memperbaiki taraf kehidupan masyarakat luar bandar.

CHAPTER I

INTRODUCTION

A balanced combination of land, labour, capital and management is imperative for the sustained development of agriculture in Bangladesh. The advent of MV (modern varieties) seeds, fertilizers, pesticides and irrigation has accelerated this development. These modern technologies were introduced in 1961,[1] but their rapid diffusion was observed after independence in 1971. A dramatic increase in the use of small-scale irrigation equipment, primarily the LLPs (low-lift pump), DTWs (deep tubewell) and STWs (shallow tubewell), followed by MV seeds, fertilizers and pesticides has indeed had a positive contribution towards increasing the cropping intensity and the foodgrain production. Cropping intensity has increased from about 144% in 1971 to 159% in 1987 (BBS, 1989). The growth rate of cereal foodgrain (rice and wheat) production has increased from only 2.6% during 1950-71[1] to 3.4% during 1972-87 (Hossain, 1989). In spite of this success, the nation's aspiration for foodgrain self-sufficiency has not been achieved. Inequality in per capita income has been worsening. Poverty has remained ubiquitous (BASR, 1989).

1; All years represent financial year beginning on 1st July of a year and ending on 31st June of following year; e.g. 1961 is 1961-62, but 1950-71 is from 1950-51 to 1970-71.

Despite constant persuasion, casual non-utilization and frequent underutilization of the LLPs, DTWs and STWs has been continuing (Boyce, 1985). To mitigate this problem, an intensive Irrigation Management Programme called IMP was launched in 1978 (Haq, 1980). What has been achieved since then? The present study investigates into the effects of IMP on the irrigated *boro* (winter) rice productivity in terms of land, labour, capital and management, and on the farmers' income inequality by selected farm size and land tenure status in the north-western part of Bangladesh.

Salient Features of the IMP Scheme

The IMP was conceived as an intensive pilot project within the framework of the World Bank financed Rural Development-I (RD-I) Project in 1978, tested in the field in 1979 and launched in 1980. Main objectives of the IMP (Haq, 1980) are:

(a) to resolve institutional, financial and technological constraints to command area development under small-scale irrigation investments through 'two-tier co-operative system', and by using appropriate techniques, and

(b) to maximize the utilization of small-scale irrigation investments and increase irrigated crop yield.

Salient features of the IMP (Haq, 1980) are as follows:

1. Action Plan: This shows successive activities to be taken up including their time schedule.
2. DTW Selection: This is done according to a set of

predetermined institutional and technological criteria. A site is selected if it holds at least 50% potential for command area development.

3. **Presentation of IMP:** This is done to explain relative benefits of water management to all members in a weekly meeting of their KSS (Farmers' Co-operative Society) in order to assure them of timely and adequate supplies and services of all modern inputs including crop credit.
4. **Training:** Chairmen, Managers, Model Farmers, Block Leaders, Pump Machine Operators and Field Men of KSS, and Village Inspectors and Accountants of UCCA (Sub-District Central Co-operative Association) are given prior training on IMP by UIT (Sub-District Irrigation Team) members at UTDC (Sub-District Training and Development Centre).
5. **Land Map and Land Register:** A command area is mapped into high, medium and low plots in different colours and a register is maintained with owner's name and plot-size.
6. **Irrigation Block Demarcation:** A command area is divided into six blocks in order to irrigate the whole area within the first six days (one block per day), and conduct weekly maintenance of pump-engine, clean irrigation system and consider any request for extra water on the seventh day.
7. **Block Priority List:** This consists of farmers' names with their plot numbers and 'irrigation day'. Their names are arranged by blocks and by 'irrigation priority' within each block in descending order. A block located at the

farthest corner from the pump site, and a plot at the farthest point within a block get top priority. These measures help to develop more confidence in distant plot owners and minimize water loss also.

8. **Block Leader Selection:** This is done by the farmers of each block through open election. Block Leaders assist the Scheme Manager in allocation and distribution of water as per priority list and in collection of water charge.

9. **Irrigation Channel:** This is designed by concerned SAE (Sub-Assistant Engineer) in consultation with Scheme Manager and Block Leaders, and constructed through voluntary labour provided by KSS members.

10. **Irrigation Budget:** This is prepared by Scheme Manager in view of crop-water requirements, costs of oil-fuel (or electricity) and O&M (Operation and Maintenance) of pump-engine and irrigation channel.

11. **Irrigation Ledger:** This consists of block-wise detailed particulars of water-use of recipient KSS members.

12. **Irrigation Fund:** This is collected as irrigation charge by Scheme Manager from recipient KSS members as per *a priori* fixed rate (*taka*[2] per decimal) decided in a KSS meeting and deposited in a nearby bank account jointly operated by KSS Chairman and Scheme Manager. They withdraw money from this account with prior approval of their KSS Executive Committee and submit voucher for approval.

2; *Taka* ; Bangladesh Currency. U.S. $ 1.00 = Tk 31.24 in 1987 (BBS, 1989).

13. **Production-Input Credit:** This is provided by UCCA against an approved Production Plan showing estimates of fertilizer, pesticide and irrigation and submitted by KSS Manager along with a list of KSS members who need credit.
14. **Maintenance of Account:** This is done by KSS Manager and is produced before KSS Executive Committee for approval.
15. **KSS Visit:** UIT Members visit irrigation-based KSSs, inspect registers, listen to technical problems and give spot decision. They also explain better technique to KSS members and demonstrate its application in the field.

In view of the above features, IMP is considered to involve some unique spectrum of multifaceted activities conducive to retaining institutional discipline, making prompt decision and taking prompt action in order to combat myriad of institutional, economic and technological problems of irrigated agriculture in Bangladesh.

In 1988, 20,348 DTWs were in operation in the country (BSS, 1989). Nearly 33% of them were IMP schemes. Although this rate of converting the DTW irrigation schemes into IMPs is very slow, the performance of IMP schemes is reportedly encouraging. It is envisaged that paricipation of the cultivators of various farm size and land tenure status has contributed towards improving the age-old agrarian income inequality situation also.

Major Constraints with the Non-IMP Scheme

Besides the IMP schemes, there are also many DTW irrigation schemes, which for convenience will be called the non-IMP schemes. Usually once these DTWs were installed and handed over to KSSs, various management problems (institutional, economic and technological) were encountered. Some of these problems are narrated below:

Institutional: The DTW irrigation-based non-IMP schemes also operate under the government-registered KSSs or farmers' co-operatives, but institutional discipline does not exist any way. A few so-called fugitive farmers who often hold leadership of different social, cultural and political factions are seen to hold control, direct or indirect, over these institutions. They hardly abide by the co-operative principles. Their actual motive is to fulfil vested interests and give undue privilege to a few cultivators who are supporters of their own socio-political factions. They like to administer their self-assumed and self-contained activities, which are termed as *de facto* and *de jure* roles regardless of their nature of involvement as managers or members in the co-operatives (Levine, 1977). As a result, frequent conflicts within and between factions persist and institutional disciplines cease to function. Undue vested interest of a few people gains upper hand and later, is being fulfilled in an illegal manner (Haq, 1980).

Economic: The farmers also face an economic constraint mainly due to their inherent poverty and institutional