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Investment in fish seed multiplication farms in Bangladesh: Evidences of an attractive business

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Abstract
This study mainly evaluated the profitability of Fish Seed Multiplication Farms (FSMFs) having hatchery, nursery and hatchery-cum-nursery located in the districts of Jessore, Jhenidah and Narail in Bangladesh. The general findings of the study were that the investment in FSMFs with hatchery, nursery and hatchery-cum-nursery was highly profitable business. The results clearly indicated that the investment on hatchery was the most profitable than those of nursery and hatchery-cum-nursery operations from the viewpoints of individual investors. The results of sensitivity analysis suggested that the investment in nursery farm was a risky business with 20 per cent increase in operation and management as well was production costs or 20 per cent reduction in benefits if other things remaining the same. It was also evident from the study that the investors of FSMFs had currently been facing some crucial problems, which among others are: problems of inbreeding, shortage of brood fish, incidence of diseases, unavailability of certain inputs and lack of credit.
Keywords: Fish seed, Benefit-cost ratio, Internal rate of return

Introduction

Fish culture under scientific management with hatchery produced seeds is relatively a new gesture in Bangladesh, which at the very beginning was fully dependent on seeds collected from rivers, estuaries and coastlines. Production of fish seeds in hatcheries through induced breeding initiated in the country in 1967. In the last decade, fish culture under improved management expanded rapidly. The major input in culture fishery is quality fish seed and the expansion and development of aquaculture production depend mainly on the availability of seed. In order to ensure the supply of fish seed it is essential to establish hatchery. For this purpose, the Department of Fisheries (DOF) established 110 Fish Seed Multiplication Farms (FSMFs) covering almost all the districts of Bangladesh. Private FSMFs have currently been established in different areas to the country which are also producing fish seeds and competing with government FSMFs.

However, timely supply of fish of seeds high yielding species is a precondition for fish culture in inland water bodies. FSMFs can ensure this service. The supply of stockable fish seeds does not depend only on the collection of spawn from the hatcheries

and the natural sources. But it also depend of the survivability of spawn to fingerlings in the nursery ponds. So importance of fish seed farming in the country cannot be ignored. The shortage of fish seed has been identified by various agencies as the main constraint for aquaculture development in Bangladesh. A few empirical studies (Ali *et al.* 1982, Islam and Dewan 1987) observed that pond fish production was suffering due to shortage of fish seeds. An economic study is therefore very essential of FSMFs possessing either hatching or nursery facilities or both together to understand their profitability, the production status and possibilities of increasing more production. As such no study has yet been undertaken in this regard, the present study was a moderate attempt to determine the profitability of FSMFs and problems related to fish seed business.

Methods

The present study was based on primary data of a sample survey of FSMFs under the management of private ownership. On the basis of easy accessibility and high concentration of fish seed farms, Jessore and Jhenidah districts were selected for this study. Three categories of FSMFs such as: (a) FSMFs with hatchery (b) FSMFs with nursery pond and (c) FSMFs with hatchery-cum-nursery pond were investigated in this study. Out of 47 pre-selected FSMFs, 17 were hatchery, 10 were nursery and 20 were hatchery-cum-nursery.

Three sets of questionnaires for each of the selected categories of FSMFs were prepared separately to collect relevant information. The survey of the present study covered the whole production period of 1998. The formal survey, however, was conducted during the months from March to May'99. The data so collected were then coded and data entry and analysis were done to obtain results useful in the project appraisal calculations. The whole analysis of course was done on per farm basis.

Methods of appraisal

The method of project appraisal suggested by Gittinger (1994) was followed, since it is widely used by the World Bank and also many other donor and planning agencies, for evaluating agricultural projects (Miah and Hardaker 1988). This study was limited only to financial analysis.

Most investments accrue benefits and incur costs in the future as well as in the present. The time streams of costs and benefits can vary considerably among projects. For this reason, costs incurred and benefits derived in different periods must be reduced to some common point in time, before they can be compared with each other (Riodan 1980, Miah and Hardaker 1988). In the financial analysis, all costs and benefits were determined in domestic currency using farm-gate prices.

This appraisal, however, is based on the actual field level data, rather than the planned level utilization and/or recommendations of the concerned aquaculture experts regarding the selected FSMFs. Three discounting measures namely: (i) benefit-cost ratio

(BCR), (ii) net present value (NPV) and (iii) internal rate of return (IRR) were employed in the study.

Benefits of FSMFs

The items considered under the benefits of different categories of FSMFs are as follows:

a. Gross value of production includes mainly the values of spawn and/or fingerlings of the concerned fish seed farms,
b. Return from sale of unproductive and/or old brood fish after every five years,
c. The salvage values of the concerned capital items and/or durable tools and equipment were estimated considering the views of the concerned experts, traders and their ultimate users. Salvage values of these assets have been added to the benefit stream at the last year of the project life and/or at the end of the productive life of the concerned equipment.

Cost of FSMFs

The cost of FSMFs can broadly be classified into the following heads:

a. Investment costs,
b. Operation and maintenance (O & M) costs, and
c. Production costs.

Investment cost of the selected FSMFs included cost of farm structures and building, cost of shallow tube-well (STW), cost of others tools and equipment, cost of brood fish and cost of re-excavation of ponds.

O & M costs involve cost of human labour, cost of fuel and dewatering cost, cost of electricity, cost of repairing and spare parts. These were essential for all categories of FSMFs to produce fish seeds and continuing the farm business.

Production costs associated with fish farming was calculated by taking into considerations the cost of humar labour, feed, fertilizers, chemicals, lime and miscellaneous cost and cost of hormone was also included for hatchery and hatchery-cum-nursery farms for induced breeding. On the other hand, cost of stocking of spawn was included for FSMFs with nursery and hatchery-cum-nursery.

Discount rate

The result of benefit-cost analysis is highly sensitive to the discount rate. The choice of an appropriate discount rate, therefore, plays a vital role in the appraisal of project. The selection of discount factor has become more different in developing countries because of various imperfections and distortion in capital market. However, the available literatures (Miah and Hardaker 1988, Gittinger 1994) suggest that the opportunity costs of capital in most developing countries vary between 8 to 15 percent. In this study 14 percent discount rate was chosen for the appraisal of fish seed farming projects. Other researches (Kabir 1995, Islam and Miah 1999) have also used this rate.

Results and discussion

The appraisal results of the evaluation based on the opinion of individual investors of hatchery, nursery and hatchery-cum-nursery farms are presented in this section.

Financial analysis

The calculations of financial appraisal the FSMFs were based on the following general and technical assumptions:

General assumptions:

a. A typical model of FSMFs with hatchery, nursery and hatchery-cum-nursery having 1.91 ha. 2.5 ha and 2.92 ha farm sizes, respectively and there will be no change in farm size throughout the project life.
b. All brood fish have been purchased in cash for the purpose of induced breeding for every five years.
c. It was assumed that farmers stocked all different species of brood fish at a time and the species combinations and ratio would remain the same.
d. The rate of stocking of brood fish in different ponds was assumed 1709-1870 Kg/ha depending upon the condition of fish and ponds.
e. Brood fish mortality in every five years was assumed to be nil and 5 percent were not used for breeding purpose, and spawn production was assumed not to be affected by these reasons.
f. Per unit prices of the concerned inputs and outputs are given and constant during the whole project life.

Technical assumptions

a. The most productive age of brood fish was assumed to range from 1 to 7 years for the concerned species and the same brood fish was used for induced breeding up to 7 years of age.
b. The size ranges of different species used by the model FSMFs for induced breeding were assumed 1.5 kg Rohu, 3.0 kg Mrigal, 2.5 kg Silver carp, 2.5 kg Grass carp, 2.0 kg Mirror carp, 2.0 kg Carpio and 0.5 kg Thai sarpunti.
c. The nursery owners assumed to buy 4 days old spawns, stock the spawns in the nursery pond for 2-3 months to raise up to 2-3$''$ and sell out to the buyers.

In can be seen from Table 1 that the investments on all categories of FSMFs are profitable business. It is evident from the table that BCRs of the three categories of farms are more than the unity and NPVs are also positive at the selected discount rate and all these investments yields much higher IRR than the possible opportunity costs of capital.

Table 1. Result of financial analysis of FSMFs

Discounted measures	FSMFs with hatchery	FSMFs with nursery ponds	FSMFs with hatchery-cum-nursery
BCR at 14%	1.49	1.17	1.22
NPV at 14% (Tk 10^3)	1808.67	310.10	849.16
IRR (percent)	80.0	41.0	56.0

Source: Adapted from Siddique (1999).

It is evident from the above table that all the selected FSMFs are attractive to individual investors considering the real world situation. It is also evident from the study that FSMFs with hatchery will bring a higher profit than the FSMFs with nursery ponds and FSMFs with hatchery-cum-nursery ponds.

Sensitivity analysis

The results of sensitivity analysis show how the value of the investment criteria changes with the changes in the value of any variable in the discounted cash flow analysis. The profitability of these small-scale fisheries farm projects may be sensitive, as expected, to O & M costs, production costs and gross benefit of the project. Two factors were, therefore, taken into consideration for sensitivity analysis of FSMFs such as: (i) reducing existing benefits (other than salvages values of the concerned equipment) at the rate of 10 and 20 percent, and (ii) if O & M and production costs increase at the rate of 10 and 20 percent.

Under the changed circumstances, the financial analysis has been reworked separately in this section to see what happen in the profitability of FSMFs.

Table 2. Result sensitivity analysis of FSMFs considering 10 percent increase in O & M and production cost

Discounted measures	FSMFs with hatchery	FSMFs with nursery ponds	FSMFs with hatchery-cum-nursery
BCR at 14%	1.37	1.08	1.13
NPV at 14% (Tk 10^3)	1518.94	150.48	526.85
IRR (percent)	66	27	38

Source: Adapted from Siddique (1999).

It is evident from the results presented in Table 2 that BCRs of all the selected FSMFs are greater than unity, NPVs are positive and IRRs are higher than the opportunity cost of capital (14 percent). This implies that if O & M and production cost would increase at the rate of 10 percent, while benefits and other costs would remain the same, investment of FSMFs would still be profitable.

Table 3. Result sensitivity analysis of FSMFs considering 10 percent increase in O & M and production cost

Discounted measures	FSMFs with hatchery	FSMFs with nursery ponds	FSMFs with hatchery-cum-nursery
BCR at 14%	1.28	0.99	1.04
NPV at 14% (Tk 10^3)	1229.20	-10.04	204.53
IRR (percent)	54	13	23

Source: Adapted from Siddique (1999).

Table 3 shows that BCRs of hatchery and hatchery-cum-nursery farms are still greater than unity, NPVs are positive and IRRs are higher than the opportunity cost of capital. This situation also yields more profits to the investors of hatchery and hatchery-cum-nursery farms. On the other hand, the nursery farm could not make any profit at this changed situation. This implies that if O & M and production costs of nursery farms increase by 20 percent then it becomes a risky to invest on nursery farms.

Table 4. Result sensitivity analysis of FSMFs considering 10 percent increase in Gross profit

Discounted measures	FSMFs with hatchery	FSMFs with nursery ponds	FSMFs with hatchery-cum-nursery
BCR at 14%	1.34	1.06	1.10
NPV at 14% (Tk 10^3)	1267.27	106.84	392.81
IRR (percent)	58	24	33

Source: Adapted from Siddique (1999).

Table 4 indicates that BCRs of all categories of farms are greater than unity, NPVs are positive and IRRs are still higher than the opportunity cost of capital. This implies that if benefits would decrease at the rate of 10 percent while all costs would remain the same, investment on all categories of farm projects would still be profitable.

Table 5. Result sensitivity analysis of FSMFs considering 20 percent decrease in gross profit

Discounted measures	FSMFs with hatchery	FSMFs with nursery ponds	FSMFs with hatchery-cum-nursery
BCR at 14%	1.19	0.94	0.98
NPV at 14% (Tk 10^3)	725.43	-97.41	-63.54
IRR (percent)	38	4	11

Source: Adapted from Siddique (1999).

It can be seen from Table 5 that BCR of hatchery farm is greater than the unity, NPV is positive and IRR is higher than the opportunity cost of capital, while nursery farm and hatchery-cum-nursery are making loss at 14 percent discount rate. This implies that if gross benefit would decrease at the rate of 20 percent, while all costs remain the same, investment on only hatchery farm would still be profitable and nursery farm is more loser than the hatchery-cum-nursery. It can therefore be concluded that the BCR, NPV and IRR are highly sensitive to change in benefits of FSMFs.

Although the selected FSMFs are found highly profitable considering the real world situation, but the results of sensitivity analysis clearly hint that O & M and production cost and gross benefits, as expected, have a strong influence on the opportunity of hatchery, nursery and hatchery-cum-nursery farms.

Problems of owners of FSMFs

Fish seed production through artificial propagation or induced breeding is relatively a new practice in Bangladesh. This section indicates the major problems facing the farmers in conducting fish seed farm business. For the sake of convenience the problems and constraints faced by the selected owners of FSMFs have been categorized under three groups such as: (i) technical (ii) economic and (iii) social.

Technical problems are related to production techniques and technologies such as breeding, lack of brood fish and its management problem, non-availability of various inputs, attack of diseases infestation, insufficient water in dry season and lack of scientific knowledge and technology.

Economic problems and constraints are related to such financial considerations are lack of capital or institutional credit, problems of selling spawn or marketing facilities and high price of various inputs.

Some social problems were also faced by all categories of owners of FSMFs such as: theft of brood fish, poisoning of ponds and problems of getting pond.

The farmers put forward some suggestions for resolving these problems, which included implementation of government rules, fixation of prices of key inputs, providing social, moral and scientific education and training to the producers and improving marketing facilities.

Policy implication and conclusions

The fisheries sector must make a significant contribution and could contribute more than any development sector of Bangladesh in the form of income, employment, human nutrition and foreign exchange earning to the national economy. Several policy recommendations as emerged from the results of this study which are highlighted below:

Present level of institutional credit of fisheries is not sufficient to meet the demand for credit of the owners of FSMFs. Since these farms are profitable, financial

institutions should come forward to provide required credit to the genuine farmers for establishing new FSMFs.

- In order to meet the demand for brood fish for induced breeding production of brood fish through scientific management should be increased.
- For overcoming the inbreeding problem, the hatchery owners can exchange brood fish among their hatcheries. It is advisable to set up "brood bank" for successful hatchery operation in terms of quality of seeds.
- Government should take positive steps to train up the concerned interested people on modern methods of brood fish rearing, hatchery and nursery management.
- More emphasis should be given on nursery pond management.
- An effective mechanism for information exchange between the farmers and researchers has to be developed and maintained.

The present evaluation provides some useful information for farmers, researchers and decision-markers regarding the economic as prospects of fish seed production. The findings of the study, however, are based on the data collected from a specific area of Bangladesh. These findings should, therefore, be interpreted cautiously if any greater generalizations are sought for different regions with distinct topographies of the country. Nevertheless, fish farmers from the similar region, who have enough money and resources should come forward to invest in FSMFs, since these are highly profitable and attractive business to the investors.

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