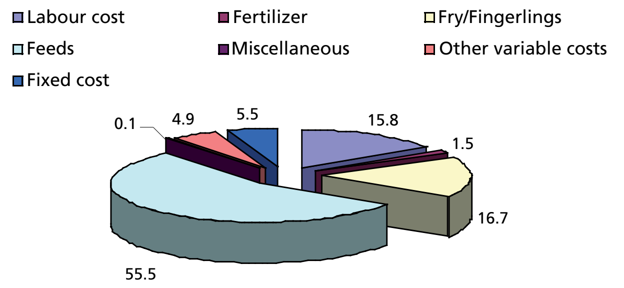
3.5.4 Traditional farms

The cost of feeds on traditional farms has been estimated at 45.2 percent of total production costs. Among the three farm categories this is, not unexpectedly, the lowest share. The second most important cost item among traditional farmers is labour which accounted for 21.6 percent of the total. A moderate percentage proportion of 18.4 percent has been defrayed on purchases of fry/fingerlings. Part of the cost of labour is for unpaid family labour. The time spent by family labour has been monetized in the analysis. So the relatively higher use of family labour among traditional farms may imply that they are low on cash. The proportion of labour costs among traditional farms in the Philippines and China have been respectively estimated at 56.5 and 36.9 percent, respectively (Table 19 and Figure 7).

TABLE 19
Relative proportion of aquaculture production cost (in percent) by cost item, traditional farms

Cost Item	Country						All countries
	Bangladesh	China	India	Philippines	Viet Nam	Thailand	
A. Variable cost							
1. Labour cost	12.6	36.9	14.9	56.5	0.3	8.6	21.6
2. Fertilizer	0.5	-	4.8	-	-	0.8	1.1
3. Fry/fingerlings	9.5	47.0	10.4	12.1	21.7	9.6	18.4
4. Feeds	58.5	10.7	46.4	11.2	73.6	72.2	45.2
5. Miscellaneous	0.0	-	0.6	-	-	0.3	0.4
6. Other variable/ miscellaneous input costs	9.7	4.7	9.9	1.0	3.7	3.0	5.4
Subtotal	91.0	99.3	88.4	80.8	99.3	94.3	92.1
B. Fixed costs	9.0	0.7	11.6	19.2	0.7	5.7	7.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	99.8

FIGURE 6
Relative proportion (percent) of aquaculture production cost by item, semi-intensive farms, all countries



3.6 Regional comparative analysis of economic indicators

3.6.1 Gross factor productivities (benefit cost ratio)

The region-wide summary of gross factor productivities or benefit cost ratios (BCRs) by country and farm categories is shown in Table 20. The region-wide average benefit-cost ratio for all farm categories has been estimated at 1.59 which implies an income of US$1.59 for a dollar of expenditure in aquaculture production. BCR estimates were highest among intensive farms (1.70) and lowest among traditional farms (1.46) which indicates that in general and throughout the region all three (3) farm categories have been able to generate benefits from their investments in aquaculture production. High BCRs were recorded for the average aquaculture farms in both the Philippines and Bangladesh. Viet Nam and China reported the lowest BCRs at 1.22 and 1.34, respectively.

The best performers among intensive farms are those based in the Philippines (2.66) and Thailand (1.71). Among semi-intensive farms high BCRs of 2.01, 1.81 and 1.76 are respectively generated by aquaculture farms from the Philippines, India and Bangladesh. In the case of traditional farms, Bangladesh has recorded the highest BCR of 2.12 while India has provided a respectable BCR of 1.75. The Philippine based traditional farms only were able to break even.

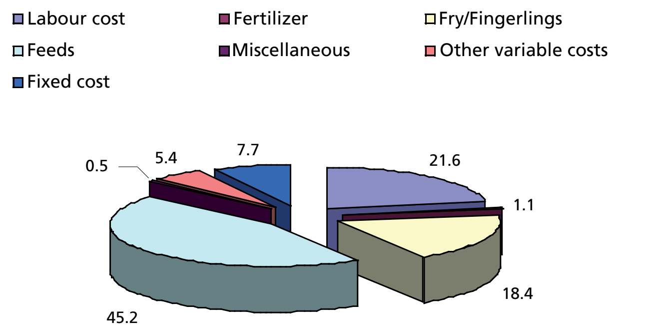
The findings at the regional level do not fully establish the direct relationship between intensified feeding practice and the BCR coefficient. The positive relationship has been supported by the data from Thailand and the Philippines. However, data from Bangladesh and Viet Nam did not support this hypothesis as their best BCR performers are the traditional farms. Data from China and India were inconclusive as BCRs estimated for these two countries under different feeding practices were very similar. It is interesting to note that while the individual country reports indicate relatively low absolute incomes among traditional farms, their high BCR values imply that their low cost of production makes them viable.

3.6.2 Break-even prices

The break-even price measures the price level(s) by which an enterprise is able to recover its production costs. For most farms the break-even price level lower than the actual prices received for fish and thus can be expressed as a proportion, or percentage, of the latter. Break-even prices were calculated based on a combined average of prices for all species produced on the farms[1].

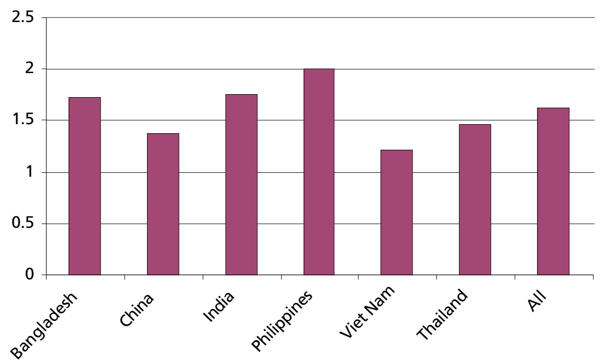
The performance of the farmers by farm category and by country can be assessed by examining the proportion of the market price that corresponds to the estimated break-even price. A comparison of break-even prices relative to actual prices is presented in Table 21 and Figures 10–13.

FIGURE 7
Relative proportion (percent) of aquaculture production cost by item, traditional farms, all countries



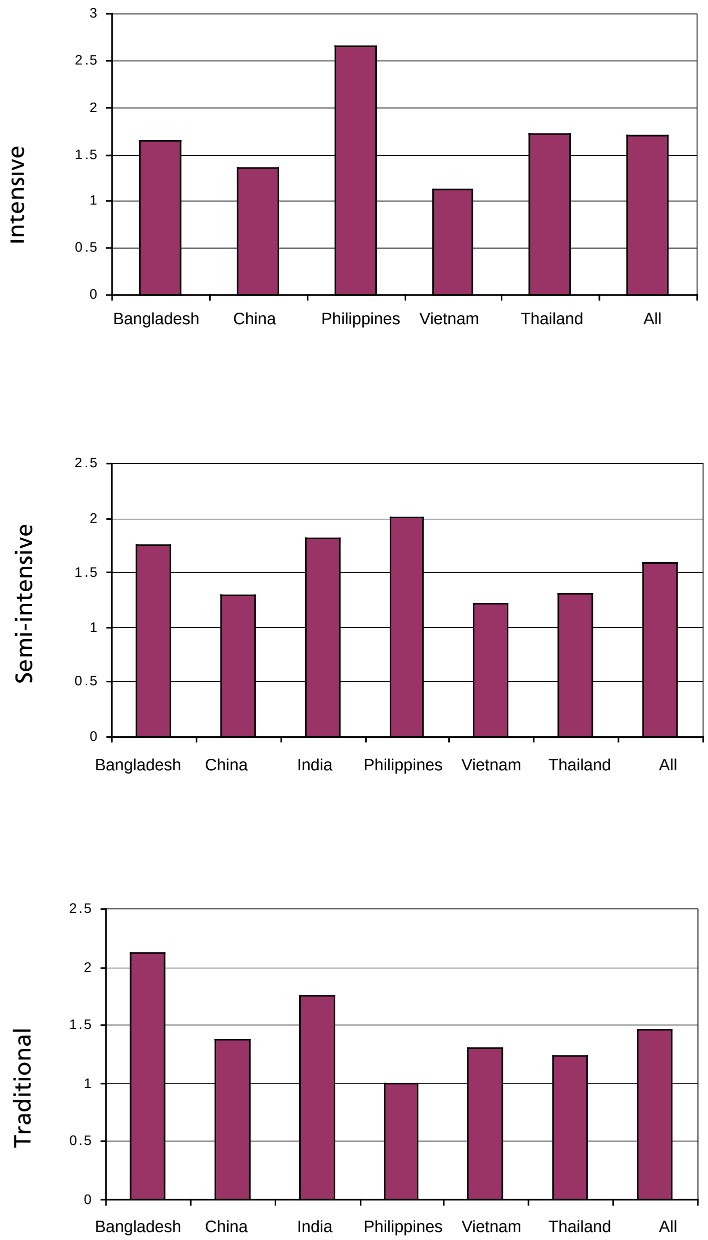
The overall break-even price level for all countries was estimated at US$0.53 per kg which amounts to 67 percent of the actual market price of US$0.78 per kg. The break-even prices recorded by aquaculture farms in Bangladesh and India appeared to be the most efficient of those studied. In these two countries they amount to only 57 percent of the market price. Likewise aquaculture farms in China, Thailand and the Philippine appear to be less vulnerable to output price changes given that their respective break-even prices amount to about 68 and 69 percent of prevailing market prices. Viet Nam is the least performer. For the average Vietnamese fish farmer in this study the break-even price (at 85 percent) is just below the market price. These price relationships indicate that aquaculture farms in Bangladesh can afford to absorb a 43 percent reduction in market prices and still break even. Aquaculture farms from China, Thailand and the Philippines can still break even if

FIGURE 8
Benefit cost ratios: all farm categories



1 In order to facilitate comparisons authors used one currency for both inputs and outputs. Local currencies were converted into their US$ equivalents.

FIGURE 9
Benefit cost ratios by country



exposed to a 31-32 percent reduction in output prices. The most vulnerable farmers in terms of output price decreases were those from Viet Nam who can only afford to absorb a 15 percent output price decrease and still break even.

Considering intensive farms only, the estimated break-even price was US$0.54/kg, and the observed average market price was US$0.84/kg. This break-even price represents 65 percent of the actual market price. These figures imply that on the average intensive farms can absorb significant price changes and still achieve profitability. Looking at intensive farms by country the result is almost the same. The exception is farms in Viet Nam. In Viet Nam the break even price was only 9 percent below the market price. However, in general intensive farms in the region can absorb even a significant reduction in their output prices.

In the case of semi-intensive farms, the break-even price at US$ 0.55/kg was almost identical to that recorded for intensive farmers, while the average market price was considerably lower at US$ 0.76/kg. This implies that the situation of semi-intensive farmers is somewhat worse than that of intensive farmers, the break-even price reaching 72 percent of the market price.

But the situation varied considerably amongst the semi-intensive farms. Farms in India and Bangladesh were well off recording break-even prices amounting to as little as 55and 57 percent, respectively of market prices. The semi-intensive farms most vulnerable to output price fluctuations were those in Viet Nam and China where farms would just cover costs if output prices rose by 17 and 19 percent respectively.

While traditional farmers achieved as high prices for their fish (US$ 0.75/kg) as did farmers using semi-intensive feeding strategies, their costs per kg produced were higher reaching US$ 0.59/kg. This means the average traditional farmer could afford a drop in fish prices of 23 percent and still cover his costs. The study thus indicates that the traditional farms were more vulnerable to decreases in output prices than either intensive or semi-intensive aquaculture farms. But, differences amongst countries are large. If fish prices were to fall generally for fish from traditional farms the least affected would be farms in Bangladesh for which the break-even price reaches only 47 percent of the market price. The most vulnerable traditional farms are those based in the Philippines where fish prices have to increase for farmers to break even.

Overall, the 100 farmers using intensive feeding strategies seem more able to cover their costs than do the 120 using semi-intensive feeding strategies. These in turn appear better at this than do the 120 farmers using traditional feeding strategies. While this is true when comparing these three groups it is not always true when making this same comparison on a case study basis. While the 20 intensive farms based in the Philippines and the 20 intensive farms in Thailand have stronger break-even price structure then do their co-nationals who use semi-intensive and traditional feeding practices, traditional farmers in Bangladesh, China and Viet Nam have a better break-even price situation than their compatriots using more modern feeding practices.

TABLE 21
Comparative analysis of actual price and break-even price by country, all species (US$/kg)

Country	Category: Intensive			Semi-intensive			Traditional			All categories		
	Actual price	Break-even price	Proportion of break-even with actual price (%)	Actual price	Break-even price	Proportion of break-even with actual price (%)	Actual price	Break-even price	Proportion of break-even with actual price (%)	Actual price	Break-even price	Proportion of break-even with actual price (%)
Bangladesh	0.62	0.37	60	0.62	0.35	57	0.62	0.29	47	0.62	0.35	57
China	1.11	0.73	66	0.98	0.79	81	1.02	0.61	60	1.04	0.71	68
Philippines	0.93	0.51	55	0.94	0.72	77	0.95	1.22	128	0.93	0.64	69
Viet Nam	0.66	0.60	91	0.54	0.45	83	0.56	0.42	75	0.59	0.50	85
Thailand	0.88	0.51	58	0.75	0.57	76	0.67	0.55	82	0.79	0.54	68
India*				0.74	0.41	55	0.72	0.42	58	0.73	0.42	57
All Countries	0.84	0.54	65	0.76	0.55	72	0.76	0.59	77	0.78	0.53	67

* Note: India did not have intensive feeding practice in its study sites

3.6.3 Break-even production

The break- production level is the volume of production needed to recover total production costs at the prevailing output prices. A comparative analysis of break-even production levels by country and feeding strategy is presented in Table 22 and Figure 14.

The estimated break-even production levels per hectare for each country vary widely in absolute figures due to the differences in size and metabolisms of the farmed fish species. Comparing farmers in the six countries, without considering fish feeding strategies, the study reveals that Chinese farmers were most successful as 35 percent actual production would enable the average farmer to break even. This implies that the overall current aquaculture production levels in China could fall by up to 65 percent before the average farm reaches a break-even production level. Aquaculture farmers from India, Bangladesh, Thailand and the Philippines likewise performed credibly having break-even production levels of 56, 58, 68 and 69 percent. All are production levels that are comfortably above estimated break-even production. The most vulnerable farms in terms of yield fluctuations are those in Viet Nam as their production volumes on the average are only 14 percent above break-even volumes.

The results differ somewhat when each of the three feeding strategies is analyzed separately. However, Chinese farmers remain the most secure. The intensive, semi-intensive and traditional farms in China have break-even production levels well below 50 percent of recorded production volumes (respectively 29 and 43 and 44 percent). Amongst other groups of farmers (see table 22) only traditional farmers in Bangladesh reach a similar level (47 percent). The most exposed and probably least efficient farms are the traditional farms in the Philippines. In fact, these farms are unlikely to continue for long unless economic and/or technical conditions change as recorded production levels were below break-even volumes.

FIGURE 10
Actual and break-even prices of all farm categories by country

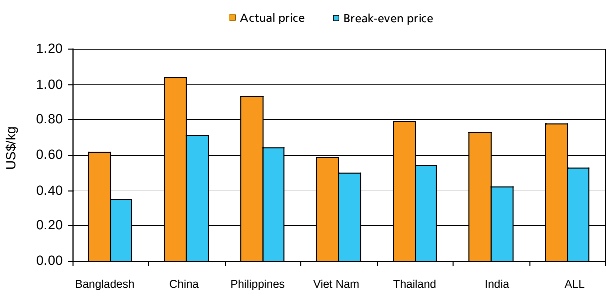
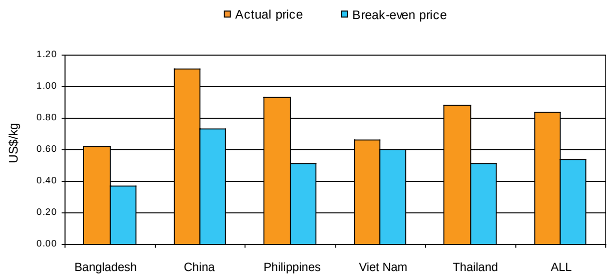


FIGURE 11
Actual and break-even prices of intensive farm category by country



Among intensive farms, only the Viet Nam-based farms can be considered as highly vulnerable to significant drops in their production levels. Intensive farms in the other five countries exhibited production levels showing significant margins to break-even production implying that they are capable of handling also drastic reductions in production.

In regards to semi-intensive farms, those in China, India and Bangladesh can afford to absorb significant reductions in productivity levels and still break even, while farms in Philippines and Thailand can not afford to lower their production levels by more than 24 percent. It is not only in the Philippines that traditional farmers are vulnerable to downward fluctuations in production. This also applies in Thailand (break-even production amounting to 81 percent of production) and Viet Nam (77 percent).

A review of break-even production data from the six countries and the three feeding strategies does not exhibit a clear pattern. On the one hand, data from China, Thailand and the Philippines supports the argument that intensified feeding shall result in more efficient aquaculture farming in this case illustrated by large production volumes relative to break-even estimates. On the other hand, data from Bangladesh and Viet Nam demonstrate the reverse - intensified feeding result in less efficient performances.

FIGURE 12
Actual and break-even prices of semi-intensive farm category by country

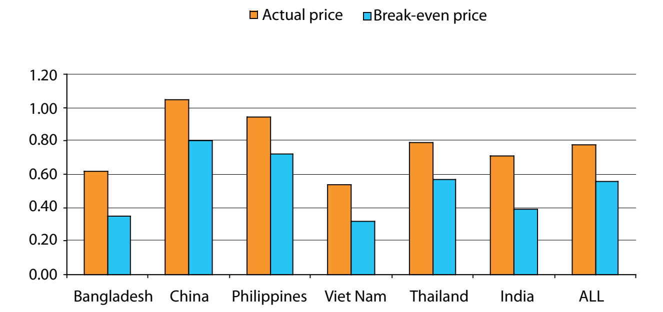


FIGURE 13
Actual and break-even prices of traditional farm category by country

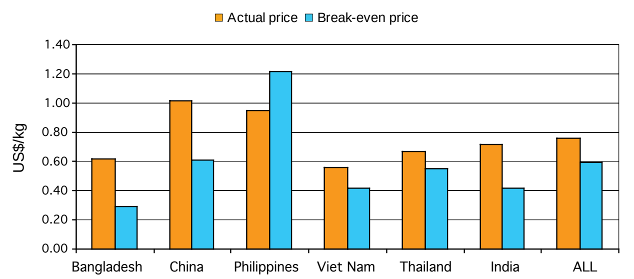
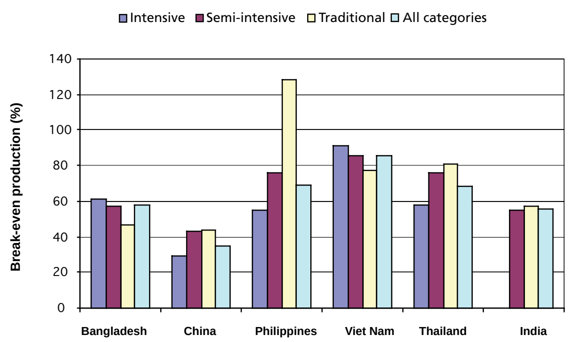


FIGURE 14
Proportion (in percent) of break-even production to actual production by farm category and country



3.7 Production problems

3.7.1 Enabling production factors

The respondents cited several factors that contribute to efficient aquaculture production. The most important enabling factors and reported by about 25 percent of the 340 respondents were good water quality, intensified feeding with commercially manufactured feeds, and, high rates of stocking (Table 23). While water quality issues can be addressed both on and off the farm, increased use of commercial manufactured feeds and higher stocking rates often require that farmers have access to cheap credit. Other factors which farmers reported would contribute to efficient production were: effective disease control (23 percent of respondents), better management (19 percent), and use of good quality fish fry (13 percent).

Among intensive farmers, improved water quality (31 percent), disease control (28 percent) and better management (19 percent) are identified as the most important factors in any strategy intending to in increase productivity. In particular, Chinese farmers have reported their inability to focus on these factors as their major problem. For semi-intensive farmers, higher stocking rates for fry, more commercial feeds and improved water quality are their priorities for increasing aquaculture production. These problems have been more pronounced in Viet Nam and China. As perhaps could be expected, amongst traditional farmers as many as 35 percent of respondents reported that the most important enabling production factor is intensified commercial feeding. This is a likely consequence of the fact that the average traditional aquaculture farmer lacks the

TABLE 22
Comparative analysis of actual production and break-even production (kg/ha/year) by country and farm category

Country	Category									All categories		
	Intensive			Semi-intensive			Traditional					
	Actual production (A)	Break-even production (B)	% of B to A	Actual production (A)	Break-even production (B)	% of B to A	Actual production (A)	Break-even production (B)	% of B to A	Actual production (A)	Break-even production (B)	% of B to A
Bangladesh	13 945	8 478	61	7 705	4 377	57	3 380	1 593	47	8 343	4 816	58
China	38 251	11 085	29	16 111	6 891	43	9 343	4 132	44	21 235	7 369	35
Philippines	3 012	1 669	55	882	674	76	578	742	128	1 491	1 027	69
Viet Nam	240 199	218 749	91	243 887	210 913	86	157 452	121 128	77	213 846	183 596	86
Thailand	108 943	63 457	58	82 904	63 280	76	62 182	50 633	81	84 676	57 895	68
India*	-	-	-	5 699	3 151	55	5 853	3 353	57	5 772	3 252	56

*Note: Case study carried out in India did not have intensive feeding practice

TABLE 23
Enabling factors to increase production by farm category, all countries

Enabling factor	Farm category							
	Intensive		Semi-intensive		Traditional		All categories	
	No.	%	No.	%	No.	%	No.	%
More commercial feeds	16	20	27	34	28	35	71	30
High stocking of fry	13	16	29	36	22	28	64	27
Quality fry	13	16	14	18	5	6	32	13
Better management	19	24	16	20	10	13	45	19
Disease control	22	28	15	19	17	21	54	23
Improved water quality	31	39	25	31	26	33	82	34

Analysis only included data from China, the Philippines, Thailand and Viet Nam financial capacity to purchase commercial feeds. Region-wide, one third of traditional farmers also consider that improved water quality would contribute much to enhance their production. This is a problem common to all farm categories.

3.7.2 Disabling production factors

Table 24 summarizes information on disabling factors, that is those factors that create obstacles for farmers who want to increase production. Irrespective of the feeding strategy one quarter of the farmers reported that lack of capital was the most important obstacle to increased aquaculture production. It is clear that without access to capital farmers will not be able to improve their production by using commercial feeds and increased stocking rates. The second largest obstacle for the 240 respondents is limited technical know-how. Almost one of every five farmers considered their relative technical ignorance as a disabling factor.

The importance of obstacles is not much changed when looked at by country or by feeding strategy. But, again, perhaps not unexpectedly, lack of capital was reported more frequently as an obstacle among traditional farmers (43 percent) than among farmers using more sophisticated feeding strategies. In respect of technical knowledge the situation is reverse. It is more common that farmers using intensive feeding strategies find that they are lacking in technical know-how (21 percent) than that the traditional farmer does so (15 percent). Poor market facilities have discouraged 5, 15, and 18 percent of the intensive, semi-intensive and traditional aquaculture farms respectively, to increase their aquaculture production.

3.7.3 Other problems

The high cost of commercially/industrially manufactured feeds is a major concern among all farm categories as reported by 61 percent of the respondents (Table 25). Intensive (58 percent), semi-intensive (64 percent) and traditional farmers (62 percent) share such concerns. While traditional farmers readily recognized the importance of commercial feeding, its high cost per given unit prevented them from purchasing these types of feeds. Likewise it appears that the high cost of feeds has made both intensive and semi-intensive farmers decide not to buy optimum quantities.

As generally is the case farmers (in this case 55 percent of all respondents) have the view that low prices for cultured fish prevent them from achieving higher returns (Table 26). This problem has been consistently cited by respondents, and seem to be a particular concern of those who live in the Philippines, China and Bangladesh. High cost of transportation, poor market facilities and intermediary influence are considered minor marketing problems by all respondents.

TABLE 24
Disabling factors to increase production by farm category, all countries

Disabling factor	Farm category							
	Intensive		Semi-intensive		Traditional		All	
	No.	%	No.	%	No.	%	No.	%
Lack of capital	11	14	14	18	34	43	59	25
Limited seed availability	1	1	3	4	7	9	11	5
Limited feed availability	0	0	1	1	4	5	5	2
Limited fertilizer	1	1	4	5	5	6	10	4
Poor market facility	4	5	12	15	14	18	30	13
Limited knowledge	17	21	14	18	12	15	43	18
Poor water quality	9	11	4	5	0	0	13	5

Analysis only included data from China, the Philippines, Thailand and Viet Nam

TABLE 25
Problems concerning industrially manufactured feeds by farm category, all countries

Problem	Farm category							
	Intensive		Semi-intensive		Traditional		All	
	No.	%	No.	%	No.	%	No.	%
High price	58	58	64	64	62	62	184	61
Procurement/availability	22	22	5	5	6	6	33	11
Affects small fishes	0	0	2	2	5	5	7	2

Analysis only included data from Bangladesh, China, the Philippines, Thailand and Viet Nam

TABLE 26
Constraints in aquaculture marketing by category of respondents, all countries

Problems/constraints	Farm category							
	Intensive		Semi-intensive		Traditional		All	
	No.	%	No.	%	No.	%	No.	%
Low product price	48	60	39	49	46	58	133	55
High transport costs	5	6	7	9	7	9	19	8
Poor market facilities	9	11	5	6	2	3	16	7
Intermediary influence	5	6	5	6	5	6	15	6

Analysis only included data from Bangladesh, China, the Philippines and Thailand.

3.8 Statistical analysis

Table 27 provides a summary of the results of the statistical analysis by country. The statistical analysis establishes the existence or non existence of the relationships between aquaculture production and or profit as the dependent variables and the factors that affect their behavior such as feed cost, labour cost, stocking rate, survival rate, and fertilizer cost as the independent variables. The table also includes regression coefficients which measure the nature and extent of relationships between these variables.

Each country author selected a regression model based on which model provided the “best fit” in terms of the values of F and R^2. High R^2 values, for instance, imply that the variation in the dependent variable is largely explained by the independent variables (called predictors in the regression model). In addition the standardized coefficient (*Beta*) provides a measure of the direction (sign) and extent (value) of the effect of a predictor on the dependent variable. The table likewise shows the existence and or non existence of each predictor at a given level of significance.

The Cobb Douglas Production Function was used in Bangladesh, Viet Nam, India and Thailand while the Profit Function models were utilized in China and the Philippines. In addition authors of the China report provided an analysis of the technical efficiency of aquaculture production. Except for the Bangladesh case, where the model was run for each aquaculture farm category, the other country papers report on the results of regression analysis for all farm categories combined. The Thailand model used a dummy variable (Di) to indicate the impact of management by using farm category as the indicator.

Results of the statistical analysis shows a low adjusted R^2 value of 0.54 in India implying that the predictors included in the Indian model accounted for only 54 percent in the variation of the dependent variable. Results of the statistical analysis in the other countries indicated high adjusted R^2 values ranging from 0.800 to 0.995 suggesting that the predictors included in their models have largely (e.g. at least 87 percent) explained the behavior of the aquaculture production or gross profit/income. Likewise the values of the F statistic for all the models are at least significant at 5 percent level.

Results from the Bangladesh study indicated that among intensive farms, size of the farm, stocking cost, and feed cost yielded highly significant t values. However, the signs of the beta coefficients for stocking, fertilizer cost and feed cost are negative which would run counter with theoretical expectations. In the case of semi-intensive farms, the beta coefficients for the above variables yielded positive signs and are consistent with theoretical expectations. Among intensive Bangladesh farms, farm size was the only important predictor of aquaculture production both in terms of the sign and value of the beta coefficient as well as the value of t which is significant at 5 percent level. The regression results suggest that increasing farm size by one (1) percent can contribute 0.68 percent to an increase in output. Among semi-intensive farms, farm size, stocking cost, feed cost, and fertilizer cost, yielded positive beta coefficients whose t values are significant at 1 to 5 percent levels. In addition the values of the beta coefficients of 0.12 to 0.39 implying that these predictors significantly influence the increase in output of the semi-intensive aquaculture farms in Bangladesh. It is also interesting to note that since the sum of the beta coefficients (bi's) is greater than 1 (one), it suggests that the function exhibits increasing returns to scale, that is if a all the predictors are increased by one (1) percent, aquaculture output would increase by more than one (1) percent. In the case of traditional farms, farm size, stocking cost, feed cost, and fertilizer cost, likewise yielded positive beta coefficients whose t values are significant at 5 to 10 percent levels. It is interesting to point out that feed cost and seed cost are the most important predictor of output behavior among traditional aquaculture farms in Bangladesh.

Results of the statistical analysis in Viet Nam suggests that feed quantity, fixed cost, stocking rate, farm feed to total feed ratio, and number of ponds are excellent predictors of aquaculture output variation as exhibited by signs of the beta coefficients and t values that are significant at 1 to 5 percent levels. Among the predictors, feed quantity had the highest value at 0.735. This finding supports the hypothesis that intensified feeding shall result in increased aquaculture production.

Results of the statistical analysis from Thailand yielded consistent signs of the beta coefficients whose t values for feed cost, seed cost, labour cost, survival rate are all significant at one (1) percent level. The most important predictors in terms of the value of the beta coefficients are survival rate (b=0.71) and seed cost (b=0.55). Labour and feed cost can be considered as moderate predictors of aquaculture production in Thailand. Fertilizer cost, fuel cost and size of the fingerling yielded theoretically correct signs of the beta coefficients but did not pass the test of significance.

Results of the regression analysis using a profit function in China identifies feed cost as a significant predictor of profit in aquaculture production given its high beta coefficient of 0.594. Seed cost was also a major explanatory variable of aquaculture profit with a beta coefficient of 0.394 while labour cost has a relatively lower coefficient. These variables have t values that are significant at one (1) percent level. Fertilizer cost, training days and educational level provided insignificant values of their respective t statistics. Aside from the profit function, the China study likewise provided a technical efficiency analysis using the general stochastic frontier production function to express the relationship between inputs and aquaculture output. The results indicate that all the cost items had significant effects on aquaculture productivity in China. In addition, pond number, average water area and experience in fish farming are positively correlated with technical efficiency of production while pond size, average pond water depth, marital status, family size, education, and training had negative relationships with technical efficiency. By farm category, the highest average technical efficiency was reported in intensive fish farms at 0.82, while the lowest was estimated in semi-intensive fish farms at 0.769. Traditional or extensive fish farms had a technical efficiency coefficient of 0.8. The variations in technical efficiencies by farm groups have been related to feed management efficiency.

The regression results of the profit function model in the Philippines tried to explain the variation in aquaculture profits using the variables such as stocking rate, recovery or survival rate and total feed cost. Results of the analysis indicate that stocking rate was the most important predictor of aquaculture profit based on a very high value of its beta coefficient at 0.924. Recovery rate yielded a relatively lower beta coefficient at 0.225. The t values of these predictors are significant at 1 to 5 percent levels. Feed cost has a theoretically correct sign of coefficient but failed to pass the test of significance.

Results derived from applying the Cobb Douglas profit function model to the data from Indian farms indicate that the t values of cost of feeds and the cost of organic fertilizer as predictors of gross revenues are statistically significant at 1 percent level. Likewise cost of feeds yielded a high beta coefficient of 0.494 while a beta coefficient of 0.319 has been estimated for the cost of organic fertilizer. These imply the relative importance of feeds and organic fertilizer as major factors for profitability of carp farms in India.

The statistical analyses in the six study sites were all based on best fit models, which allow identification of the various predictors of profit and production. In general, the important predictors were labour cost, feed cost, feeding rate, stocking rate, recovery or survival rate, and fertilizer cost. This suggests that projects or programs aimed at enhancing productivity and profit should focus on the above mentioned variables as the major points of intervention. The results also imply that technical efficiencies can be addressed by enhancing the feed management capabilities of aquaculture farms.

TABLE 27

Summary of results of statistical analysis by country

Country/variable name	Regression model	Adjusted R^2	F value	Level of significance (%)	Standardized coefficient (*B*)	t-value	Level of significance (%)
Bangladesh							
Intensive farms		0.995		5			
Y-intercept	Cobb-Douglas production power function				2.37	na	1
Farm size					0.681	na	5
Stocking cost			1 696.06		-0.081	na	5
Feed cost					-0.191	na	1
Fertilizer cost					-0.169	na	10
Labour cost					0.58	na	NS
Semi-intensive farms		0.926	1 934.80	5			
Y-intercept					3.125	na	1
Farm size					0.391	na	1
Stocking cost					0.382	na	1
Feed cost					0.231	na	1
Fertilizer cost					0.115	na	5
Percent cost					0.092	na	NS
Traditional farms		0.993	1 433.82	1			
Y-intercept					2.58	na	1
Farm size					0.284	na	10
Stocking cost					0.557	na	5
Feed cost					0.365	na	5
Fertilizer cost					0.434	na	5
Labour cost					0.041	na	NS
China		0.882	102.6	1			
Y-intercept	Profit function					0.449	5
Labour cost					0.182	3.592	1
Seed cost					0.370	6.908	1
Feed cost					0.607	11.163	1

TABLE 27
Continued

Country/variable name	Regression model	Adjusted R^2	F value	Level of significance (%)	Standardized coefficient (B)	t-value	Level of significance (%)
Fertilizer cost					0.047	0.980	NS
Age					-0.121	-2.436	5
Educational level					-0.006	-0.111	NS
Training days					-0.016	-0.328	NS
Philippines	Profit function	0.869	46.32	1			
Y-intercept						-2.829	1
Stocking rate/seed					0.924	7.586	1
Recovery rate					0.225	2.250	5
Total feed cost					0.163	1.595	NS
Viet Nam	Cobb-Douglas production function	0.951	232.4	1			
Y-intercept						1.642	NS
Feed quantity					0.735	16.082	1
Fixed costs					0.390	5.937	1
Stocking rate					0.114	3.611	1
Farm-made feed/total feed ratio					-0.133	-3.229	1
Number of ponds					0.084	1.888	5
Thailand	Cobb-Douglas production function	0.800	40.971	1			
Y-intercept			27.214		2.5204	2.9887	1
Feed cost					0.2359	3.4714	1
Fertilizer cost					0.0743	1.9305	NS
Fingerling/seed cost					0.4865	7.4956	1
Fuel cost					-0.0069	-0.876	NS
Labour cost					0.2715	2.6570	1
Fingerling size					0.0750	0.4654	NS
Survival rate					0.7078	5.9571	1
D1 (Dummy variable)					0.5325	3.2510	1
D2 (Dummy variable)					0.4375	2.8990	1
India	Cobb-Douglas profit function	0.538					
Y-intercept						4.002	1
Cost of labour					-0.107	-0.917	NS
Cost of inorganic fertilizer					0.138	1.148	NS
Cost of organic fertilizer					0.319	2.661	1
Cost of fingerlings					0.082	0.560	NS
Cost of feed					0.580	4.157	1
Cost of electricity/fuel					0.059	0.494	NS
Other variable cost except electricity/fuel					-0.014	-0.115	NS

NS = not significant; na = not analysed

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

The expectation of large profits had caused most of the respondents to start fish farming and this irrespective of the culture systems and feeding regimes that they use. There is no clear link between any of the three feeding regimes and the demographic characteristics of respondents with one exception: farmers with higher educational attainment use industrially manufactured feeds more often than do farmers with less education.

High benefit cost ratios were not found exclusively among intensive farms in response to intensive feeding regimes but were also identified among farm-made feed users in traditional and semi-intensive practices in Bangladesh and Viet Nam. Break-even price indicators pointed to a high degree of efficiency on farms in Bangladesh and India followed by China, Thailand and the Philippines. Break-even production coefficients identified farmers in China, India and Bangladesh as the most efficient. However, no matter how measured the farming systems used in Viet Nam were found to be the least efficient.

As is usually the case stocking rates were generally highest among intensive farms, moderate among semi-intensive farms and lowest among traditional farms. In Chinese carp farms industrially manufactured feeds accounted for a larger proportion of feeds used than in any of the other culture systems studied. However, farms in Viet Nam and Thailand used larger quantities of industrial feeds, measured in absolute terms, than did respondents in the other four countries.

The share of feed in total costs varied from a low 25 percent in China to a high of 86.5 percent in Vietnam. As an average for all culture systems and feeding regimes feeds accounted for more than half (58 percent) of total input costs. Taken together purchases of fingerlings and wages to farm worker accounted for about one third of the total. Variable costs accounted for 94.2 percent of the total cost the remaining 5.8 percent being fixed costs. Variable costs account for a remarkably high proportion of the total. In part this has come about as many farmers have managed to initiate the culture systems reviewed in this study without having to construct ponds. They have used already existing structures.

Farmers reported that to improve operations the most important factors are improved water quality, intensified commercial feeding and increased rate of stocking. According to the analysis, other enabling factors are: effective disease control, better farm management, and improved quality control. Regardless of farm category, lack of capital was reported to be the greatest obstacle to increased aquaculture production. In respect of feeding strategies, the surveys show that industrially manufactured feeds would be much more common on the farms if they were less expensive.

As ex-farm prices generally are not within the control of the respondents, feed cost, feeding rate, stocking rate, recovery or survival rate, and fertilizer cost are the most important determinants of the outcome of their fish farming. This suggests that projects or programs aimed at enhancing productivity and profit in the studied farming systems should focus on the above mentioned variables. The results also imply that technical efficiencies can be addressed by enhancing the feed management capabilities of fish farmers.

4.2 Recommendations

Four key recommendations have been derived. They are addressed to governments, industry, farmer organizations, research and development organizations and development agencies. The recommendations are as follows:

1. Non-economic variables (such as water quality and seed quality) should be explicitly considered in future economic studies of fish feeding practices.
2. Lobby for the provision of credit assistance tailored to the circumstances of small-scale fish farmers using traditional and semi-intensive feeding practices.
3. Urge relevant government agencies to implement capacity building programmes in farm management with particular emphasis on feeding rates, stocking density and fingerling survival.
4. Urge governments to implement area specific, action-research types of programs that integrate institutional-technical and socio-economic aspects of fish farming and include post harvest and marketing aspects. The purpose of such programmes

is to devise effective ways to make to farmers benefit from innovation including those concerning farm-made and/or commercially manufactured feeds.

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