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Research Article

Mechanical Rice Transplanting: A Profitable Business for Bangladeshi Agropreneurs

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Abstract

Mechanical rice transplanting has been emerged as an alternative of traditional rice transplanting in Bangladesh. Hence, this study analyzed the financial viability of rice transplanter operation businesses for agropreneurs using the "RuralInvest" software developed by FAO. The analysis considered that seedlings were raised by the farmers themselves and the estimated lifespan of a rice transplanter machine was set at 6 years. The direct beneficiaries were identified as 4 individuals, while an additional 40 individuals were considered indirect beneficiaries of this business model. The financial assessment based on field data revealed favorable indicators with an internal rate of return (IRR) of 45.09%, a net present value (NPV) of BDT 644276, a payback period of 2 years and an annual net income of BDT 199860. By adopting the mechanical rice transplanting agropreneur model, individuals are provided with an opportunity to generate income while contributing to the widespread use of mechanical transplanting methods. This not only addresses the challenges of labor scarcity and high wages but also improves the timeliness of transplanting thereby enhancing food security in Bangladesh.

Keywords: Agropreneurs, Rice transplanter, RuralInvest, Transplanting

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1. Introduction

Bangladesh is a developing country [1] but its agricultural sector has been growing progressively in recent years and this growth has contributed to the country's recent successes in food production and food security [2]. While the country's development indicators are encouraging [3] then the agriculture productivity in terms of mechanized agriculture remains dismally low [4]. In line with other development indicators, agricultural mechanization could enhance and give a boost to agriculture sector growth by enhancing food production by timely operations on the fields and reducing the cost of production using machines instead of labor [5]. The cost and shortage of labor is increasing in Bangladesh [6] and now only 41% of the total labor force of Bangladesh is involved in agriculture sector [7]. Agricultural mechanization policy is promoting agricultural machinery to address the labor shortage issue [8]. Now, the country is focusing on putting modern agricultural machinery like rice transplanters, combine harvesters, paddy dryers, etc. into use to enhance agricultural mechanization [9].

Now, most of the country's mechanical transplanters are used for training and demonstration purposes to spread the technology to farmers and agropreneurs. Government entities, research institutions, as well as private sector investors are also participating [10]. The rice transplanter machine can transplant seedlings raised on polythene mats or plastic trays [11]. Mechanical transplanting is less labor-intensive and faster compared to manual traditional rice transplanting [12]. Mechanical rice transplanting reduces the dependency on labor and ensures on-time transplanting of paddy seedlings [13]. Considering this, the government of Bangladesh is giving

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subsidies for the purchase of rice transplanters (50% generally and 70% for selected coastal and haor areas) for Bangladeshi agropreneurs [14]. These agropreneurs are doing their business by renting their machines to their neighbours' also known as local service providers (LSP) [15, 16].

Even though farmers are innovative and entrepreneurial, they often lack the knowledge and skills to do so alone [17]. They need advice from others; they need services. The United Nations Food and Agriculture Organization (FAO) created the RuralInvest toolkit [18] to evaluate the potential of such entrepreneurs. To determine the entrepreneurial viability of a rice transplanter operation business for mechanical rice transplanting, this study employed the RuralInvest toolkit software to analyze financial data from rice transplanter agropreneurs. The research also analyzes the small holder inclusivity and suitability of financial technology to enhance farm mechanization.

2. Materials and Methods

2.1 Location and duration of the study

From 2017 to 2019, extensive field trials of rice transplanter were conducted to identify the appropriate rice transplanting machine and suitability of the rice transplanter machine for the farmers of the Southern Delta of Bangladesh. This study was conducted at Hazipur village in Kalapara Upazila of Patuakhali district. The study location is shown in Figure 1.

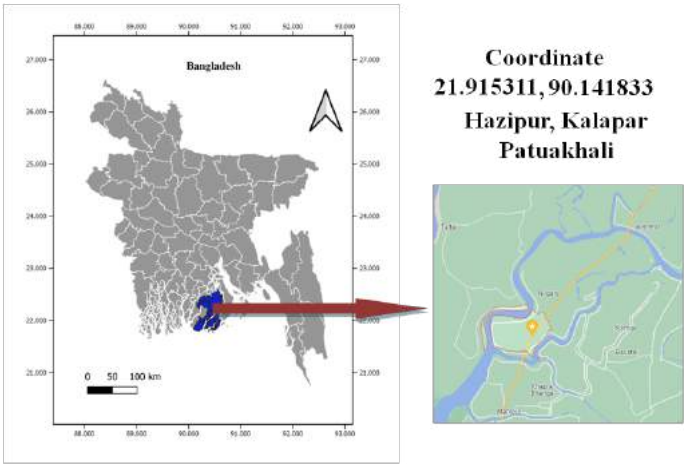

Figure 1. Location of the study

2.2 Data collection and analysis

A detailed breakdown of the significant parameters considered during the experiment is provided in Table 1. Some of these parameters include the number of direct and indirect beneficiaries, the cost of the rice transplanter machine, the requirement for operators and labor, fixed costs like shelter costs, the annual area coverage of the transplanter machine, the consumption of fuel and oil, maintenance costs (cleaning and greasing), and the anticipated unit sales income per hectare. These details serve as a base parameter for assessing the economic viability of the rice transplanter.

Table 1. Estimated data for analysis in RuralInvest based on field experiment

Description	Assumptions and collected data
Number of direct beneficiaries	04 (1 household)
Number of indirect beneficiaries	40 (10 household)
Price of the machine	BDT 400000
Operator and labor requirement	1 operator and 2 labor
Fixed cost items (tax, shelter etc.)	BDT 1200
Yearly covered area by rice transplanter	20 ha
Fuel	65 liters
Oil	1 liter
Maintenance cost	BDT 200 per season
Unit sales income	BDT 5500 per ha

2.3 RuralInvest Toolkit

The RuralInvest program examined the collected data of the rice transplanter operation business in accordance with the instructions in the RuralInvest (RIV) toolkit (Figure 2). A methodology, manuals, training materials and software make up the RIV toolkit. Combined, these provide a simple yet efficient process for identifying, creating, implementing, managing, and evaluating modest community or family investment projects. RIV, a program created by the FAO, automates a lot of the financial computations necessary to assess project proposals. It incorporates all relevant factors, allows for alternative comparison, and can be applied to project tracking and evaluation. The RIV software's main outputs include annual cash flow, internal rate of return (IRR), net present value (NPV), payback period, expenses, revenue, and net earnings.

Figure 2. RuralInvest software interface (screenshot of software)

2.4 Block and unit of production (UoP)

The link between the input and output for one production cycle is represented by the term unit of production (UoP). For one production cycle, the unit's entire operational cost and income were put into the blocks. The results are multiplied by the number of production cycles per year to get annual operational costs, revenues, and income [19].

2.5 Internal rate of return (IRR)

IRR is called the discount cash flow yield on investment, or effective rate of interest method, or marginal efficiency of capital. The IRR is the value of the discount factor when the NPV is zero [20].

IRR = Lower discount rate + (Difference between the discount rates) × {Present worth of cash flow at lower discount rate/(Sum of the present worth of cash flows at the two discount rates, signs ignored)} (i)

2.6 Net present value (NPV)

NPV was calculated by using the following formula [20]:

NPV =∑ Present worth of Benefits – ∑ Present worth of costs (ii)

2.7 Payback period

The term payback period (PP) refers to the time frame in which investment expenses can be repaid by revenues [21].

PP = Investment (total initial, BDT)/ Net benefit (BDT/yr.) (ii)

3. Results and Discussion

3.1 Financing of investment

Financial and working capital for starting the rice transplanter operation business by an agropreneurs was observed BDT 400000 for purchase of rice transplanter machine. The percentages of initial investment from own resources were 100% (Table 2) for starting the business for the first time.

Table 2. Financing of investment

Type	Amount (BDT)	Percentage
Donation	0.00	0
Own resources	400,000.00	100
To be financed	0.00	0
Total	400,000.00	100

3.2 Investment per beneficiary

Investment per beneficiary for household and individual beneficiaries were estimated. The investment amount for a direct beneficiary for household was BDT 400000 and for indirect beneficiaries it was BDT 40000. For the individual level the amount was BDT 100000 and BDT 10000, respectively (Table 3).

Table 3. Investment per beneficiary

Beneficiary type	For household level (BDT)	For individual (man, woman, and children) (BDT)
Direct beneficiaries	400,000.00	100,000.00
Indirect beneficiaries	40,000.00	10,000.00

3.3 Production block and cash flow

Two seasons were considered for production block for 6 years. The number of productions per cycle was 1, 2 cycle per year and a total of 20 working days were considered (Figure 3). Receipt of payment was considered just after the service.

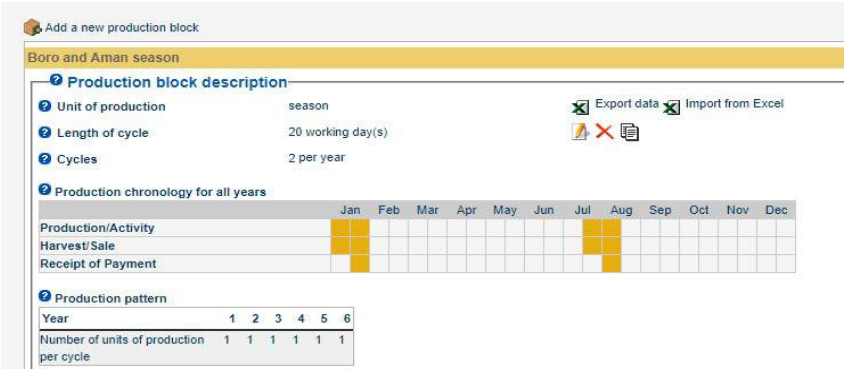

Figure 3. Production block description in the RIV software (screenshot of software)

Cash flow of the business is shown in Table 4. The positive cumulative cash flow was seen from the first year as the income will generate from the first season. Over a 6-year period the cash flow of the business was positive, which indicates that if the assumed area coverage was covered by the machine there was no chance of loss for the business.

Table 4. Cash flow of the rice transplanter operation business

Year	1	2	3	4	5	6
Total expenses	418940	18940	18940	18940	18940	18940
Cash flow before financing	-198940	201060	201060	201060	201060	201060
Cash flow after financing	201060	201060	201060	201060	201060	201060
Cumulative cash flow	201060	402120	603180	804240	1005300	1206360

3.4 IRR, NPV and payback period

The IRR, NPV and payback period was found 45.09%, BDT 644276 and 2 years, respectively for rice transplanter operation business (Figure 5).

Figure 5. Financial profitability (screenshot of software)

The developed rice transplanter business is profitable because the IRR value outperforms any bank interest rate and the NPV is positive. In this situation, the payback period shows that, if the business plans continue to be successful, the machine's cost will be recovered after two years. The rice transplanter was expected to last 6 years.

4. Conclusions

The RuralInvest software developed by FAO is useful in determining the financial parameters for the decision-making process of small businesses for agropreneurs. The financial parameters of the rice transplanter operation business for the agropreneurs revealed that mechanical rice transplanting technology is suitable for commercial use for small-holder farmers. The initial investment of the business will be recovered within 2 years. Agropreneurs can start a business in their locality with the help of a government subsidy, which will reduce the high initial investment burden.

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