Resource Transformation and Social Profitability in Small Scale Aqua-Enterprises: Case Studies

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ABSTRACT

Aqua-entrepreneurs are the key factor for aquaculture growth in the developing country like India. The study analyses and descriptively compares the economic strength of transforming local non-marketable resources into marketable outputs by two selected aqua-entrepreneurs. The study also emphasized on the larger social and ecological profits they create in the process. The objective was accomplished using Resource Cost Ratio (RCR) approach wherein RCR value reflects the economic strength of converting non-marketable resources to marketable output. RCR values (2004-05) of Sarkar Matsya Prakalpa (SMP) *and* Deepak Roy's Aqua-farm (DRA) *were found to be 0.44 and 0.76 respectively. Study reveals that* DRA *was more efficient and profitable than* SMP *in terms of profit over private as well as social costs. The* SMP *is a small but better organized farm showing higher profit per unit area as compared to* DRA. *Overall, both are innovative and unique to efficiently transform the local human and material resources to create economically viable and socially desirable outputs.*

Keywords: *Aquaculture; aqua-entrepreneurs; resource transformation; resource cost ratio, social profitability.*

Aquaculture remains a growing, vibrant and important production sector for high protein food. World aquaculture output has increased substantially, from less than 1 million tonnes of annual production in 1950 to the 52.5 million tonnes reported for 2008, increasing at three times the rate of world meat production (2.7 % from poultry and livestock together) in the same period (*FAO 2010*). In contrast to world capture fisheries production, which has almost stopped growing since the mid-1980s, the aquaculture sector maintained an average annual growth rate of 8.3 % worldwide between 1970 and 2008. Since mid-1980s, Indian fish production from natural waterways, such as rivers and lakes, has trended downwards, primarily due to proliferation of water control structures, indiscriminate fishing and habitat degradation (*Katiha 2000*). Diminishing resources, the energy crisis and the resultant high cost of fishing have led to an increased realization of the potential for and versatility of aquaculture as a viable and cost effective alternative to capture fisheries (*Ayyapan and Jena 2001; Ayyapan 2004; Jena and Jena 2004; Pillai* and *Katiha 2004*). The annual growth rate in world aquaculture production between 2006 and 2008 was 5.3 per cent in volume terms (*FAO 2010*) and it is considered a potentially significant growth area for the future inland fisheries development in India. Aquaculture makes a very strong contribution in fish protein supply, and hence the food production, as well, employment generation.

One of the most important issues in aquaculture development is the efficient management of local available resources by entrepreneurs. Aqua-entrepreneurs are the key influential factor for aquaculture growth and to turn it into a commercially viable business especially in India.

Profitability of aqua-business depends upon how the available resources are combined to get efficient output like fish. Two innovative entrepreneurs in the aqua-business sector from North Bengal (India) were studied using 'Resource Cost Ratio approach' to know the economic strength of transforming non-marketable resources like unskilled labor etc. to relatively marketable outputs like fish. To transform local resources into marketable product or services, entrepreneurs organizes some innovative approaches. The ways of resource arrangement and innovations have some effect on cost and profitability of enterprise both in private as well as social terms. This study provides the micro-economic analysis of private and social profitability by two selected

successful aqua-entrepreneurs in terms of RCR and therefore, the comparison between them in order to recognize the resource utilization pattern that affects the level of private and social profitability.

METHODOLOGY

The Resource Cost Ratio (RCR) approach is a variant of Domestic Resource Cost Ratio (DRCR) that *Morris (1990)* has applied to determine the comparative advantage between countries. *Datta (2001)* has argued about the robustness of DRCR in the study of global competitiveness of Indian agri-business products as against the traditional measure of competitiveness. In the present case, the issue at hand was to assess besides the conventional private cost and benefit, the social and ecological costs and benefit at micro-level. *Debnath et al. (2009)* have used this approach for estimation of resource use efficiency and social profitability of an integrated aqua-farm, Tripura. *Debnath et al (2010)* reinterpreted DRCR and suitably adapted to be applied at micro-level i.e. at individual farm level.

In the RCR approach, all the possible inputs and outputs of a production unit are categorized as marketable and non-marketable. Here, factors of production (inputs) which enter in the production system from the market by the producer is considered as marketable input, for example skilled labor, manure, fish feed, lime etc. And those which enter in the market from the production system (even if it is self-consumed, it must not be used as an input in production system) are the marketable outputs, for example, produced fish, produced milk in fish-cum-livestock farm etc. (even if it is consumed by the producer's family also). On the other hand, the non-marketable inputs are those which are relatively less marketable than that of the products (like fish) in the local area. Here, unskilled labor was categorized as a non-marketable input for *resource cost ratio approach*. It is considered so as unskilled can't get steady jobs at steady wages like the standard skilled labors, in other words, they are not as marketable as standard skilled labors especially in local market situation. The outputs which don't enter into the market rather get reused in the production system are the non-marketable outputs. For example, Poultry manure from fish-cum-poultry integrated farm which is reused as manure for aquaculture is a non-marketable output. Non-marketable outputs also include the environmental and social outputs from aquaculture activities (if not marketed).

The valuation of these inputs and outputs are done in both producers' price as well as at economic price. Here, producers' price is the price of inputs/ outputs items expressed in monetary term that are paid or received by actual producer in the localized market and the economic price is the real price of inputs/outputs items expressed in monetary term without the effect of all possible externalities (third party effect: either good or bad, or parties not directly involved in the production or use of commodity).

All the inputs and outputs of both marketable and non-marketable categories were structured in a matrix considering its producer's price and economic (or opportunity) price. The matrix termed as Policy Analysis Matrix (PAM) has been used to calculate several indices of RCR (Table 1).

Table 1. Policy Analysis Matrix (PAM) for Resource Cost Ratio approach

Item	Outputs	
	Marketable	Non-marketable
Producer's price	A	B
Economic price	E	F
Item	Inputs	
	Marketable	Non-marketable
Producer's price	C	D
Economic price	G	H

The following indices can be defined from the PAM:

Private profit	=	(A + B) – (C + D)
Private profit per unit farm area (ha)	=	Private profit/ farm area (ha)
Private cost	=	(C + D)
Private profit per unit private cost	=	Private profit/ Private cost
Social profit	=	(E + F) – (G + H)
Social profit per unit farm area (ha)	=	Social profit/ farm area (ha)
Social Cost	=	(G + H)
Social profit per unit social cost	=	Social profit/ Social Cost
Resource Cost Ratio (RCR)	=	(H – F) / (E - G)

All these indices are self explanatory in their terms, but the characteristic of RCR and its possible results should be illustrated to make it more simple and convenient to understand. RCR is the ratio of net cost of non-marketable resources (H - F) and the net value addition effected through marketable route (E - G). Some of the key inferences of this approach are:

1. Usually, $0 < RCR < 1$ on the assumption that $(E - G) > 0$.
2. Social profit is inversely related to RCR

   Social profit $= [(E + F) - (G + H)]$
   $= [(E - G) - (H - F)]$
   $= (E - G)[1 - (H - F) / (E - G)]$
   $= (E - G)[1 - RCR]$
3. When social profit = 0 and $(E - G) > 0$, then $(1 - RCR) = 0$ and hence, $RCR = 1$
4. If $RCR = 0$, then social profit $= (E - G)$, then assuming $(E - G) > 0$, social profit > 0 even when $RCR = 0$. But $RCR = 0$ implies $(H - F) = 0$. It means that when RCR is zero, there is no social profit arising out of value addition through conversion of non-marketable resources into marketable outputs, but social profit may arise because of value addition on marketable inputs i.e. $(E - G) > 0$.
5. Even when $(E - G) < 0$, RCR can still be positive if $(H - F) < 0$. Also, social profit can be positive even if $(E - G)$ is negative i.e. negative value addition through marketable route, is more than made up by positive value of $(H - F)$, i.e. sufficiently positive value addition through the non-marketable route. Many investment in rural infrastructure can be of this kind (*Datta 2001*)
6. Another interesting situation is where $(E - G) > 0$, but $(H - F) < 0$ i.e. value addition through non-marketable route is positive alongside the fact that value addition through the marketable route is positive as well. In this case, social profit is clearly positive, even though the $RCR < 0$, in other words, negative value of RCR (or DRCR) does not automatically rule out positive social profit (*Datta 2001*).

The versatile character of RCR approach within a PAM structure can be elaborated with the help of a few more illustrations.

Brief cases on two successful aqua-entrepreneurs of North Bengal were prepared in this study and above interpreted RCR approach were applied to know the economic strength of transforming local resources into marketable outputs or services. The required data on inputs and outputs of the selected aqua-production units were collected through visit to the farm, personal contact and conversation. The financial accounts for the year 2004-05 of both entrepreneurs were collected and made use of for RCR analysis.

RESULTS AND DISCUSSION

The Sarkar Matsya Prakalpa (SMP): The Aqua-farm, SMP is located in Hemtabad, a rural area in Raiganj, North Bengal (India). Asish Sarkar has diversified the

Table 2. Marketable inputs (transformation cost) for SMP[1]

Items	Producers price	Economic price
Brooder (brood fish for breeding)[2]	93,750	93,750
Fish feed	1,31,400	1,31,400
Lime	15,600	15,600
Organic manure	51,511	51,511
Pituitary gland for breeding	1,38,600	1,38,600
Hormone (Ovaprim, ovatide)	5,000	5,000
Happa and net	37,905	37,905
Medicine and chemicals	29,020	29,020
Replacement cost of the biogas plant[3]	8,000	16,000
Replacement cost of the cattle[4]	7,500	7,500
Diesel/mobile	87,484	87,484
Repair & maintenance	42,525	42,525
Transportation cost	5,495	5,495
Packaging cost (including oxygen)	92,838	92,838
Electricity charges	49,073	49,073
Bank charge	1,018	1,018
Interest on loan	13,836	13,836
Feeding and rearing cost of Cow	46,155	46,155
Own labor[5]	84,000	2,52,000
Depreciation of farm house	70,653	70,653
Lease rent	64,500	64,500
Sub total	10,75,863 (89.00)*	12,51,863 (90.00)*

*Note: Figure in parenthesis indicates percentage over total marketable cost.

1. Numeric values are given in Indian Rupee (INR), 1 USD = INR 45.95 (average 2004-05), reference: FEDAI (Foreign Exchange Dealer's Association of India) indicative rates.
2. Replacement cost of brooder = 15 % of 12.5 tons @ Rs. 50 per kg
3. Replacement cost of 4 nos biogas plant = Rs 8000, it is imputed with assumed lifetime of 10 years and construction cost of Rs 20000 each (subsidy = Rs 20000, considered in economic price)
4. Annual replacement cost of 15 nos. of cattle is imputed with assumed lifetime of 10 years and purchase cost of Rs 5000 each.
5. Opportunity cost: 2 skilled person @ Rs 3500 / month, where economic price is imputed with premium of three times for his skill.

Table 3. Marketable inputs (transaction cost) for SMP

Items	Producers price	Economic price
Breeding contract**	70,000	70,000
Traveling expenses	23,883	23,883
Audit fee	800	800
Printing and studio	2,066	2,066
Post and subscription	1,101	1,101
Miscellaneous expenses	14,917	14,917
Insurance	4,340	4,340
Aid to local organization	8,530	8,530
Road tax	2,800	2,800
Land tax	5,700	5,700
Professional tax	600	600
Panchayat tax	500	500
Sub total	1,35,237 (11)*	1,35,237 (10)*
Total Marketable inputs (Table 5 & 6)	12,10,100	13,87,100

**Note:* Figure in parenthesis indicates percentage over total marketable cost.

**Type of expenditure is not sufficiently explained in profit and loss account.

Table 4. Non-marketable inputs for SMP

Non marketable input	Producers price	Economic price
Salary and bonus to local members	72,150	72,150
Daily wages to casual labor	2,29,890	2,29,890
Incentives in kinds to the workers*	73,040	73,040
Total non-marketable inputs	3,75,080	3,75,080

Note: *Providing canteen facility to the workers.

farm activities by developing fish breeding cum culture unit and during study period, he had constructed a hatchery to produce ornamental fish seed and another hatchery was under construction. He has designed the little upland area of his farm into an aesthetic garden on his own interest.

RCR analysis for SMP: The producer price and economic price (opportunity cost) of all the marketable and non-marketable inputs and the outputs are presented in Table 2, 3, 4 and Table 5 respectively. These data are tabulated from profit and loss account of *SMP* for the year 2004-05. Marketable input costs are classified as transformation and transaction costs to evaluate the transaction cost contribution to the total marketable cost. It has been found that nearly 10 percent of the costs are involved in transaction whereas transformation contribute the nearly 90 per cent. The farm earned a private profit *(Rs. 2,42,006)* of 15 percent over private

Table 5. Marketable and non-marketable outputs for SMP

Items	Producers price	Economic price
Marketable outputs		
Spawn	16,17,939	16,17,939
Table fish	77,927	77,927
Agriculture	93,040	93,040
Milk	50,630	50,630
Total marketable outputs	18,39,536	18,39,536
Non-marketable outputs		
Plantation[1]	-11,350	0
Biogas[2]	0	16,800
Biogas slurry[3]	0	12,900
Total non-marketable outputs	-11,350	29,700

Note:

1. Plantation (garden) does not provide any marketable value to him, so his expenditure on it is a negative non-marketable output. But aesthetic and ecological value of garden is intangible non-marketable output. It was not considered in economic price as the aesthetic and ecological value of garden is found to be difficult to quantify. Quantification of such value will pull down the value of RCR.
2. Annual opportunity cost of biogas is Rs 16800 (Gas @ 1000 per month + Electricity @ 400 per month)
3. Opportunity cost of slurry is equivalent to the cost of manure needed (Rs 8600).

cost and 6 percent social profit *(Rs. 1,07,056)* over social cost (Table 6). RCR value for *SMP* is found to be high i.e. 0.76, which indicate that net costs on non-marketable resources especially in the form of unskilled labour is 0.76 rupee per unit output effected through marketable route. An uncommon feature to be noticed is the expenditure on plantation amounting to Rs. 11,350 (Table 5). Here plantation expenses include all the expenditure for maintenance of the garden during financial year 2004-05. Developing such a valuable garden in that rural area has only an intangible value, as it is very difficult to derive any commercial benefit from it in absence of any market. In producer point of view, as the plantation expenses by SMP were not incurred for the production system; so the producer price of this expenses was considered as a negative output. But in economic point of view, plantation expenses do not contribute any value of late and hence, the economic price of the plantation expenses was considered as zero.

Innovation and resource utilization in SMP: The garden has been developed with nearly 850 – 900 varieties of medicinal and other valuable plants that are collected from different sources. Report of some educational tours and excursions are also found in the

Table 6. PAM and RCR indices for SMP

PAM	Marketable	Non-marketable
Outputs		
Producer price	A = 18,39,536	B = -11,350
Economic price	E = 18,39,536	F = 29,700
Inputs		
Producer price	C = 12,10,100	D = 3,75,080
Economic price	G = 13,87,100	H = 3,75,080
RCR Indices for SMP:		
Profit		= 2,42,006
Profit per hectare (area = 5 ha)		= 48,401
Private Cost		= 15,86,180
Profit per unit of private cost		= 0.15
Social Profit		= 1,07,056
Social Profit per hectare		= 21,411
Social Cost		= 17,62,180
Social Profit per unit of Social Cost		= 0.06
RCR (Resource Cost Ratio)		= 0.76

visitor's register of the farm. It's really a natural taxonomical laboratory for the botany students. Several professionals, technologists, environmentalists have appreciated the ecological and aesthetic value of plantation. The guesthouse located in the garden is also pleasant to the eyes. Further, he is conserving nearly 15 numbers of tortoises to breed them, not with commercial intension; rather out of his commitment towards tortoise conservation. Breeding of some endangered fish species like Chitala (*Notopterus sp.*), Pabda (*Ompak sp.*) etc also has been attempted by him. Mr Asish Sarkar, like his father has got great sense of importance for historical heritage and maintains some documents of the history very carefully. Mr Asish has inclination towards larger public good is further evident from the fact that he extended the road upto his farm from the main road on his, thereby providing easy access to nearby three villages.

If all these aesthetic, medicinal, educational, social and conservation value are valued as intangible outputs in the PAM, the net cost on non-marketable items (H - F) will fall. Then the RCR would also be lesser than the present value of 0.76. On the other hand, some of input items like diesel, repair and maintenance, polythene package, depreciation of the farmhouse, breeding contract, travelling expenses, and miscellaneous expenses were unusual (Table 6) and also were not sufficiently explained in the profit and loss account of *SMP*. Unusual expenses might be intentionally explained in the profit and loss account to avoid income taxes. Otherwise, the *SMP* is a well-organized farm as regards to its infrastructure and management point of view.

The Deepak Roy's Aqua-farm (DRA): Deepak Roy is basically a fresh water fish farmer from *Malda* district of North Bengal, India

RCR analysis for DRA: The marketable and non-marketable input costs and output costs for *DRA* during 2004-05 were arrived through the conversation with Deepak Roy (the Table 7 and 8 respectively). From the constructed PAM, it is evident that there is hardly any difference between producer prices and economic prices for output categories (marketable and non-marketable) as well as the input categories (Table 9). Only in case of marketable inputs producer price is lower mainly due to the subsidy component and utilization of skilled family labour in the farm (Table 7). RCR indices show that Deepak Roy has earned an annual private profit of *Rs 3,85,384* which is nearly 48 per cent of total private cost incurred. In the societal point of view his earning for that financial year is *Rs 2,22,384* which is nearly 23 per cent of total social costs. The RCR value is found to be 0.44, which means that the net costs on non-marketable resources especially in the form of unskilled labour is 0.44 rupee per unit output through marketable route. It may be observed that the theft of 12 numbers of reared cows has been reflected in the marketable output as negative value in calculating the economic price (Table 8).

Innovation and resource utilization in DRA: Elaboration of some of the aspects that has not been accounted for PAM should be done, so that the difficulties and opportunities of resource utilization by Deepak Roy can be comprehended better. Successful breeding of some rare varieties of fish like Chitala (*Notopterus sp.*), Pabda (*Ompak sp.*), Pangus (*Pangasius sp.*), Puntti (*Puntius sp.*), Nandus (*Nundus sp.*) is a result of his innovation and consistent hard work. He is taking advantage of collecting nature parent fish stock from nearby Farrakka reservoir (especially Pungus), which are acclimatized in their pond water for the breeding purpose. Further the *happa* breeding in natural environment of nearby large *bheel* (open water body with lower water depth) of 11 acre where survival rate of spawn was found to be higher than that of the pond environment in the farm.

His expertise helped him to get the chance to work with government in the collaborative project on breeding of rare fish varieties. He received a subsidy amount of

Table 7. Marketable & non-marketable inputs of DRA

Items	Producers price	Economic price
Marketable inputs		
Fixed capitals		
Brooders	15,000	15,000
Happa (for breeding & keeping spawn)	4,150	4,150
Pump set	19,500	19,500
Replacement cost of cow	6000	6000
Tank hatchery (subsidy)	0	10,000
Working capitals		
Hormones for breeding (PG, Ovaprim, Ovatide)	24,875	24,875
Fish feed	152,424	152,424
Disease control (Chemical, disinfectant etc.)	10,000	10,000
Lime	78,300	78,300
Manure	110,227	110,227
Urea & SSP	36,540	36,540
Expenditure on horticulture	32,000	32,000
Operating cost for pump	20,000	20,000
Own labor	96,000	240,000
Seed rearing cost (Chitala, Pabda & Puntius)	3,500	3,500
Subsidies from NBFGR under NATP	0	10,000
Total marketable inputs	653166	772516
Non marketable inputs		
Labor cost	208,800	208,800
Total non-marketable inputs	208,800	208,800

Table 8. Marketable and non-marketable outputs for DRA

Item	Producer price	Economic price
Marketable outputs		
Fish seed & spawn	350,000	350,000
Chitala, Pabda & Puntius seed (reared for 45 days)	707,500	707,500
Table fish	49,200	49,200
Horticultural product	59,500	59,500
Home consumption of horticultural product	0	7,000
Cow	0	-6,000
Total	1,166,200	1,167,200
Non marketable output		
Food of some labors	36,500	36,500
Total	36,500	36,500

Table 9. PAM and RCR indices for DRA

PAM	Marketable	Non-marketable
Outputs		
Producer price	(A) 1,166,200	(B) 36,500
Economic price	(E) 1,167,200	(F) 36,500
Input		
Producer price	(C)1608,516	(D) 208,800
Economic price	(G)772,516	(H) 208,800

RCR Indices for DRA:		
Profit	=	2,42,006
Profit	=	3,85,384
Profit per hectare (Total area = 14.5 ha)	=	26,578
Private Cost	=	8,17,316
Profit per unit of private cost	=	0.47
Social Profit	=	2,22,384
Social Profit per hectare (Total area = 14.5 ha)	=	15,336
Social Cost	=	9,81,316
Social Profit per unit of Social Cost	=	0.23
RCR (Resource Cost Ratio)	=	0.44

Rs 80,000 in the form of material input under National Agricultural Technology Project (NATP) project from National bureau of Fish Genetics Resources (NBFGR), which has been taken into consideration in input cost categorization (Table 7). Other than this, around 175 – 180 people in that rural area are getting benefit directly or indirectly out of his business, which is an excellent example of using unskilled labour to produce marketable fish and fish seed.

Comparative analysis between the entrepreneurs: From the above contented case studies, it may be observed that these two aqua-entrepreneurs are really efficient in their economic strength and capable of using the available rural resources efficiently. The comparative picture of PAM indices (Table 6 and 9) for both the aqua-business units revealed that Deepak Roy's Aqua-farm (RCR = 0.44) were found to be more efficient and profitable than the Sarkar Matsya Prakalpa (RCR = 0.76) in terms of profit over unit private as well as social costs. In other words, the former are more efficient in converting the non-marketable input mainly in the form of unskilled labor into a marketable output than the later. Another important comparison is the profit per unit farm area which is found to be higher in *SMP* than that of *DRA*. While *DRA* has comparatively similar high profit levels, it's nearly one third lower for *SMP*. The reasons are not for too seek. One is the credibility

of the account being maintained by *SMP*, and also a clearer study of *SMP's* annual account revealed that it has deliberately inflated several input costs so as to show a more modest profit, probably to avoid taxes. However, the ecological and societal benefits due to his effort and commitment in conserving the tortoise and some endangered fish species as well as maintaining a valuable plantation would bear fruit only in the future. For *SMP*, it is more commercially oriented have better infrastructure facility and more professionally managed in comparison with *DRA*. This is the reason for which the profit per unit area was higher for *SMP*. Though Deepak Roy was a successful breeder, the natural resources available at his disposal could be put to more effective use.

CONCLUSION

Two aqua-entrepreneurs from North Bengal (India) were studied through RCR analysis to know the economic strength of converting non-marketable resources like unskilled labor of the locality to relatively marketable outputs like fish. Overall, all these three aqua-entrepreneurs are among those persons who basically initiated, developed and managed aquaculture technology and its business affairs that combine the factors of production either marketable or non-marketable input to supply fish and other aquaculture products and services.

These case studies on economic strength of local resource utilization have demystified several misconceptions about the aquaculture sector in North Bengal. For instance, aquaculture is assumed to generate many undesirable environmental and social externalities. However, these case studies have proved that they never create the negative externalities; rather they utilize locally available labor and material resources more efficiently to crate socially desirable and profitable outputs. Another general misconception is the dearth of innovation and entrepreneurial skills in the rural India. The inventiveness and risk taking abilities of the breeding expertise of Deepak Roy, the business acumen of Ashish Sarkar are all testimonies to the quality of entrepreneurship and innovation available in the rural aquaculture sector.

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