



Extension methodology for assessing effectiveness of shrimp farmer groups

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ABSTRACT

Shrimp farmer groups either mobilised by the farmers themselves or facilitated by the development institutions are playing an important role in disease prevention by enforcing common crop calendar and collective compliance of Better Management Practices (BMPs) in the shrimp farming clusters. A weightage based index was developed using four constructs *viz.*, collective compliance of BMPs, group governance, interface with stakeholders and compulsory membership and these were applied purposively among 32 shrimp farmer groups operating in Andhra Pradesh and Tamil Nadu to measure their effectiveness. The Shrimp Farmers Group Effectiveness Index (SFGEI) was found to be reliable and validated appropriately. Findings showed that about 40% of the shrimp farmer groups which enforced compulsory membership for all the farms operating in the cluster irrespective of size and infrastructure were found to be highly effective in collectively preventing disease incidence. The study identified several potential conflict points in implementing group approach and suggested appropriate management solutions for resolving the same. The SFGEI can be applied by any development institution as a guiding tool to mobilise new farmer groups as well as to evaluate the existing groups with suitable modifications. Farmer groups need to be suitably strengthened with adequate institutional support from research and development departments to transform them as producer companies to play an active role in the entire supply chain of aquaculture.

Keywords: Collective compliance, Farmer groups, Group Effectiveness Index, Shrimp aquaculture

Introduction

The transformation of traditional shrimp filtration practices to commercial shrimp farming was due to technological advancements in seed production and controlled rearing of shrimps under pond conditions in 1980s. Favourable government policies and institutional support spread shrimp farming to about 1.5 lakh ha with a production of more than 2.7 lakh t. Shrimp farms are located along the brackishwater creeks and rivulets as clusters, drawing water and draining waters into the same natural body. Majority of the shrimp farms are small in size (< 2ha) with one or two ponds, very contiguous to each other and lack essential infrastructure like electricity and reservoir pond. Two major issues *viz.*, outbreak of white spot viral disease and legal intervention in the mid nineties though affected the sector heavily, paved the way for scientific development of shrimp farming. Shrimp farming has been under threat from frequent disease outbreaks mainly due to poor quality seed, 'self pollution' arising out of poor farm management, negligence and lack of cooperation among the farmers operating in a

shrimp cluster. The identification of disease risk factors and development of Better Management Practices (BMPs) to prevent these risks is the major scientific intervention to revive shrimp farming. The disease causing pathogen is free living, transferable through vectors and hence omnipresent in the farming environment. Disease prevention is possible only when all the farms operating in a shrimp cluster collectively adopt BMPs. Therefore, an institutional mechanism (group) for collective planning, compliance and enforcement of BMPs is the pragmatic solution to ensure disease free shrimp farming.

Shrimp Farmer Group (SFG) is "an institution of farmers owned and controlled by them, which collectively plan, enforce and adopt a common crop calendar and code of practices in a farm cluster to prevent the entry and spread of common risk factors, thereby enable good production for all and establish forward and backward linkages for better economics and sustainability". Shrimp farmer groups are either initiated and controlled by farmers themselves or mobilised and facilitated by the development institutions. Penrose-Buckley (2007) emphasised that farmer groups

have three key defining features: *viz.*, rural businesses; producer-owned and controlled; and collective activities. The concept of grouping among shrimp farmers originated initially in 1990s while the shrimp farmers mobilised themselves as associations to fight against anti-shrimp farming campaign, legal hurdles and socio-economic threats from the local public. However, these associations became defunct once the above issues were sorted out. The experiential learning from the disease outbreaks brought an attitudinal change among the shrimp farmers to unite and exchange information among them rather than keeping secrecy of farm operations. This realisation has caused the evolution of technical control of the shrimp clusters in some pockets mainly in Tamil Nadu, wherein the farmers themselves planned and enforced a code of conduct such as crop planning, collective seed procurement and source water management to prevent disease outbreaks in their shrimp clusters. The success story of these farmer groups in preventing disease outbreaks constantly has culminated in the implementation of 'cluster farming' concept to adopt BMPs collectively.

Farmer groups are widely perceived as an institutional response to different economic needs and social constraints of farmers and a variety of factors motivate their formation (World Bank 2007; Bernard *et al.* 2008; Fischer and Qaim, 2011). Experiences and earlier case studies has amply shown that farmer groups can ensure responsible and sustainable aquaculture development by minimising disease outbreaks (Kumaran *et al.*; 2003; Kutty *et al.*, 2003; Kumaran, 2009), empower farmers through collective decision making (Davis, 2006; MPEDA, 2006), offer opportunities to link with markets, improve social, environmental and food safety responsibility (Kumaran, 2009), facilitate delivery of farm extension services and contribute to the long-term sustainability of the shrimp farming (Krishna *et al.*, 2000; Franzel *et al.*, 2003; Omoyeni and Yisha, 2005; Wennink and Heemskerk 2006; Havard *et al.* 2007; Kumaran, 2007). Effective leadership (Rowland, 1997), smaller size groups (Coulter *et al.*, 1999) and shared values relevant to the purpose of the group (Kilpatrick and Bell, 2001) facilitate higher internal cohesion and prerequisite for the effectiveness of farmer groups.

Even though experiences with farmer groups in the agriculture sector have been mixed, recent experiences in the aquaculture sector show that collective action can yield a number of positive benefits (Laila Kassam *et al.*, 2011). Fewer studies had analysed the collective action in agricultural production, processing and marketing and rural livelihoods. Available studies consist mainly of case studies (Jones 2004; Hellin *et al.*, 2007) and very few analysed farmer groups using quantitative methods

(Karami and Rezaei-Moghaddam, 2005; Barham and Chitemi, 2009; Bernard *et al.*, 2009). In this backdrop, a maiden attempt was made in this study to develop an index to measure the effectiveness of shrimp farmer groups and the same was used to assess the functioning of shrimp farmer groups in achieving the collective compliance of BMPs.

Materials and methods

A Shrimp Farmer Group Effectiveness Index (SFGEI) was developed specifically for the study adopting the standard methodology for evaluating the farmer groups. The fisheries extension workers of the state departments and other developmental agencies are the end users of this group assessment tool, therefore it is pertinent to name this index development as extension methodology. A sample of 32 shrimp farmer groups functioning in Andhra Pradesh and Tamil Nadu states were identified purposively as respondents of the study. The SFGEI along with a checklist of questions was employed to collect primary data from the shrimp farmer groups. One office bearer and two member farmers in each group constituted the sampling unit. Descriptive statistical methods were adopted to interpret the results with the context of the investigation. Decision tree analysis was performed to develop a classification model for effective and non-effective groups and to identify variables that split the instances into categories like effective and non-effective. The input variables for the model include compulsory membership, collective compliance of BMPs, internal group governance and management as well as interface with stake holders. C4.5 Decision tree model implemented in WEKA 3.6 data mining software was used for performing decision tree analysis (Witten and Frank, 2005).

Results and discussion

Development of Shrimp Farmers Group Effectiveness Index (SFGEI)

The present study adopted a five step procedure suggested by Babbie (1995) to develop the SFGEI which include, (i) selection of relevant dimensions, (ii) selection of actions under each dimension, (iii) allocation of weightage to the actions and dimensions, (iv) combine the dimensions into an index and (v) measure the reliability and validity of the index.

Selection of dimensions and actions

A brainstorming session involving researchers, fishery extension personnel and aqua farmers has identified four dimensions *viz.*, collective compliance of better management practices, group governance and

management, interface with stakeholders and compulsory membership as relevant for assessing the effectiveness of shrimp farmer groups.

Selection of statements/actions

A universe of 48 statements/actions reflecting the various functions of the selected dimensions were identified and properly worded on the basis of the

informal criteria for editing statements (Edwards, 1957). Relevancy of these statements were assessed through opinion from 30 experts representing the key stakeholders based on a 3 point continuum: mostly relevant, relevant and least relevant. Accordingly, 36 statements with a mean relevancy score of 75 and above were selected for inclusion in the index under the 4 dimensions with 16, 13, 5 and 2 items respectively (Table1).

Table 1. Dimensions and statements of shrimp farmer Group Effectiveness Index (SFGEI) with their weightage

S. No	Dimensions and statements	Weightage
A.	Collective compliance of BMPs	(1.2)
1	SFG collectively plan for the optimum farming area for culture season (by restricting some existing ponds based on assumed carrying capacity).	1
2	SFG plans common crop calendar and organises collective procurement of seed from approved hatcheries through contract seed production.	3
3	SFG stipulate the stocking density to be followed in the cluster and all the members should stock the approved number as per the CAA guidelines.	2
4	SFG makes certain that without its knowledge, no additional external inputs are used in the shrimp ponds.	2
5	SFG advocates common reservoir for group of ponds which lack space.	2
6	SFG approved aqua consultants alone should be approached for technical consultancy by the farmers of the cluster.	1
7	Water inlet and outlet are followed as per the approved schedule of the SFG.	2
8	During disease outbreaks SFG handles the situation collectively and prevent the spread of disease to a possible extent	3
9	SFG has an internal compensation package to help the affected farm(s) who have accepted to bleach their stock to prevent the spread of disease	3
10	SFG prohibits the use of banned antibiotics or drugs in the cluster	2
11	SFG invites buyers and bargains for a better sale price for the shrimps produced in the cluster	2
12	SFG regulates establishment of new farms within the cluster based on the available potential and internal consensus	2
13	SFG ensures knowledge sharing among the members by organising group seminar and on-farm discussions on culture aspects including food safety principles and traceability protocols	2
14	SFG ensures environmental safety of the ecosystem through proper drainage management and common effluent treatment facility	2
15	SFG insists all the farms to maintain proper record of farm operations and management	2
16	SFG with the help of its members develop, maintain and repair common infrastructure like desilting of creek, repairing of road, maintenance of source water and drainage canals	3
B.	Group governance and management	(1.4)
17	SFG is a registered body governed by a written constitution	1
18	Office bearers of the SFG are elected as per the constitution	2
19	SFG holds meetings at regular intervals or whenever required during the culture period.	2
20	SFG ensures maximum participation of members in its meetings.	2
21	SFG ensures detailed discussion and adopt resolutions with the consensus of members	2
22	SFG ensures its decisions are binding on its members and suitable action is taken on erring members.	3
23	SFG has dynamic leaders to carry forward its activities taking the members together.	3
24	Mutual trust and commitment prevailed among the members of the SFG (2)	2
25	SFG is socially cohesive and successful since most of the members belong to the same village and community.	3
26	SFG adjudicates the problems/conflicts among the members amicably.	2
27	SFG collects membership fee and common fund to carry out common works	2
28	SFG keeps proper financial records and are audited every year	2
29	SFG make sure that all the members are registered with Coastal Aquaculture Authority (CAA)	2
C.	Interface with stakeholders	(0.6)
30	SFG as an institution has the negotiating/bargaining power to deal with governmental and private institutions.	2
31	SFG has interaction with the neighbouring SFG or farmers and shares information for mutual benefit	2
32	SFG ensures cordial relations with local community by preferring local people for farm level employment and helping in societal infrastructure development	2
33	SFG maintains close rapport and linkage with government departments for mutual benefits.	3
34	The government and private institutions recognise SFG as the representative of farmers and implement their activities through SFG.	1
D.	Compulsory membership	(2.8)
35	SFG ensures that all the farms using the same water source within its boundary are its members and governed by the SFG.	3
36	SFG could convince all the farmers that through group action alone every one could continue to have successful crop.	3

Allocating weightage to the items and dimensions

A group of 30 experts were asked to assign a weightage of 3/2/1 to each of these 36 statements as per their perceived criticality for the shrimp farmer group effectiveness. Further the experts were also asked to allocate a weightage of 5.0 among the four dimensions suitably as per their relative significance to the overall effectiveness of the group. The experts were briefed to give the dimension weightage in such a way that the maximum total score did not exceed 100. Subsequently each statement was assigned a score of 3/2/1 derived from the mean weightage of the judges and weightage for the dimensions were also decided based on the mean score. The items were measured on a dichotomous response of “yes” or “no” with a score of ‘1’ or ‘0’ respectively. The total score for each dimension was arrived at by adding the scores of all the statements of the dimension and multiplied with the dimension weightage. Accordingly all four dimension scores were calculated and summed up to arrive at the SFGEI score of a particular shrimp farmer group (Table 2).

Table 2. Scoring methodology of SFGEI

Dimensions	Maximum score possible	Group weightage (w)	Maximum weighted score possible
Collective compliance of BMPs (A)	33	1.2	33 x 1.2 = 39
Group governance and management (B)	27	1.4	27 x 1.4 = 38
Interface with stakeholders (C)	10	0.6	10 x 0.6 = 6
Compulsory membership (D)	6	2.8	6 x 2.8 = 17
Shrimp Farmer Group Effectiveness Index = $\sum(Aw_1+Bw_2+Cw_3+Dw_4)$			

Criteria for measuring the effectiveness of shrimp farmer group

While allocating the weightage for the items and dimensions of the SFGEI, the experts were of the view that compulsory membership is the key for group’s success and hence, full score for that dimension (*i.e.*, compulsory membership) should be the primary criterion to appraise a group as effective or not. Disease prevention is the main objective, collective compliance of BMPs is the only means to achieve that and compulsory participation of every shrimp farmer in the cluster is the key. This is because mismanagement of an individual farmer can spoil the whole cluster. Hence, the experts opined that effectiveness of a group need to be judged based on two criteria. The first criterion is the full score in complete membership and the second criterion is the total SFGEI score of 70 and above.

Measurement of reliability and validity of the index

Reliability is the accuracy and precision of a measuring instrument. An index is said to be reliable

when it consistently produces the same results when applied to measure the same phenomena from time to time. In the present investigation, ‘test-retest’ technique was used to measure the reliability of SFGEI. The SFGEI was administered to a group of thirty farmers to collect the data and calculate the SFGEI score. After a gap of one month, the index was again re-administered with the same respondents. A product moment correlation coefficient was computed between the two sets of scores and it was found as 0.8541. The desired degree of reliability is a function of the purpose of research and reliabilities of 0.70 or higher will suffice for exploratory or applied research (Kent, 2001). Therefore SFGEI was considered as reliable. When the index was constructed, the judges were asked to ensure that the index adequately covers both the content and the objective of measurement so that the index was measuring what we are intending to measure (content validity). The judges were also given free choice to add, reword or modify the statements on the draft index. Scores were assigned to the items, which after careful consideration of face validity, (*i.e.*, extent

to which empirical measures conform to our common understandings and mental images concerning a particular concept (Babbie and Mouton, 2001) were deemed to be good indicators of the subject under measurement.

Assessment of shrimp farmer groups

The findings of the study indicated in the Table 2 showed that about 40% of the groups were functioning effectively and the remaining 60% of them were in the process of consolidation and restricted their role with some aspects of collective compliance of BMPs like common crop calendar and collective seed procurement. Farmer groups who could ensure the compulsory membership of all the farms operating in the cluster were found to be very successful in preventing the disease outbreaks continuously. It was found that effective groups enforced obligatory membership, followed common crop calendar, collective seed procurement from a single reputed hatchery, collective management of disease outbreak, collective maintenance of the common infrastructure,

good rapport with development departments, negotiations with buyers for a premium price, ensured non-use of banned inputs, enforced compulsory record keeping and social responsibility matters. Many groups formed mainly for small farmers were found to be ineffective and it was difficult for these farmers to convince relatively big farmers operating in the same cluster. However, they could enforce few BMPs like contract hatchery system for procurement of quality seed (which is the critical input) and non-use of banned chemicals as well as antibiotics. It was observed that farmer groups which had total control over all the farms and enforced maximum BMPs for collective compliance performed better than the other groups. Further, those farmer groups who had compensation linked disease management integrating the buyers into that process were found to be very successful for a long period. Collective action can also reduce individual farmer risks and work as an informal insurance mechanism for small scale farmers (Larry Burmeister *et al.*, 2001; Di Gregorio *et al.*, 2004). It was also observed that relatively older groups performed better than the nascent (two to three years old), since still many were in the process of consolidation. The successful farmer groups were found to have achieved increase in their members' productivity, increase in net income, continued crop successes without disease and premium price with relatively reduced cost of cultivation.

The structure and composition of the farmer groups were not uniform. However, in some groups where government department facilitation was available, the governance of the group was based on the rules framed by the department. In general, in other farmer groups, the office bearers were elected by consensus and it was purely honorary. Successful farmer groups conducted general body meeting, also known as the first meeting in which all the members participated. In the meeting, the crop calendar and compulsory BMPs for collective compliance were discussed and finalised. The proceeding of the GB was signed by all the members and it formed the guiding book for that crop period. No deviation was allowed without the prior permission of the group. Subsequent meetings were organised whenever required during the culture period in which executive committee met and discussed the developments. The conflicts/issues of the farmers were brought to the executive committee and settled amicably. The farmer groups are legal entities registered as per government procedure. The groups had a joint account in the bank and the accounts were transparent and audited every year. Effective farmer groups negotiated with hatcheries and shrimp buyers for quality seed and premium price respectively. The development departments

considered the farmer group as the representative of the farming community. Farmer groups facilitated the group members to avail registrations from the regulatory body.

The decision tree model used for classifying the farmer groups could successfully classify (with a classification accuracy of 100%) the instances based on only one variable out of the above four variables used *i.e.*, compulsory membership. As per the model compulsory membership having the numerical value more than 8.4 falls into effective group (Fig.1).

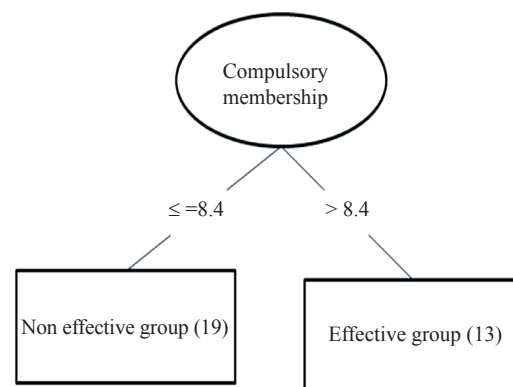


Fig. 1. Decision tree used for classifying the effective and non-effective groups

Effectiveness of farmer groups is a function of group cohesiveness by managing potential internal conflicts and threats. Successful shrimp farmer groups over the years had identified potential conflict points in collective compliance and devised appropriate solutions to minimise those conflicts and strengthen the group cohesiveness which ultimately result in better performance (Table 3). Further, the investigation has indicated that group cohesiveness was dependent on complete membership of all farms in the cluster, economic deliverability through continued success, compulsory technical consultancy, community linked social cohesiveness, conviction that group action is indispensable, accountability - payment of compensation and auditing, collective and compulsory compliance of BMPs, dynamic leadership, and moderate group size (<50). Impact studies on various projects involving farmer groups indicated that groups with an optimum membership range between 20 and 50 people was found to be efficient (Sanginga *et al.*, 2001; Pretty, 2003). Further, the farmer groups in agriculture and allied sector are advancing towards producer companies and provided macro level leadership to collective marketing and food safety (Larry Burmeister, *et al.*, 2001). Therefore, shrimp farmer groups too have the potential to be converted into a producer company which could help them in availing

Table 3. Assessment of Shrimp farmers Groups as per the SFGEI (N=32)

Farmer Group Number	Compulsory membership	Collective compliance of BMPs	Internal governance and management	Interface with other stakeholders	Group Effectiveness Index	
1	16.8	39.6	30.8	6.0	93.20	Effective
2	16.8	39.6	33.6	6.0	96.00	Effective
3	16.8	39.6	33.6	6.0	96.00	Effective
4	16.8	39.6	30.8	6.0	93.20	Effective
5	0.0	13.2	0.0	0.0	13.20	Not Effective
6	0.0	15.6	12.6	5.4	33.60	Not Effective
7	0.0	15.6	12.6	5.4	33.60	Not Effective
8	0.0	15.6	12.6	5.4	33.60	Not Effective
9	16.8	15.6	35.0	6.0	73.40	Effective
10	16.8	15.6	23.8	6.0	62.20	Effective
11	16.8	27.6	35.0	6.0	85.40	Effective
12	16.8	24.0	35.0	6.0	81.80	Effective
13	16.8	24.0	37.8	6.0	84.60	Effective
14	16.8	25.2	37.8	6.0	85.80	Effective
15	16.8	24.0	37.8	6.0	84.60	Effective
16	0.0	12.0	35.0	4.8	51.80	Not Effective
17	0.0	12.0	35.0	4.8	51.80	Not Effective
18	0.0	12.0	35.0	4.8	51.80	Not Effective
19	0.0	12.0	35.0	4.8	51.80	Not Effective
20	16.8	34.8	37.8	6.0	95.40	Effective
21	8.4	12.0	35.0	4.8	60.20	Not Effective
22	8.4	12.0	35.0	4.8	60.20	Not Effective
23	16.8	10.8	37.8	6.0	71.40	Effective
24	0.0	0.0	12.0	35.0	47.00	Not Effective
25	0.0	0.0	12.0	35.0	47.00	Not Effective
26	0.0	13.2	0.0	0.0	13.20	Not Effective
27	0.0	15.6	12.6	5.4	33.60	Not Effective
28	0.0	15.6	12.6	5.4	33.60	Not Effective
29	0.0	13.2	0.0	0.0	13.20	Not Effective
30	0.0	0.0	12.0	35.0	47.00	Not Effective
31	0.0	0.0	12.0	35.0	47.00	Not Effective
32	0.0	0.0	12.0	35.0	47.00	Not Effective

support services like institutional credit, insurance and tax exemptions from the government.

Based on the findings, the study proposes the following ‘ten point guidelines’ which are mandatory to make a shrimp farmer group effective and can be used as criteria to evaluate shrimp farmer groups:

1. Compulsory/full membership – obligatory not an optional irrespective of farm size, location and infrastructure
2. Collectively plan for a common crop calendar which should indicate when to begin and close the farming operations in the cluster
3. Collective compliance of agreed BMPs as ratified in the ‘guidebook’ for the culture period
4. Collective seed procurement and stocking by forming seed team to identify the hatchery, monitoring the seed production process and multistage PCR screening
5. Collective disease management and compensation for the sacrificed farms.
6. Develop repair and maintenance facilities for common infrastructure like inlet and drainage canals, approach road
7. Collective marketing arrangement with one or two buyers to get premium price and link buyer with the group for collecting funds for the group.
8. Food safety protocols by not permitting any chemical or input with out the concurrence of the executive body and procuring some inputs collectively
9. Social responsibility by ensuring cordial relations with local community and fixing minimum labour standards and minimum wages for various operations
10. Compulsory record keeping by printing a uniform record book and periodically verifying the same

Group approach is the pragmatic solution for disease free shrimp culture and hence the shrimp farmer groups need to be strengthened and empowered. Farmer groups as social capital refer to the value of connectedness and trust between people and as such to one of the five key assets (human, social, physical, financial and natural) for

sustainable livelihoods (Grootaert *et al.*, 2002; Pretty, 2003). Getting together with fellow farmers will help to better cope with risk, particularly when neither the private sector nor the government provides any insurance against risks of shrimp aquaculture. Shrimp farmer groups and their collective compliance of BMPs hold the key for sustainable shrimp farming. Institutional support in the form of policy guidelines, linking farmer groups with banks, insurance, inputs and buyers is vital wherein the banks can directly pay the input cost to the feed companies and collect back the money directly from the buyers. Insurance companies with a suitable premium could play a vital role in compensating the association for the amounts the association expends on compensations. Researchers and extension workers integrated with farmers' groups and improved communication among all will bridge the Research-Extension-Farmer linkage problem to focus the efforts on solving farmers' problems as suggested by Krishna *et al.* (2000) and Abaru *et al.* (2006). An integrated and institutionalised approach to resolve the problems faced by the farmers will strengthen the group farming movement in India.

Collective action through an institutional mechanism is the realistic approach to ensure sustainable shrimp farming. The farmer group effectiveness index developed for this study can be applied by any development institution as a guiding tool to mobilise new farmer groups as well as to evaluate the existing groups with suitable modifications. Complete membership is the cornerstone for achieving the objective of collective compliance of BMPs and prevent diseases. Therefore, irrespective of any criteria, farmer groups should ensure the involvement of all the farms operating in the cluster into the group. Extension agencies need to facilitate farmer groups to access needed institutional support from research and development departments and help to transform effective groups as producer companies to play an active role in the whole supply chain process.

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