Chapter 3
Shrimp Farmers in India: Empowering Small-Scale Farmers through a Cluster-Based Approach

N.R. Umesh, A.B. Chandra Mohan, G. Ravibabu, P.A. Padiyar, M.J. Phillips, C.V. Mohan, and B. Vishnu Bhat

Abstract The great bulk of shrimp farming in India, as in most of Asia, as well as that of aquaculture in general in the region, is based on small scale farming activities, and in this regard, is no exception to other primary sector activities. The work on the development of better management practices (BMPs) on the shrimp culture sector commenced with the recognition of the need to place the sector on a firmer footing, while combating the problems of frequent disease occurrences, and to ensure its long term sustainability. The process commenced with the organization of small scale farmers into groups – clusters and/or aquaclubs – grouping farmers in a given area, drawing on common resources such as a common water supply channel, and inducing the farmers to act collectively rather than individually to the betterment and benefits of all. Such clusters and/or aquaclubs were later transformed into Societies with a legal standing, with the establishment of the National Center for Sustainable Aquaculture in 2007, with a purview to monitor society functioning and dissemination of technical know-how to other areas. The outcomes include improved shrimp yields, less impact on the environment, improved product quality, and better relations among players in the market chain. In short, the society formation and/or organization of small scale farmers into groups facilitated the adoption and implementation of the BMPs providing benefits to the farmers, environment, and society. As a result of the cluster approach, and hence, adoption of BMPs, shrimp production has increased from 4 tons in 2002 to 870 tons in 2006. Implementation of simple, science-based farm level plans (e.g., BMPs) and adoption of cluster farming through the participatory concept reduced disease risks in cluster farms significantly, for example, in the demonstration farms, it was reduced from 82% in 2003 to 17% in 2006. Economically, for every Rs. 1,000 (US$ 25) invested by a farmer, around Rs. 520 (US$ 13) was earned as net profit in 2006. This was a substantial increase compared to the Rs. 250 (US$ 6) profit made by nondemonstration farmers during the same period.

N.R. Umesh (✉), A.B.C. Mohan, G. Ravibabu, P.A. Padiyar, M.J. Phillips, C.V. Mohan, and B.V. Bhat
National Centre for Sustainable Aquaculture, 69-17-8, SBI Officers Colony, Rajendra Nagar, Kakinada-533003, AP, India
e-mail: nacsa.hq@gmail.com

S.S. De Silva and F.B. Davy (eds.), *Success Stories in Asian Aquaculture*,

The organization of small scale shrimp farmers in India has (a) empowered small-scale farmers, (b) increased stakeholder interaction and involvement within the clusters, and (c) is an ideal model for small scale farmers to meet market requirements, a model accepted by many Asian countries and being increasingly adopted. The model is of a self propagating nature, and most of all, has contributed to the sustainability of shrimp farming in India, and indeed, in the region. Needless to say, this example drawn from India best exemplifies how small scale shrimp farmers could remain economically viable and are able to comply to the increasing demands of sophisticated markets, and most of all, achieve sustainability.

Abbreviations

CAA	Coastal Aquaculture Authority
MPEDA	The Marine Products Export Development Authority
NACA	Network of Aquaculture Centres in Asia Pacific
NaCSA	National Centre for Sustainable Aquaculture
NATURLAND	Association for Organic Agriculture was founded in 1982 with its headquarters in Graefelfing, near Munich, Germany
SIPPO	Swiss Import Promotion Programme

3.1 Introduction[1]

The Network of Aquaculture of Centers in Asia Pacific (NACA), in collaboration with the Marine Products Export Development Authority (MPEDA), Government of India, conceived and implemented a project for "Shrimp disease control and

[1] Definitions used in this presentation are as follows:

- *Better management practices (BMP)*: Management practices aimed at improving the quantity, safety, and quality of products taking into consideration animal health and welfare, food safety, and environmental and socio-economic sustainability. BMPs are management practices, and implementation is generally voluntary; they are *not* a standard for certification. The term "better" is preferred rather than "best" because aquaculture practices are dynamic and continuously improving (today's "best" is tomorrow's "norm").
- *Cluster*: Cluster is a group of farmers whose shrimp ponds are situated in a specified geographical locality; commonly all ponds are dependent on the same water source.
- *Aquaclub*: Aquaclub is a term used in India to describe an informal group of farmers cooperating with each other on various aspects of management in the cluster.
- *Society*: Society is a term used in India to describe a formal (legal) registered group of (20–75) aqua farmers in a farming locality. Societies are setup according to a model established by the Indian government, and they are legally registered by the Ministry of Revenue and subject to annual audits by government officials to verify accounts and ensure a democratic and transparent management.

coastal management" to address disease and environmental problems in the shrimp industry in India, and ensure that small shrimp farmers of India meet high standards for biosecurity, food safety, and environmental protection. The project aimed to address capacity building in shrimp health and quality management at the grassroots level by organizing small scale farmers into aquaculture clusters.

The shrimp industry is a key sector in India's economy because of its significant contributions to export earnings and gainful employment. Given its vast natural water resources, India has tremendous potential to excel in aquaculture. But in reality, the country's shrimp exports had stagnated since the late 90s. Problems began a few years earlier with the outbreak of white spot disease (WSS). Later on, the judgment by the highest court of India on shrimp aquaculture also impacted its advancement. In response, to address the rising concerns about the sustainability of the sector, in the year 2000, the MPEDA with the technical assistance of NACA initiated the aforementioned project. The project started in 2001 with a large-scale epidemiological study aimed at identifying the risk factors for key shrimp diseases and developing and disseminating better management practices (BMPs) to minimize farm-level risk factors for disease outbreaks and address more broadly shrimp farming sustainability.

The project has since been institutionalized to organize small shrimp farmers and build capacity at grassroots level in India, and provides a strong basis for future progress, as well as an example for other countries in addressing some of the special problems and concerns facing small scale aquaculture farmers.

3.2 The Shrimp Industry in India

The development of more commercial hatcheries, coupled with credit facilities from commercial banks and technical and financial assistance programs from MPEDA, led to a phenomenal increase in the area under shrimp farming between 1990 and 1994. The tiger prawn, *Penaeus monodon* indigenous to the region, was the main species cultured. In the states of Andhra Pradesh and Tamil Nadu, a large number of commercial integrated shrimp farming units with foreign collaboration also emerged adopting "scientific" culture systems with facilities for production of shrimp seed, shrimp feed, and processing. But this trend did not continue for long as the large scale corporate shrimp farms failed to make profits, and consequently, shrimp farming became more or less a small farmer activity. Presently, coastal aquaculture in India is synonymous with shrimp aquaculture and mainly carried out by small scale farmers. Shrimp farming in India involves three categories of farmers/entrepreneurs, i.e., small and medium farmers, middle-level entrepreneurs, and big entrepreneurs. The farming of shrimp is largely dependent on small holdings of less than 2 ha; these farms account for 90% of the total area utilized for shrimp culture, 7% of farms are between 2 and 5 ha and the remainder has an area of greater than 5 ha (Jayaraman 1998; MPEDA 2008). The small scale farmers were unorganized and most of the farmers did not have access to technological innovations

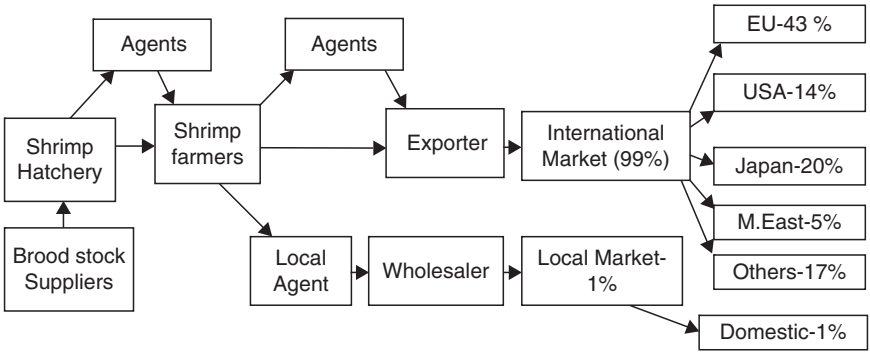

Fig. 3.1 The value chain for farmed shrimp (source MPEDA, 2008)

and scientific applications. They contribute around 80% to the total shrimp production, but were poorly served. Small-scale farmers are innovative and productive, but because of poor organization, lack of skills, inadequate information, and knowledge base, they are vulnerable to the numerous risks and hazards that impact their livelihoods, farm productivity, and competitiveness.

Shrimp farms are operated using both leased out government/private lands and landowner-operated shrimp farms. A credit system functioned throughout the sector, operated and controlled primarily by intermediaries. Intermediaries also acted as input suppliers and providers of credit at each stage in the supply chain, and were also involved in buying back the harvested shrimp. On average, farmers end up paying a whopping 30% interest on the loans from the intermediaries that affect the profitability of their operations.

At present, about 283 shrimp hatcheries operate in the country providing a total production capacity of 1,254 billion PL/year. Farmed shrimp production increased from 40,000 tons in 1991–1992 to 143,170 tons from a 140,000 ha farming area, and another 42,820 tons of scampi (the giant freshwater prawn, *Macrobrachium rosenbergii*) from a 4,300 ha area during 2006–2007, generating about Rs. 40,790 million in export sales equivalent to US $ 0.8 billion (MPEDA 2008). The value chains associated with the shrimp farming sector is shown in Fig. 3.1.

3.3 Background to MPEDA-NACA Project

In November 1994, the WSS, which is caused by a systemic ectodermal and mesodermal Baculovirus, led to extensive damage to shrimp culture in India (as elsewhere in Asia), and continued its devastation in 1995 and early 1996 throughout the west and east coasts of India. Both *P. monodon* and *P. indicus* in extensive, improved extensive, and semi-intensive farms, irrespective of the source of water

for culture, were affected by the disease and the total loss was estimated to be about Indian rupees 6,000 million (Vijayakumaran 1998). With improved biosecurity measures, the severity of the WSS syndrome has since decreased in India and shrimp farming was limping back to normalcy until a court order issued by the Supreme Court of India in December 1996 suspended coastal aquaculture within 500 m from the high tide level in coastal regulation zone. This decree also led to the establishment of an Authority to regulate the development of coastal farms and farming practices. Subsequently, the Government of India enacted the Coastal Aquaculture Authority (CAA) Act, 2005, enabling the establishment of the CAA for enforcing proper regulatory measures for coastal aquaculture in a more sustainable and eco-friendly manner. The Act encompasses all forms of aquaculture in saline or brackish waters in the coastal areas, but excludes freshwater aquaculture.

While analyzing the issues concerned with small farmers, it was amply clear that the majority of the shrimp farmers neither had the skills to adopt scientific norms, nor access to useful technical information essential for shrimp farming. The awareness levels of farmers were inadequate and neither the Government nor the farmers were geared to meet the challenges that were posed by issues, such as pollution, viral diseases, and traceability and food safety concerns. The availability of technical personnel in the fisheries departments in the respective states to support the vital extension functions at the grassroots level were inadequate, resulting in poor transfer of technology, lack of coordination with other departments, and poor research linkages. With the conventional top-down approaches showing limited success in extension services, there was a need to promote the bottom-up participatory approach with effective coordination and convergence at the appropriate levels.

In order to address the rising concerns about disease and sustainability of the sector, in the year 2000, the MPEDA with the technical assistance of NACA initiated a project on "Shrimp disease control and coastal management."

3.3.1 Key Steps Adopted in the Project (also see Fig. 3.2)

- *2000*: A baseline study of the major diseases affecting the shrimp aquaculture operations.
- *2001*: Longitudinal epidemiological study in 365 ponds in Andhra Pradesh to identify major risk factors associated with WSS and low productivity in *P. monodon* culture ponds.
- *2002*: Development of farm level contextualized BMPs to address the identified risk factors. Pilot testing of BMPs in selected farms.
- *2003:* Development and testing of the concept of cluster farming for effective BMP adoption among farmers in a cluster.
- *2004*: Expansion of BMP promotion to a large number of clusters. Extension of some of the BMPs to downstream activities such as hatcheries.
- *2005*: Review and refinement of BMPs and production of BMP extension leaflets for each stage of the culture operation.

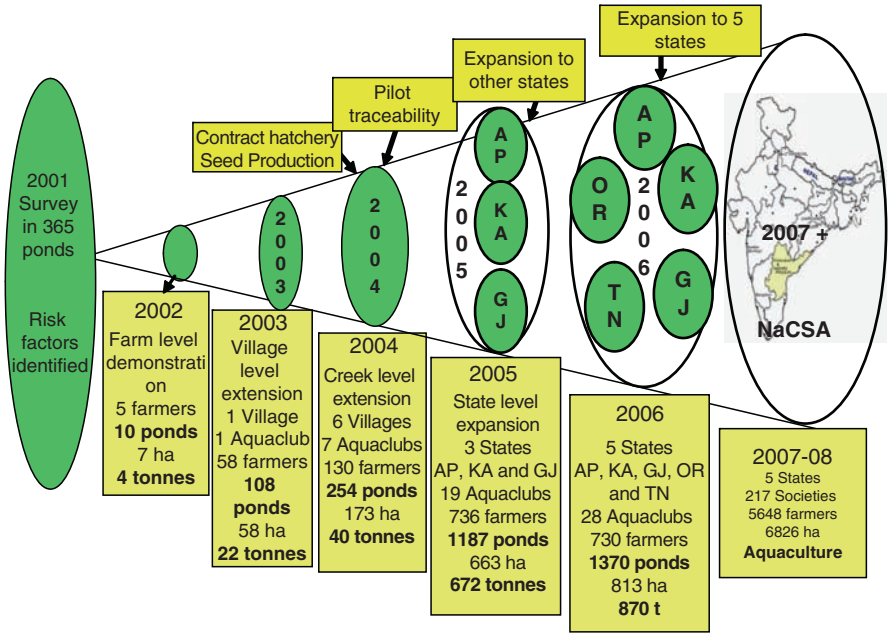

Fig. 3.2 MPEDA/NACA Project development since 2000. The figure indicates the adoption of the strategies by different states and increasing number of farmer groups (*A* – Andhra Pradesh, *G* – Gujarat, *K* – Karnataka, *O* – Orissa, *T* – Tamil Nadu)

- *2006*: Expansion of the BMP program to clusters in five different states. Conceptualization of an institutional framework for sustaining the cluster approach as aquaculture societies for sustainable aquaculture.
- *2007*: Establishment and inauguration of National Center for Sustainable Aquaculture (NaCSA) to carry forward the MPEDA/NACA project activities.

3.3.2 Risk Factor Study (2000–2001)

Following the base line survey and study of the major diseases that were affecting shrimp farming operations and also with some preliminary consultations with farming communities and other stakeholder groups, a detailed longitudinal epidemiological study was conducted on shrimp disease problems during 2001. The study involved 365 ponds in West Godavari and Nellore districts of Andhra Pradesh state, and used an epidemiological approach to better understand the key risk factors contributing to shrimp disease outbreaks and low pond production, with an emphasis on the economically impacting "WSS." The findings from the risk factor study and management practices to address the problems have been published into a "Shrimp Health Management Extension Manual" (MPEDA/NACA 2003).

3.3.3 Development of BMPs Based on International Principles for Responsible Shrimp Farming

The outcomes provided a better understanding of the risk factors for WSS outbreaks, and those causing unusually low pond productivity. Toward the end of 2001, results were discussed widely with farmers and other agencies in Andhra Pradesh, and some consensus was reached on the study findings and their practical application to improve performance of shrimp farming systems of Andhra Pradesh. Risk factors significantly associated with disease outbreaks and low pond productivity were then used to develop locally relevant management strategies BMPs to reduce the identified risks.

The MPEDA/NACA project in India has also provided a good example of translating the International Principles (FAO/NACA/UNEP/WB/WWF 2006) for responsible shrimp farming into BMPs adapted to local farming conditions, and ensuring their easy implementation by relevant stakeholders. The findings from these projects provide evidence of the advantages of small farmers being organized (into aquaclubs or societies), sharing resources, helping each other, and adopting BMPs. The outcomes include improved shrimp yields, less impact on the environment, improved product quality, and better relations among players in the market chain. In short, the implementation of the BMPs has provided benefits to the farmers, environment, and society (Mohan et al. 2008).

In order to enhance BMP uptake and promote adoption in different coastal states of India, BMP brochures on ten key thematic areas were developed in English and translated into the five regional languages of the respective states. For each of the thematic areas, the illustrated brochures describe the field procedures in 15 simple steps in the local language. The BMP dissemination was principally through weekly farmer meetings, society coordinators, and regular pond visits by the NaCSA staff.

The key BMPs developed and implemented in the project are:

1. *Good pond/water preparation*: The soil should be checked for the presence of black layer and should be removed from the pond. Water should be screened at the water inlet point to avoid entry of virus carrying fish and crustaceans, which may be predator or competitor for shrimp. Water depth of at least 80 cm should be maintained in the pond.
2. *Good quality seed selection*: Seed is best purchased through contract hatchery seed procurement system where all the group farmers purchase quality seed for whole group.
3. *Water quality management*: Basic water quality parameters like dissolved oxygen, pH, and alkalinity must be maintained at optimum level. Water exchanges only when felt necessary and during critical periods.
4. *Feed management*: Efficient use of feed. Demand feeding using check trays and feeding across the pond using boat/floating device. FCR must be kept below 1:1.5.
5. *Pond bottom monitoring*: The pond bottom soil should be monitored on weekly basis, especially at the feeding area or trench for black soil, benthic algae, and bad smell, and corrective actions should be taken.

6. *Health monitoring/biosecurity*: No draining or abandoning of disease affected stocks. Farmer groups are encouraged to discuss common actions that can be taken during disease outbreaks to avoid spreading of disease from one farm to another.
7. *Food safety*: No use of any harmful/banned chemicals like pesticides and antibiotics.
8. *Better harvest and post-harvest practices*: Quick harvesting, chill killing of harvested shrimp, and quick transport to processing plant.
9. *Record maintenance/traceability*: Maintenance of hatchery/pond management record book by hatcheries and farms to identify problems in the tank/pond environment, and to rectify these problems at the earliest during the production cycle. This is also required for traceability purpose.
10. *Environmental awareness*: Improved environmental awareness about mangroves, pollution, and waste management among farmers.

3.4 Implementation of BMPs and Evolution of the Group Approach

3.4.1 Pilot Testing of BMPs at Farm Level (2002)

In 2002, demonstrations were conducted in five selected private farms, involving ten ponds, in three villages in West Godavari and Nellore districts of Andhra Pradesh on the east coast of India. NACA and MPEDA provided technical assistance to demonstration farmers for on-farm testing of BMPs, and supported monitoring and evaluation to understand benefits and constraints. The demonstrations were also used more widely to disseminate information on risk management strategies to farmers. Although the adoption of BMPs did not completely eliminate shrimp disease problems, the outcomes as judged by participating farmers and the MPEDA/NACA study team were very promising. Adoption of pond level risk management practices led to improvements in both profits and productivity. In demonstration farms, returns shifted from a loss in 80% of ponds in 2001 to a profit in 80% of ponds in 2002. During district level workshops in November 2002, with over 470 farmer participants from Nellore and Bhimavaram, farmers responded positively to the findings, and requested urgent support for more demonstration activities and initiatives to extend the concept of BMPs to the wider farming community.

3.4.2 Promotion of BMPs at Group Level (2003)

In 2003, MPEDA and NACA responded positively to farmer requests and supported an extension of the project for further demonstrations in one farmer group in a village of West Godavari District of Andhra Pradesh. The objective was to

promote adoption of BMPs across a wider number of farmers to create a visible and quantifiable impact on the village community through organization of a "self-help group" (aquaclub) to collectively address common shrimp health and farm management problems using a participatory approach (collective planning, decision making, and implement crop activities).

The core NACA/MPEDA team lived in the village during the early part of 2003, promoting adoption of BMPs, supporting farmers to establish the Aquaclub, facilitated weekly farmer meetings, and organized "service provider – farmer" contacts and exchange of information, thereby trying to build up mutual trust among these parties. At the same time, the team established a monitoring program and at the end of the 2003 crop, evaluated with farmers the outcomes of the village demonstration to better understand the benefits and constraints to adopting better health management practices.

3.5 Promotion of BMPs at the Cluster Level and Expansion of the Program (2004–2006)

Following the success of BMP promotion at the group level, the program moved one step higher and promoted BMP adoption among clusters along a creek (their shared water source). In 2004, 130 farmers with 254 ponds were assisted to organize into seven aquaclubs/clusters in Andhra Pradesh and BMPs were promoted at the level of clusters (MPEDA-NACA 2005). The results of all of the above are best illustrated schematically when the number of farmers adopting BMPs increased almost exponentially within half a decade, and the individual profits obtained increased significantly (Fig. 3.2). Most of all, the farmer clusters have become sustainable and the livelihoods of small scale farmers that were in jeopardy previously have been ensured by scaling up and institutionalization of the program.

The MPEDA-NACA project was very successful, and the enthusiasm of the farmers involved in the project motivated MPEDA to expand this mechanism for capacity building in shrimp health and quality management at the grassroots level by organizing small scale farmers into Aquaclubs and clusters. MPEDA invested in a separate Technical Service Agency called the NaCSA under the administrative control of MPEDA. NaCSA has become operational since April 2007, and is functioning as an outreach organization of MPEDA primarily to cater to the extension needs of small scale aqua farmers. The primary objective of NaCSA is to support development of sustainable aquaculture in India through efforts primarily aimed at empowering the marginalized and poorest of the poor in the aquaculture sector, besides disseminating technologies and information on better practices, sustainable and judicious utilization of the resources, use of science in day to day activities, marketing of the produce, etc., for the benefit of the shrimp farmers and sustainability of the shrimp sector in the country (Fig. 3.3).

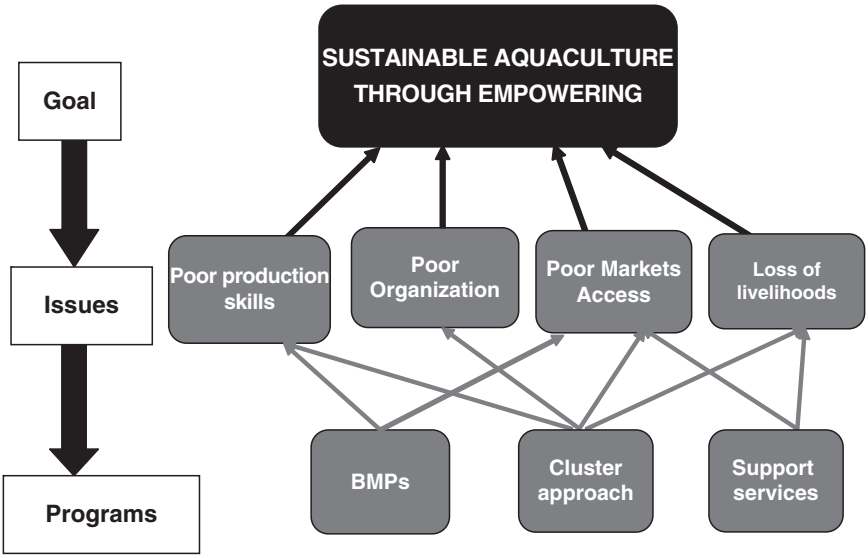

Fig. 3.3 Schematic representation of NaCSA mission and programs

NaCSA continues to consolidate and expand the BMP implementation work through the cluster concept initiated under the MPEDA-NACA program across the country through a network of aquaculture societies.

In the preparation and institutionalization phase, the NaCSA facilitated the formulation of a work plan by involving multistakeholders consultation in September 2007. The meeting was attended by over 35 delegates representing Indian Council of Agriculture Research, state fisheries departments, farmers, farmer organizations, hatcheries, processors, feed companies, professional organizations (SAP), PCR laboratories, and NACA. From MPEDA, Chairman, Director, and senior officers were present.

Now farmer groups are referred to as societies, which were called as aquaclubs earlier. Societies are setup according to a model established by the Indian government, and are registered by the Ministry of Revenue and subject to annual audits by MPEDA to verify accounts and ensure a democratic and transparent management. In a society, all the members register their farms with CAA and obtain a license. Each society consists of 20–75 farmers with strict conditions for membership and elected board members, and is a legal entity. The societies are also eligible for availing financial assistance from MPEDA and other agencies for various activities related to farming.

Intensive work in pilot clusters by project team members has led to the gaining of expertise. Moving this knowledge beyond pilot clusters required scaling up through human resources recruitment. NaCSA, accordingly, has recruited additional 20 field staff, training them and disseminating the project findings to more farmers. Also developed were organizational structure and work mechanisms and increased public awareness through various media and direct farmer meetings.

Andhra Pradesh is taking the lead in society organization as most of the BMP work was done in this state over the last 5 years. At present, NaCSA is working with more than 150 aquaculture societies, and expected to promote BMPs in 500 societies within the next couple of years.

3.5.1 Why the Approach is Considered a Success

A number of factors are thought to have contributed to the success of the approach adopted in the present exercise. Foremost among these are:

(a) Empowering small-scale farmers
(b) Ideal model for small scale farmers to meet market requirements
(c) Contributing to sustainability of shrimp farming
(d) Increased stakeholder interaction and involvement within the clusters
(e) Acceptance of the model by other NACA member countries
(f) Self propagating nature of the model

3.5.1.1 Empowering Small-Scale Farmers

Organized farmer groups (societies) are one of the key mechanisms for supporting farmer empowerment. They have the potential for cooperative action, which can change the position of the farmer in relation to the opportunity structures, and thus, influence the business environment of the farming community. Moreover, small-scale farmers can, through organization, gain the advantages of economy of scale in accessing services and markets, which are otherwise limited to large commercial farmers. Farmer groups also improve information exchange and sharing among group members. The small scale shrimp farmer groups of India are in a better position today to gain these benefits compared to the situation when they were unorganized.

3.5.1.2 Society Management

Each society has its own guidelines and implements them. The societies are audited every year by MPEDA for the implementation of guidelines and BMPs, so far 52 societies have been audited and found to be implementing BMPs. Societies which fail to implement them would lose their society registration. Some features of the registered societies are as follows:

- A society consists of 20–75 farmers and has a clear organization with strict conditions for membership, and elected board members.
- Membership to a society is purely on voluntary basis.
- In a society, all the members register their farms with the CAA.
- The members contribute an admission fee of Rs. 1,000 (US$ 25), and in addition, members have to pay 0.5% of their revenue to the society corpus fund.

- The optimum stocking density for each cluster is decided and abided by farmers/members.
- Seed purchase is through contract hatcheries 45 days prior to stocking.
- All the cluster farmers stock at the same time (within 2 weeks period).
- Agreement by all society farmers for not using any antibiotics and no/reduced chemical use.

Each of the farmer societies has one coordinator selected among its members or from the community by society farmers with a prescribed minimum education level. The society coordinator is trained in society management, BMPs, and extension techniques by NaCSA. The coordinator will be responsible for implementing BMPs in societies, and act as link between society farmers and NaCSA. Each of the NaCSA field managers will coordinate and manage the activities of ten such societies. MPEDA's society scheme provides partial financial assistance for farmers to employ a society coordinator for the first 2 years. The working mechanisms of NaCSA are schematically represented in Fig. 3.4.

To facilitate farmer involvement, ensure commitment, and inculcate confidence, the previous MPEDA-NACA and NaCSA field staff stay closer to farmer societies for the entire cropping season. Key farmers from other villages where MPEDA/NACA, NaCSA had worked previously are invited to new villages to share their experiences. Wherever possible, field visits are arranged for farmers to other villages for first hand information exchange among farmers. A contract hatchery seed procurement system is followed in registered societies. Farmers' field days are organized at the end of successful crop cycles in societies to spread the message of success to more farmers.

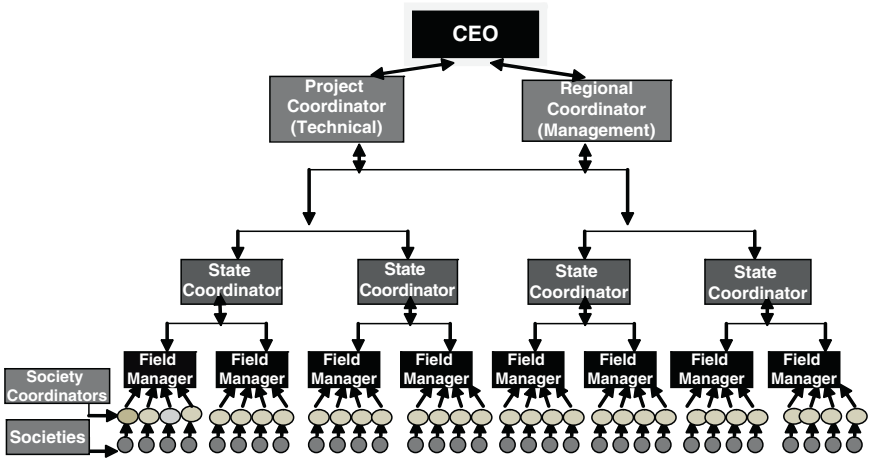

Fig. 3.4 NaCSA farmer society management plan

3.5.1.3 Capacity Building

NaCSA has taken up an extensive awareness program through village level meetings, which are key in educating farmers about market requirements and promoting the benefits of implementing BMPs through organized societies. During 2007–2008, a total of 251 village level meetings involving more than 5,000 farmers were conducted. The concept of BMPs and its implementation through society formation and the market requirement are explained in detail to all the farmers in a given area. Small farmers who do not have any other alternative other than shrimp farming are the ones who are keen to adopt BMPs through organized societies. In the process, we are seeing an emergence of farmer leaders in each society who are willing to work for the benefit of the group, many of them are voluntarily sparing their time and resources. In a village, there will be some aquaculture producers who are society members, while others are not members and prefer to keep conventional production and marketing practices. However, this trend is changing with the societies achieving better crop successes with reduced production costs, and having an opportunity to market their produce at better prices. All these have induced more and more farmers from a village to join either an existing society or form a new one.

There are 30 well-trained technical staff with NaCSA, besides 42 society coordinators trained by NaCSA. Professional Fisheries Graduates are also being trained in societies in various aspects of aquaculture, social, and environmental issues. NaCSA is planning to expand the same in future involving all the fisheries colleges in India.

3.5.2 Contributing to Sustainability of Shrimp Farming

For the aquaclubs/societies to be successful, they have to be economically and environmentally sustainable besides being socially responsible.

3.5.2.1 Economic Sustainability

Economic sustainability in aquaclubs/societies is achieved through

- Reduced disease risks
- Reduced cost of production and increased profits
- Improved service provisions

3.5.2.2 Reduced Disease Risks

The project has made significant progress, increasing from five farmers who adopted the cluster farm approach in 2002 to 730 farmers (813 ha) in 28 aquaclubs

in five states (Andhra Pradesh, Karnataka, Orissa, Gujarat and Tamil Nadu) in 2006. The production of BMP shrimp through the program has increased from 4 tons in 2002 to 870 tons in 2006. Implementation of simple, science-based farm level plans (e.g. BMPs) and adoption of cluster farming through the participatory concept reduced disease risks in cluster farms significantly. The prevalence of shrimp disease in the demonstration farms was reduced from 82% in 2003 to 17% in 2006 (Fig. 3.5), while in nondemonstration ponds, the reduction in disease prevalence was limited during the same period.

In 2006, the program was run in five coastal states, namely, Andhra Pradesh, Karnataka, Gujarat, Tamil Nadu, and Orissa. BMPs were promoted in 28 clusters (aquaclubs) comprising 730 farmers with 1,370 ponds. Participation of farmers in BMP implementation during 2006 included:

- 20 aquaclubs in Andhra Pradesh
- 3 aquaclubs in Tamil Nadu
- 2 aquaclubs in Orissa
- 2 aquaclubs in Gujarat
- 2 aquaclubs in Karnataka

Compared to surrounding nondemonstration ponds, the crop highlights included:

- 30% increase in production
- 8% increase in size of shrimp
- 30% improvement in survival
- 31% reduction in disease prevalence
- Disease risks are reduced mainly through good quality seed

Good quality disease free seed is purchased through a contract hatchery system in which society farmers place bulk orders, 45–60 days in advance of the planned stocking date. Through a consultative process, initially facilitated by NaCSA, a mutual agreement is reached between selected hatcheries and societies. These agreements include compliance on the use of BMPs in hatcheries and other terms and conditions for production and procurement of quality seed (Padiyar 2005).

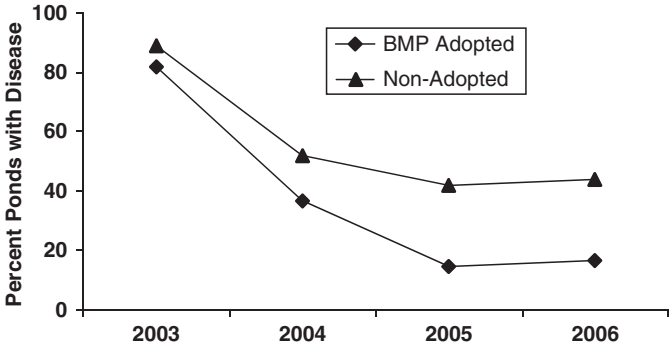

Fig. 3.5 Comparison of the prevalence (%) of disease in BMP and non-BMP shrimp ponds

- Same time stocking with optimum density
- Health management stress on prevention, rather than treatment
- Cooperation among farmers

3.5.2.3 Reduced Cost of Production and Increased Profit

Economic analysis of 2006 data clearly demonstrated that farmers adopting BMPs have higher profitability, lower cost of production, and are able to produce quality and traceable shrimp without using any banned chemicals. In the demonstration ponds for every Rs. 1,000 (US$ 25) invested by a farmer, around Rs. 520 (US$ 13) was earned as profit in 2006 (Fig. 3.6). This was a substantial increase compared to the Rs. 250 (US$ 6) profit made by non-demonstration farmers during the same period.

Prior to forming aquaclubs/societies, farmers never perceived in improving (e.g., de-silting the canal) the common water intake, but now with collective effort and pooling of resources, this has not only been made possible, the members appreciate the importance of regular de-silting to improve production. Now some farmers are progressing toward getting electricity for the entire cluster, which otherwise would have been beyond the means of individual farmers. Recognizing farmers' interest, Government is also coming forward to help the groups for development of infrastructure facilities.

Key factors responsible for improved profit in BMP implemented farms are:

- Efficient use of resources (feed)
- Reduced chemical use
- Sharing of expenses (deepening of canals, seed testing, transport of inputs, laboratory analysis, electricity, etc.)

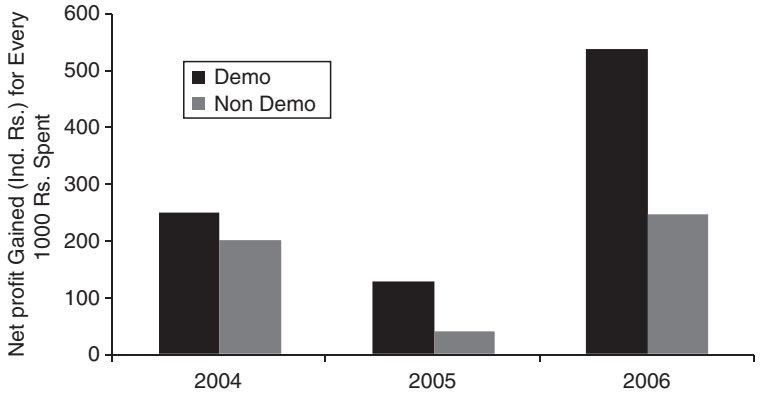

Fig. 3.6 Profit made by BMP (demo) and non-BMP farmers for every thousand rupees (US$ 25) investment

3.5.2.4 Facilitating Favorable Policy Decisions

The initiative has helped to create change towards policies that are more favorable to the small scale shrimp farmer. The Ministry of Commerce and Industry has approved a scheme for implementation through MPEDA on registration of Aquaculture Societies for adoption of code of practices for sustainable shrimp farming, with a total outlay of Rs. 25,000,000 (US$ 625,000) during the 10th and 11th plan period.

In the state of Andhra Pradesh, as soon as 100 societies were registered, all the society farmers gave a representation to the Chief Minister of the state requesting to intervene in helping small scale shrimp farmers with favorable policy changes.

3.6 Environmental Sustainability

The program also led to reduction in other aquaculture-related risks. The environmental risks were also reduced by the decrease in pollution resulting from efficient use of resources (energy and feed), reduced use of chemicals, antibiotics, and limited discharge of sediment and water exchange. In addition, the following initiatives have also been taken which will have positive environmental impacts.

3.6.1 Organic Project

The eco-friendly low density aquaculture practices of society farmers encouraged MPEDA to implement the first Indian Organic Aquaculture Project, which is a collaborative project of MPEDA and the Swiss Import Promotion Program in two aquaculture societies of Andhra Pradesh. MPEDA is providing financial assistance for the farmers to meet part of certification and expenses toward organic feed. The products will be certified by Naturland (www.naturland.com) against Naturland organic standards, providing market access with premium price. NaCSA is coordinating the implementation of the project in Andhra Pradesh.

3.6.2 Revival of Abandoned Ponds

Until mid-1990s, shrimp farmers earned good returns, but investments on technologies leading to good management practices were generally ignored. Consequently, shrimp farming in many areas failed to withstand the impact of viral outbreak in this period. As the situation failed to improve, a large number of farmers abandoned shrimp farming. In Krishna District of Andhra Pradesh where 1/3 of the farming

area developed was abandoned, NaCSA took up demonstration with the objective of reviving the livelihoods of those farmers, in particular small scale farmers. Three societies consisting of 63 farmers (84 ponds, 67 ha) agreed to follow the BMPs starting with sourcing disease free seed through the contract hatchery system. After 110 days of successful culture, farmers started harvesting and none of the ponds of the three societies were affected by disease. More than 50% of non-society ponds were affected with WSS in this area during the last summer season, while 95% of the BMP adopted ponds made good profits during the period. Seeing the success of these societies, more and more neighboring farmers from abandoned areas are coming forward to organize themselves into societies. Positive impact of this success will be seen in coming crops as new societies implement BMPs and more societies will be organized in Krishna District. This could pave the way for full-scale revival of most of the abandoned ponds in Andhra Pradesh and an example for other parts of the (Table 3.1).

3.6.3 Social Responsibility

The social impacts of group farming include reduction in risks to livelihoods and improved awareness of biosecurity and environment integrity among cluster farmers. The key indicators of increased social responsibility among cluster farmers are:

- Regular information sharing among farmers during weekly meetings.
- Cooperation in selecting/testing and buying seed through contract hatchery seed production systems.
- All farmers in a cluster stocking at the same period, thereby avoiding continuous stocking and harvest.
- Reduced contamination when there is a disease outbreak due to information sharing among cluster farmers followed up with immediate remedial actions.
- Increased cooperation in sharing common facilities-deepening inlets, drains, etc.

Table 3.1 Details of farmer Societie organized to date (2008)

State	Organized societies	No. farmers	Area (ha)
Andhra Pradesh	121	2,492	2,697
Tamil Nadu	22	665	1,270
Karnataka	05	120	197
Orissa	03	49	55
Gujarat	02	53	38
Total	153	3,379	4,257

3.7 Opportunities to Comply (for Small Scale Farmers) with Market Requirements

Over the years, the approach to quality management has assumed greater significance and importance in the seafood sector worldwide, both in production and supply chains. New trends are emerging in production and marketing, such as traceability, eco-labeling, and certification. For farmers and producers in developing countries, supplying goods for national and international markets can present a life-changing opportunity. Retailer demand is there especially for products with ethical and green credentials. The difficulty lies in meeting those retailer needs and identifying the right products where developing country producers often lack the skills to deal with the high demands of the export markets and access to capital and business expertise. These factors collectively present a formidable barrier in entry to sophisticated markets. At the other end of the supply chain, retailers often lack the ability to be able to reliably source quality products that are required.

Farmer societies provide a good opportunity to link up with retailers following the existing controls that ensure that basic requirements of markets, including social and environmental responsibility and food safety, are in place.

- Traceability back to shrimp farms and hatcheries through proper record keeping and use of GIS maps.
- Legally registered farms – in India all shrimp farmers are registered by the CAA.
- Societies follow BMPs to control the hygiene and safety of shrimp produced by registered farmers.
- Society produced shrimp are safe – no use of antibiotics at any stage in society farms.
- Existing societies organized following the model of the Indian government and controlled by government officers, which have a high degree of compliance with fair-trade requirements in terms of democracy and transparency.
- Members of societies are familiar with export requirements.

3.8 Adoption of the Model by Other NACA Member Countries

Although BMPs are often simple farm level plans to prepare for and respond to disease, their systematic adoption by farming communities and countries to manage shrimp health problems and achieve widespread sustainable shrimp production has a relatively recent history. The MPEDA/NACA project has the distinction of being the first program moving in this direction in the region. Since then, this approach towards sustainability has been adopted by several countries, and it is expected to spread to many other countries in the Asian region and be suitably modified and adopted for other cultured commodities such as marine fin fish.

The following are the examples of positive uptake in countries in the region.

Vietnam has used the "International Principles" to adapt legislation and develop its national program toward better management of shrimp farming. In addition to supporting the development of the International Principles for Responsible Shrimp Farming, projects were initiated to translate the principles into practices, which targeted better production, product quality, and environmental and socio-economic sustainability. Among the government's initiatives to promote a more sustainable development of the sector was the project that supported coastal aquaculture, which demonstrated the private and social benefits of adopting BMPs. In 2003, NACA and the Ministry of Fisheries (MOFI; currently designated as Ministry of Agriculture and Rural Development – MARD) with the support of the DANIDA-funded Fisheries Sector Program Support (FSPS) began implementing a project to support the promotion of responsible shrimp farming at all levels and for all links in the production chain.

BMPs were developed for broodstock traders, hatcheries, seed traders, and farmers. Focus was given to the development of simple and practical BMPs, which addressed the needs of less resourced small-scale farmers. Ten sets of extension material were developed and disseminated in close collaboration with the MARD. The tangible outcomes include the following:

- Implementation of BMP for hatcheries was supported in six hatcheries and resulted in seed production up to 1.5 times higher and a price per unit seed of about 30–40% higher than non-BMP seed.
- BMP implementation was also supported in seven pilot farming communities (655 direct beneficiaries). Implementation led to a remarkably lower risk of mortality, higher production, and higher probability of making a profit.
- Farming communes that introduced seed testing increased their chances of making a profit of over 7 times.
- BMP application led to average yields that were sometimes more than 4 times higher than in farms where BMPs had not been adopted.
- The project BMPs were also incorporated into the draft standards for the production of organic seed.
- The project also strengthened the institutions involved with seed health management by conducting training courses and supporting the development of national and provincial-level legal documents to improve the process of seed screening and certification.

Benefits of BMP application in Vietnam were visible from the early stages of its implementation. Farmers complying even with only two recommended practices – testing of seed for WSS Virus and removal of sludge before stocking, reduced the risk of crop failure from 61.0 to 47.8%.

In Indonesia, BMP experiences from India were used in the rehabilitation of the shrimp farming sector in the Province of Aceh, following the 2004 tsunami. A practical BMP manual was prepared during 2006 based on the International Principles for Responsible Shrimp Farming, and the manual has been widely promoted and used by various agencies involved in assistance to rehabilitation of livelihoods in Aceh. The results from practical implementation are also promising,

with similar outcomes of reduced disease risks and improved productivity in traditional shrimp farms compared to farmers not adopting better practices.

3.9 Increased Stakeholder Interactions and Involvement

The message from this project is guided by the importance of government support and collaboration of various institutions and partners to translate Principles into Practice. By coming up with the project ideas and committing resources to their implementation, the government of India provided opportunities for other local, national, regional, and international institutions, organizations, and agencies to take part in these projects. In India, MPEDA, State Department of Fisheries, ICAR and its relevant institutions particularly the Central Institute of Brackish water Aquaculture (CIBA), All India Shrimp Hatchery Association, Farmers' Associations, Seafood Exporters Association of India, academic institutions like the College of Fisheries, Mangalore, ACIAR, and FAO all had various roles to play.

Farmers being the primary producers, there is a need to link them to all other stakeholders in the industry both backwards and forward. Farmers are being linked to hatcheries, input suppliers, processors, scientists, Research Institutes, Government institutes, banks, and others. Bank loans for working capital, which are not available now for most of the small scale farmers, are likely to be made available once the societies are linked up with the market. The operational links are depicted schematically in Fig. 3.7. MPEDA is extending financial assistance in the form of the society scheme to kick-start the formation of the clubs and implement the BMPs. There is better flow of valuable information from field to research institutes. During

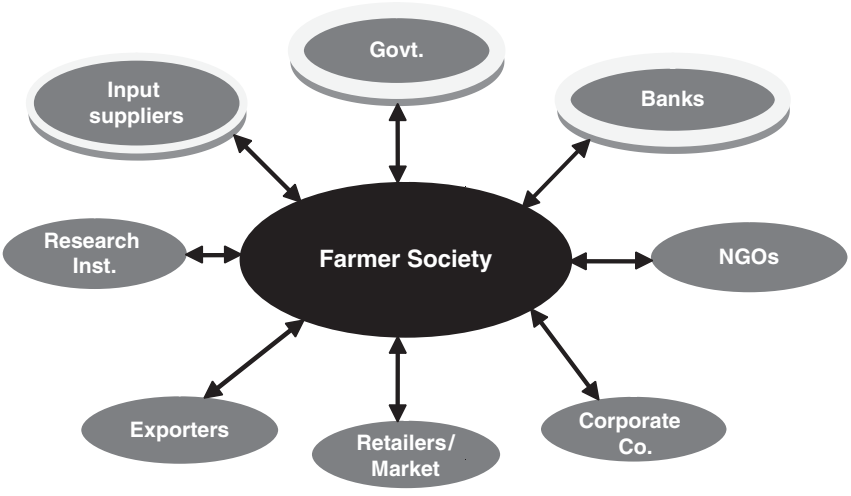

Fig. 3.7 NaCSA model of linking societies to all the key stakeholders

any new disease outbreak, it is easier to coordinate the quick flow of information and samples from field to research institutes, and report back the outcome of the diagnosis and necessary precautionary measures to farmers. Seeing the efficient implementation of the program, corporate companies are showing interest to adopt societies for further infrastructure development. Retailers from developed countries are showing keen interest in buying society produce, which are now becoming increasingly well-known for implementing sustainable farming practices in a socially responsible manner.

NaCSA is working toward developing societies as a potential business model through public-private partnership where all the concerned stakeholders help the societies to sustain for mutual benefit. The success of the approach largely depends on getting market recognition for the traceable, good quality, BMP shrimp produced responsibly and ethically without harming the environment. With the help of all the stakeholders, NaCSA is working towards this goal, thereby making society formation an attractive proposition that can motivate the rest of the farmers to organize themselves into societies. Smallholder farmers will benefit much from increased institutional coordination, capacity, and support in assisting them in managing their societies. They will also benefit from more widespread application of proven technological, social, economic, and governance innovations to reverse losses and improve livelihoods.

3.10 Self Propagating Nature of the Model

Indeed, today we are seeing the emergence of numerous farmer societies throughout India because of the farmers' confidence in participatory group farming and the concept becoming mainstreamed. Cluster organization is progressing very well, which is mainly due to the belief among the farming community that if they have to succeed as shrimp farmers, they have to organize themselves. The reasons for this confidence in group farming according to a farmer are, "*we are strong as a group, we can address issues affecting us, but alone we cannot progress especially in shrimp farming.*" Grassroots action in India demonstrates that group activities of the farmers can improve their well-being in many ways that individual approaches cannot. Farmer organization as groups is generating improvements for the individual producers in the following areas:

- Enhancing their incomes, self-respect, and bargaining power in markets. Clusters offer economies of scale, buying inputs and improve market power when dealing with suppliers and selling product.
- Clusters improve information exchange and sharing of experience among participants.
- Farming skills and technical knowledge.
- Ability to articulate demands and interact with markets and market forces, other political, and social actors.
- Access to financial services and ability to manage funds.

- Knowledge and tools to use information on markets, services, technologies, and rights.
- Self respect, social esteem, and relationships to authorities and other social actors.

With better informed farmers and the spreading awareness building about the society concept, more and more farmers are approaching NaCSA to help themselves organize as societies.

3.11 Cost Benefit Analysis of MPEDA-NACA Project

Tables 3.2 and 3.3 summarize some economic data from 2006, which show that the investment in the project gave a significant economic return. Further economic analysis of the investment would be useful, but the outcomes suggest such investment in small scale shrimp aquaculture is extremely viable from an economic perspective.

Table 3.2 Production summary of BMP and non-BMP farms from 2004 to 2006

	2004		2005		2006	
Parameter	BMP	Non-BMP	BMP	Non-BMP	BMP	Non-BMP
Number of farmers	130		736	425	730	741
Number of ponds	254	187	1187	517	1,370	949
Area (ha)	173	131	663	500	813	605
Production (tons)	40		672	296	870	620
Expenditures/ha (Rs.)	39,141	30,428	173,820	114,899	187,646	133,131
Revenue/ha (Rs.)	48,776	36,651	196,145	119,489	289,229	141,716
Profit/ha (Rs.)	9,636	6,224	22,325	4,590	101,583	19,577

Table 3.3 Project cost, increased profits of BMP farmers and return[a] per unit investment by the program, 2004–2006

Year	Project cost	Increase in profit	Return[a]
2004	1,300,000	590,276	0.45
2005	1,800,000	11,758,305	6.50
2006	3,191,500	66,670,878	20.89
Total	4,991,500	79,019,459	

All values are Indian Rs. (one US$=Rs. 48)

3.11.1 Economic Analysis MPEDA-NACA Project Costs, 2004–2006

1. Cost of MPEDA-NACA project from 2004–2006 is Rs. 4,991,500.
2. Improvement in profit made by BMP farmers compared to non-BMP farmers from 2004–2006 is Rs. 79,019,459.

For each one rupee investment in the program, it generated an average of Rs. 15.8 higher profit for BMP farmers.

3.12 Summary of Positive Impacts

Farmer societies rely more on the fundamental disciplines of sanitation, animal health, nutrition, food safety, and sound management. The BMP implementation through cluster concept has reduced disease risk and made a significant improvement in yields, less impact on the environment, production of wholesome products, and better relations among the players throughout the market chain. In short, it is

Table 3.4 Summary of MPEDA/NACA project impacts

Positive impacts	Remarks
• Reduced disease incidence	• 27% decrease of disease prevalence in BMP ponds compared to non-BMP ponds
• Reduced chemical and antibiotic use and complete traceability of the product	• 10% random BT samples from society ponds tested negative for presence of antibiotics
• Increased opportunity for market access	• Efficiently managed small farmer societies provide similar advantage of integrated larger units
	• Traceable shrimp from societies. Traceability from brood stock to pond level
• Improved profits	• By reducing the cost of production, profits have been increased. Non-BMP ponds got Rs. 39 for every Rs. 1,000 spent and where as BMP ponds got Rs. 128 for the same amount of investment
• Opportunity for bank credit access	
• Democratic and transparent societies:	• Democratically organized farmer groups, regular information sharing among farmers
• Sharing of costs	• Cooperation in selecting/testing and buying quality seed and other inputs
• Increased communication	• Farmer field days helping farmers to share their successful experience
• Harmony among farmers	• Each society is having minimum of ten meetings during the crop period
• Lower stocking densities	• The stocking density of shrimp ponds in societies vary from 2 to 6 shrimp per square meter which is far below the level when compared to other countries
• Reduced pollution	• Two societies have adopted organic aquaculture practices
• Increasing awareness on environment	• Abandoned shrimp ponds being revived

helping small farmers to sustain their livelihood through responsible shrimp farming. Specifically, they show evidence of the advantages of small farmers being organized, coming out to mainstream and sharing resources, helping each other and adopting BMPs. The implementation of the BMPs through the cluster concept has provided benefits to the farmers, the environment, and the local community. The summary impact of the project is highlighted in Table 3.4**.**

3.13 Summary of Lessons Learned

Needless to state in an exercise such as the one presented here that there are many lessons to be learned (Table 3.5). Such lessons are not only useful in improving the processes with time, but could have relevance and application to the development of small scale practices elsewhere, irrespective of the commodities farmed. The lessons learned as work progressed were not only of a technical nature, but also of a significant quantum of it was developing human-relationships, especially between the extension workers, authorities, suppliers, buyers, and the farmers. The latter

Table 3.5 A summary of the lessons learnt over the last 5 years during the success of adoption of BMPs by small scale shrimp farmers and the benefits gained

- Improved farm management practices can reduce environmental impacts, ensure food safety and improve farm profit. The "win-win" situation created by adoption of better management provides a strong incentive for positive change
- Organization of small-scale aquaculture farmers brings about positive social and economic benefits to members. These benefits include
  - Collective planning and shared responsibility helps achieve better management of risks
  - Cluster model of BMP implementation is developing into a self propagating model (farmers believe farmers)
  - Interaction between technical service providers and farmers at the ground level on a regular basis enhances the capacity of both
- Farmer groups can have stronger negotiation power with the input suppliers and traders
- The following points should be considered while organizing farmer groups
  Farmer groups comprise farmers with different needs, interests, skills and financial and technical capacity. A few common interests can hold them together in a group
- Provision of technical services should be independent and without conflict of interest to secure the confidence of farmers
- Investment in institutions (NaCSA) that is focused on small scale farmers can facilitate formation of groups and adoption of BMPs
- It should be recognized that this support takes time, investments in capacity building and institutions are necessary for sustainability
- Revival of the shrimp sector is possible. Shrimp farming can be a source of sustainable livelihood for small scale farmers provided risks are managed through improved management and institution building
- Experiences from India are more widely applicable in other countries across the region
- Links between farmer groups and markets have proved difficult to establish and need to be improved

aspects enable not only easy dissemination of technical information, but also an appreciation of farmer innovations, which are often not taken into consideration. Indeed, in the current day and age, sustainability of small scale farming practices, the backbone of Asian aquaculture, will rest significantly on the successful adoption of farmer innovations.

3.14 Way Forward

For the small scale shrimp farmers to continue to advance, we need a new approach to development. Similarly, for poor and marginalized farmer groups to access benefits of poverty reduction efforts, the position of the farmers in relation to public and private institutions has to change. The farmers must move from being passive recipients of information, services, and regulations to a situation where they take full responsibility for their own development and use public and private institutions as resource providers.

Effectively, engaging with the thousands of aquaculture producers in India and helping them to develop farm level plans for sustainable development will not be a small task, but it is one that can only be achieved with the involvement and contribution of the many players involved in the supply chain, from producers to consumers. The farmers, especially in the current market economies, need the strength that groups can offer for their economic and social advancement. Linking small farmer clusters to sustainability conscious buyers will go a long way in sustaining small farmers' livelihoods.

In this direction, NaCSA is in negotiation with one of the prominent buyers of seafood from USA for purchasing. Society produced shrimp and selling the same with a unique brand name, thereby giving a premium price to the product, which would motivate the farmers to grow the shrimp to the buyer specifications and ensure steady supply of best quality, chemical free, traceable shrimp. This market recognition for the society produce will help us to spread the message of "sustainable aquaculture" far and wide to more areas across India, and will help in sustaining shrimp sector, thereby contributing to a new vision for the aquaculture sector in support of small farmers' livelihoods in India.

Acknowledgment The authors are pleased to acknowledge Mr. G. Mohan Kumar I.A.S. (Chairman, MPEDA) and other staff and officials of MPEDA in Kochi, Andhra Pradesh, Gujarat, Karnataka, Orissa and Tamil Nadu for their kind support and cooperation during the MPEDA-NACA program. The technical services provided by Mr. Mongkhon Primphon, Shrimp farming expert, Thailand, and the cooperation of the Australian Centre for International Agricultural Research (ACIAR) are also gratefully acknowledged. We are also thankful to the All India Shrimp Hatchery Association, Shrimp farmers Association of Andhra Pradesh, Tamil Nadu and Gujarat and Seafood Exporters Association of India for their kind support. The study team is especially thankful to the farmer members of all the Aqua Clubs/societies of Andhra Pradesh, Tamil Nadu, Karnataka, Orissa, and Gujarat for their active participation in the village demonstration program and the MPEDA-NACA and NaCSA team for their dedication toward making the program a success.

References

FAO/NACA/UNEP/WB/WWF. 2006. *International principles for responsible shrimp farming*, 20. Bangkok: Network of Aquaculture Centres in Asia-Pacific (NACA).

Mohan, C.V., M.J. Phillips, B.V. Bhat, N.R. Umesh, and P.A. Padiyar. 2008. Farm level plans/husbandry measures, Changing trends in managing aquatic animal disease emergencies: Tools for preparedness and response. *OIE Scientific and Technical Review* 27(1).

MPEDA. 2008. News letter. (www.mpeda.com).

MPEDA/NACA. 2003. *Shrimp health management extension manual*. Asia-Pacific: Marine Products Export Development Authority and Network of Aquaculture Centres. http://www.enaca.org/modules/mydownloads/singlefile.php?cid=23&lid=58.

MPEDA-NACA. 2004. *Report on village demonstration programme*. Asia-Pacific: Marine Products Export Development Authority and Network of Aquaculture Centres.

MPEDA-NACA. 2005. *Report on technical assistance on shrimp disease control and coastal management report on village demonstration programme*. Asia-Pacific: Marine Products Export Development Authority and Network of Aquaculture Centres.

Padiyar, P.A. 2005. Contract hatchery systems: A practical approach to procure quality seeds for aquaclubs of small-scale shrimp farmers in India. *Aquaculture Asia* 10(3): 30–31.

Vijayakumaran, M. 1998. Environmental implications of disease treatments in aquaculture. In *Bioethics in India*, eds. Jayapaul Azariah, Hilda Azariah, and D. R.J. Macer, 210–216. Eubios Ethics Institute.