Study on the Performance Evaluation of Teesta Barrage and Irrigation Project

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Abstract

Teesta barrage project is one of the largest and most significant irrigation, flood control and drainage projects in Bangladesh. A huge area of North-west region of Bangladesh suffered much because of insufficient water supply and undeveloped irrigation system. Eventually, the installation of a barrage at river Teesta was planned. However, this paper was an attempt to study the objectives behind the construction of the project along with its achievements and present condition and thus to evaluate the overall performance of this project from several viewpoints, such as agriculture performance, cropping intensity, production performance, ecomomical and social aspects. Data were collected from both the primary and secondary sources and analyzed for the period of 12 years (2000 to 2011). The analyzed results reveal that the production performance and the cropping intensity of the irrigated area under this project have increased significantly. After all, it could be said that this project has been successful in a broader sense though some predicted goals have not yet been achieved.

Keywords: *Teesta barrage project, Irrigation performance, Water supply and Cropping intensity*.

1 Introduction

Teesta Barrage project is a combination of irrigation, flood control and drainage program. Teesta Barrage project has been constructed on river Teesta at Duani in Lalmonirhat district of Bangladesh in 1990. This barrage having a discharge capacity of 12,750 cusec of water is a 615m long concrete structure fitted with 44 radial gates (Sarker, et al., 2015). The total gross benefited area of the project is 750000 ha, of which 540000 ha is irrigable (IWM, 2003). The BWDB has divided the entire project into two phases (Phase-I and Phase-II). Phase-I has a command area of 18200 ha with a net irrigable area of 132000 ha. The remaining area was developed under Phase-II. The cost of the project was around 8574 million BDT (at 1990 price) maintaining the development cost lower as compared to that of the other irrigation projects in the country (BWDB, 2005).The major objectives of this project were to increase the agricultural production using gravity irrigation with flood protection and drainage facilities as well as to ensure the socio-economic enhancement of the people living in the territory under this project area by creating job opportunities and introducing multi development programs, such as fisheries, duck culture, grass cultivation, afforestation etc. (Rahman, 2005). Women of this area also play the significant role in collecting and processing crops. Moreover, it has also made contribution to the agro-economy of Bangladesh. So it could be said that the overall socio-economic condition of this region has changed rapidly due to the implementation of this project.

However, several researches had been carried out in the past on the performance evaluation of this project: Morshed, (2005) reported in his study that after implementation of this project, the cropping pattern had been changed from Aman-Millet to Aman- Boro and Rabi, while the cropping intensity increased from 180% to 214% and the net incremental paddy production was about 0.49 million M. ton per year. Besides, Islam, (2007) and Fakrullah & Akmam, (2007) carried out the performance evaluation of this project based on engineering, agriculture, social, econimic and environmental aspects and their study revealed that the overall environmental and socio-economic condition of the people of this project area have improved drastically due to the construction of the project. Accordingly, the aim of this paper was to promote this evaluation approach more effectively by introducing several novel strategies for the better understanding. However, the authors had to face many difficulties while collecting data from the project cite because it's a huge area covered by this project. Some incongruous information was also found while the questionnaire survey was carried out to the farmers as well as the stuffs of this project.

2 Methodology

Teesta barrage project is located within the northwest region of Bangladesh, comprising parts of the districts Nilphamari, Rangpur, Dinajpur, Bogra, Gaybangha and Joypurhat. This project is bounded by Teesta on the north, the Atrai on the west, Shantahar-Bogra Railway line on the south and Bogra-Kaunia Railway line on the east (Rahman, 2011). The corresponding data were collected from both primary and secondary sources. Primary data were collected through field visit and questionnaire survey arranged at the project site and secondary data were gathered from the secondary sources (BWDB, IWM & BMD).

2.1 Evaluation Methods

In this study, performance evaluation of Teesta Barrage Irrigation project was carried out using two main indicators - Process indicators and Comparative indicators. However, this paper mainly focused to investigate the irrigation performance with comparative indicators covering agricultural, water use and economic performance.

2.1.1 Agricultural Performance

The agricultural performance of an irrigation project can be evaluated through the following four indicators:

2.1.1.1 Irrigated Area Performance

For the computation of irrigated area performance, both actual and target irrigated area for different cropping season are required. These data were collected from IWM, BWDB, and field visit for the year of 2000 to 2011. Then using the following equation (1) irrigated area performance was obtained.

$$Irrigated\ Area\ Performance = \frac{Actual\ Irrigated\ Area}{Target\ Irrigated\ Area} \quad (1)$$

2.1.1.2 Cropping Intensity Performance

In order to investigate the cropping intensity performance, actual and target cropping intensity for different cropping season are needed. These data were compiled from IWM, BWDB and project officials for the year of 2000 to 2011. Then using the following formula (equation 2) cropping intensity performance was estimated.

$$Cropping\ Intensity\ Performance = \frac{Actual\ Cropping\ Intensity}{Targeted\ Cropping\ Intensity} \quad (2)$$

2.1.1.3 Yield Performance

This is an important indicator where land is a limiting resource for irrigation development. For the Computation of Yield Performance actual and target irrigated area and production for different cropping season are required. These data were taken out from IWM, BWDB and field visit for the year of 2000 to 2011. Yield refers to the production per unit area. Using the following formula yield performance was obtained.

$$Yield\ Performance = \frac{Actual\ Yield}{Targeted\ Yield} \quad (3)$$

2.1.1.4 Production Performance

Most important indicator for evaluating agricultural performance where both land and water are limiting resources towards irrigation development. For the investigation of Production Performance, both actual and targeted production for different cropping season are required. These data were accumulated from the IWM, BWDB and field visit for the year of 2000 to 2011. By using the following formula in equation (4) production performance was also obtained.

$$Production\ Performance = \frac{Total\ Production}{Targeted\ Production} \quad (4)$$

2.1.2 Water Use Performance

There are two types of indicators are generally used to evaluate the water use performance of an irrigation project (Levine, 1982 & Perry, 1996). These two Indicators are as follows:

2.1.2.1 Relative Water Supply

Relative water supply (RWS) mentions the adequacy of the irrigation water deliveries. Data were aggregated from BWDB, IWM & BMD for the year of 2000 to 2011. This indicator was estimated by adopting the following formula in equation (5).

$$RWS = \frac{Total\ Water\ Supply}{Crop\ water\ Demand} \quad (5)$$

2.1.2.2 Relative Irrigation Supply

For the computation of relative irrigation supply, data of total irrigation supply and irrigation demand for different cropping season are required. These data were collected from WRE Department of BUET, BWDB and IWM. Then using the following formula relative irrigation supply of the project was estimated.

$$RIS = \frac{Irrigation\ Supply}{Irrigation\ Demand} \tag{6}$$

2.1.3 Economic Performance

In this thesis study this paper has introduced the following two indicators to evaluate the economic performance of the Teesta barrage irrigation project.

2.1.3.1 Effectiveness of Fee Collection

To determine the effectiveness of fee collection, data of both total fee and collected fee are required. These data were assembled from the BWDB and field visit for the year of 2000 to 2011 and using the following formula in equation (7), the economic performance was evaluated in terms of effectiveness of fee collection.

$$The\ Effectiveness\ of\ Fee\ collection = \frac{Collected\ Fee}{Total\ Fee} \tag{7}$$

2.1.3.2 Financial Self- Sufficiency

For the Computation of Financial Self-Sufficiency, data of both annual fee revenue and total expenditure are required. These data were collected from the BWDB and field survey for the year of 2000 to 2011 and using the following formula of equation (8) the financial self-sufficiency was measured.

$$Financial\ Self-Sufficiency = \frac{Annual\ Fee\ Revenue}{Total\ Annual\ Expenditure} \tag{8}$$

3 Results and Discussions

The variation of irrigated area performance in different cropping seasons has been shown in Figure 1. The investigated result revealed that the irrigated area performance was the highest in kharif-1 among the three cropping seasons (except one) in all observed years. It was also observed that this value was exactly 1 in 2005-06 (except one) for all cropping seasons and after that it followed a gradually increasing trend in later years, which indicates that after implementation of Teesta barrage project, the overall irrigated area performance of the north-west zone of Bangladesh had been improved gradually compared to the past.

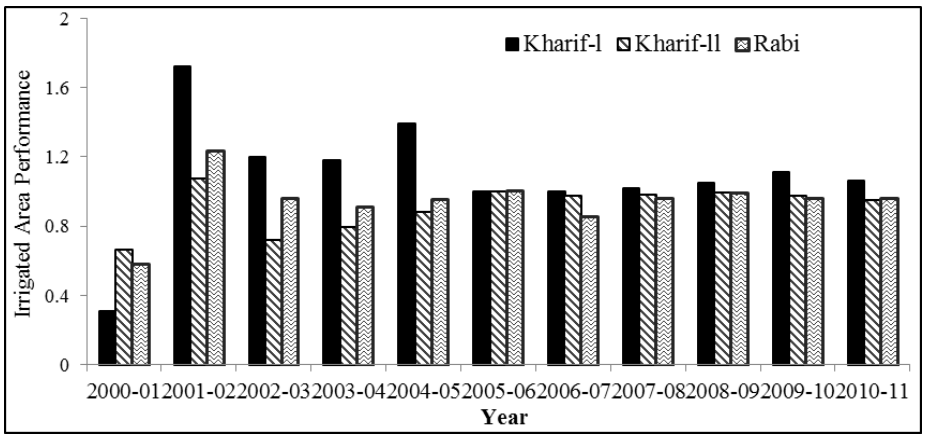

Figure 1. Irrigated area performance in different cropping season.

The variation of cropping intensity performance in different investigated year has been illustrated in Figure 2. The investigated result exhibits that there was a slight fluctuation in the cropping intensity performance of the irrigated area throughout the study period, which varied from 0.77 to 0.93 with a maximum value of 0.93 in 2004-05. This observation indicates that the overall cropping intensity performance of the Teesta barrage project was quite good and satisfactory as it remains close to 1.

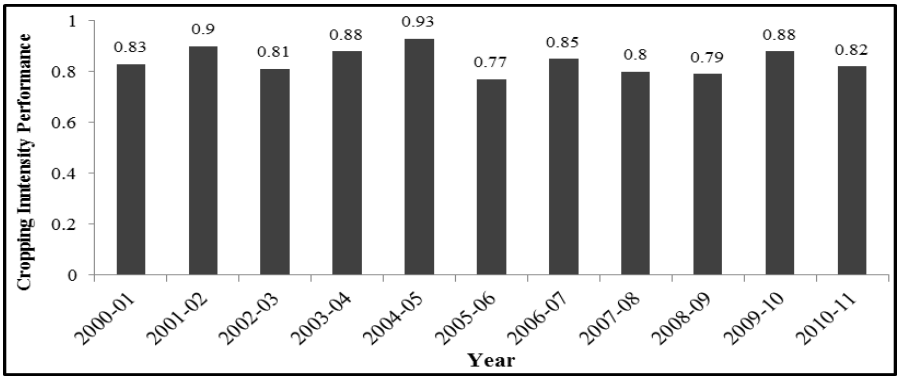

Figure 2. Cropping intensity performance in different year.

The overall yield performance of Teesta barrage irrigation project in different cropping seasons has been shown in Figure 3. The results clearly revealed that the yield performance was good and optimal enough in kharif- I among three cropping seasons. In this study, it was also observed that the yield performance of the project was lowest in 2000-01, whereas after a certain period it simulated an upward trend (close to 1), which indicates a good sign for the project down the line.

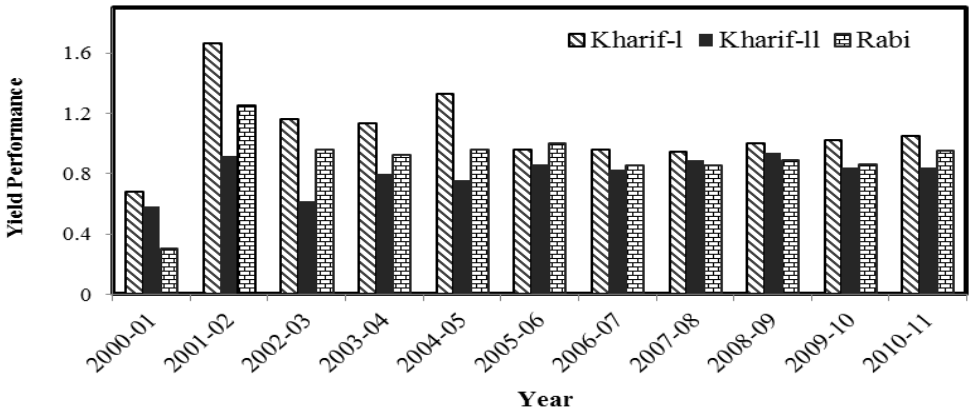

Figure 3. Yield performance in different cropping season.

The overall production performance of Teesta Barrage Irrigation Project (TBIP) in different cropping season has been demonstrated in Figure 4. It was observed that the project showed the better performance in kharif-1 cropping season compared to the rest two seasons throughout the study year (except one), whereas it was the highest in 2001 and lowest in 2000. However, after a certain period it was also observed that the production performance of the project also increased in both kharif-II and rabi season (around 1), which is a good portent for the project. Therefore, to keep up this trend steady and even to improve its production performance to 1 or more, the necessary initiatives should be taken up by the respective authority in this regard to some extent.

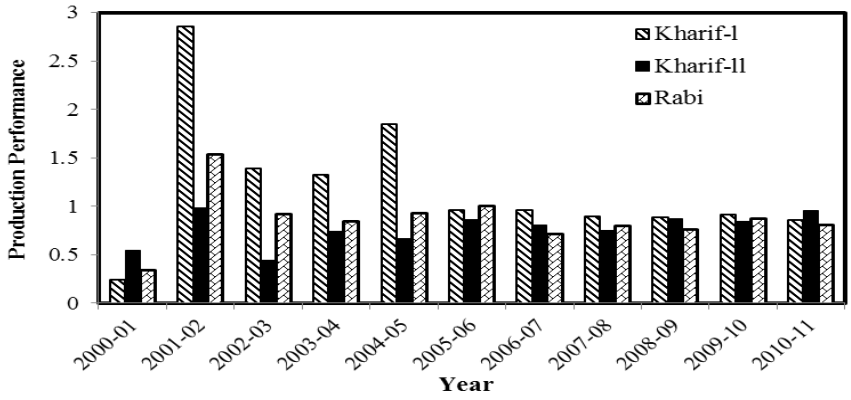

Figure 4. Production performance in different cropping season.

The variation of Relative Water Supply (RWS) of the project in different cropping seasons has been sketched graphically and shown in Figure 5. It is categorically visible that the RWS of the project was much higher in both kharif-I and kharif- II than that of in Rabi season, which implies that the water supply of the project during Rabi season was too much insufficient in respect to the crop water demand. It was also observed that though the RWS in both kharif-I and kharif- II was higher, it was yet less than 1 (except two years), which indicates that the water supply was not adequate enough to fulfill the crop water demand in these seasons as well. However, as it is one of the foremost important indicators of an irrigation project, steps should be taken to ensure sufficient water supply in Rabi season.

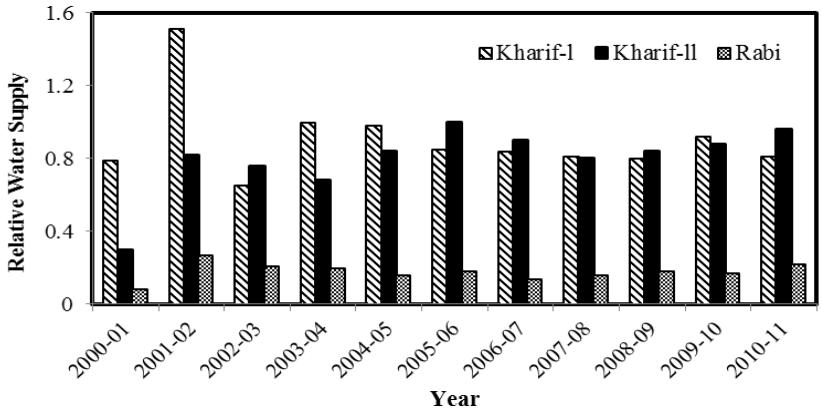

Figure 5. Relative water supply in different cropping season.

Similarly, the variation of Relative Irrigation Supply (RIS) of the project in various cropping seasons has been illustrated in Figure 6 as below. The investigated result showed that the RIS was the highest in Rabi season among three cropping seasons, which revealed that in the north-west zone of Bangladesh there was comparatively higher irrigation water demand in Rabi season. It was also observed that the value of RIS was maximum (0.47) in 2005-06 year and was even too beneath in rest of the years, which indicates that the irrigation water supplied by this project was not adequate enough (less than half) to satisfy the crop water demand in Rabi season and as it relies mainly on the availability of water in the main source, the corresponding authority should be more concern about this inevitable fact and take all necessary positive steps to increase the capacity of the catchment area and lay in as much water as possible in wet season to ensure the sufficient irrigation supply in Rabi season.

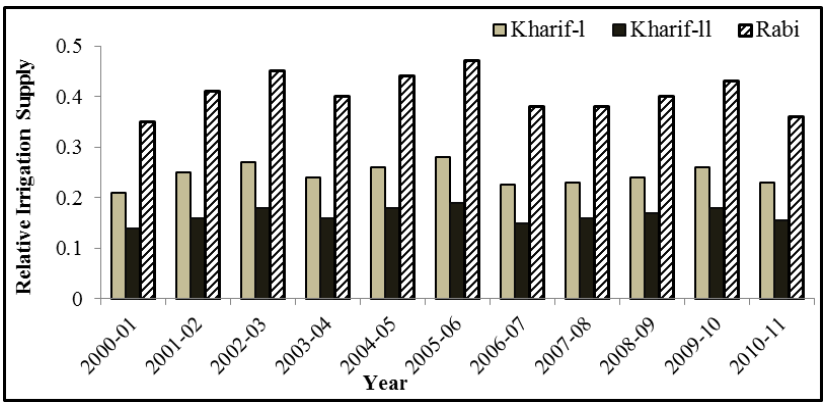

Figure 6. Relative irrigation supply in different cropping season.

The economic indicator such as effectiveness of fee collection and financial self sufficiency of the Teesta barrage irrigation project of different year has been shown in Figure 7. The chart shows that the value of effectiveness of fee collection ranged from 23% to 37%, which indicate that the fee collection performance was very poor of this irrigation project. Consequently, Plans and rules should be provided for fee collection and it is also necessary to increase awareness among farmers to pay the fee of their used water. Furthermore, it was also observed that the financial self-sufficiency was very poor (around 20%) of the project, which indicate that the annual expenditure was very high in comparison with the annual revenue. Consequently, the existing condition should be changed by introducing convenient rules to achieve the targeted annual revenue.

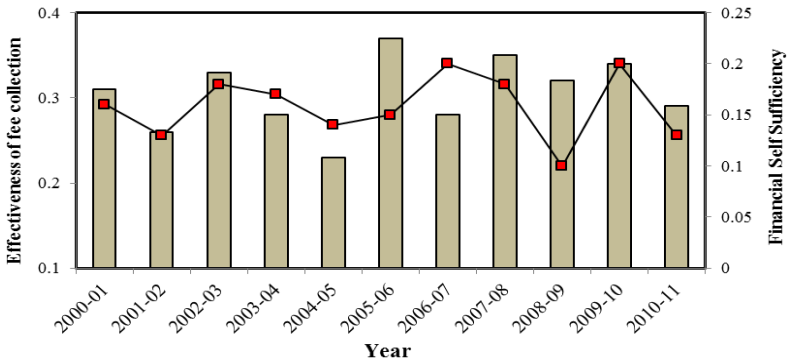

Figure 7. Effectiveness of fee collection & financial self -sufficiency.

4 Conclusion

The following conclusions could be summarized based on the scope of this study:

- Though the irrigated area performance was good only in kharif-1 season before the project was established, the overall irrigated area performance of the north-west zone of Bangladesh had been improved gradually compared to the past after the implementation of this project.
- Although the irrigated area of the TBP has been increasing steadily since 2000 and the maximum irrigated area of 76000 ha was achieved in 2005, this is still far shortage of the designed capacity of about 111000 ha.
- The project was designed mainly for supplementary irrigation during kharif-II season. In this season, though TBP performs well, the demand of substantial water supply in Rabi season also raises at present.
- According to the questionnaire survey, farmers are not satisfied enough about the schedule of irrigation. Therefore, the farmers should be provided with more guidelines about the proper schedule of irrigation for the better production and yield performance of the irrigated area of the project.
- Though irrigation is one of the many inputs contributing towards increase in yield, it can be concluded that the TBP did not have a significant impact in increasing the yield of Aman in the project area.
- Though the cropping intensity performance was not so good before the implementation of the project, it is now gradually improving rapidly.

5 Acknowledgement

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