

COMMUNITY BASED SHRIMP CULTURE IN SOUTH WEST REGION OF BANGLADESH

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DEDICATED
TO
MY BELOVED PARENTS

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Abstract

Community based shrimp aquaculture in Southwest region of Bangladesh was investigated through this thesis. The objectives of the study were to understand present profiles of the farmers and institutions involving in community based shrimp culture and to identify the strengths, weakness, threats and opportunity of community based shrimp culture in order to explore the policy implications as an alternative approach. Data were gathered from four communities in southwest region of Bangladesh through participant observations; structured interviews; focus group discussions; and key informant interviews. Sampling was done by using the snowball sampling technique. Profile of individual farmer's showed that community C (Jolma) had more experienced and educated person. 38.64% of the shrimp farmers used own lands while 37.49% of farmers used state owned lands. No female farmer was found in any of four community. Profiles of four communities association showed that every association had an effective EC committee significantly contributed to the decision making policy. A SWOT analysis proved the feasibility of existing community based shrimp culture. Weakness analysis showed that medium or low level of efforts were required to convert its weaknesses into strengths. Weakness like 'gender issues' and 'connected water bodies' were required high efforts to convert into strengths. Threat analysis shows that most of the identified threats fell in the category of high impact with a high ability to react. To address such threats, the system needed to develop a contingency plan. This thesis recognized community based culture and management as an alternative approach to commercial culture. Tactical direction was identified by considering social-ecological systems within which shrimp farming can be practiced as a community-based operation. The desired future position of the sector should have a high level of dependency on community association.

Chapter		Title	Page No.
		Acknowledgements	i
		Abstract	ii
		Table of Contents	iii-iv
		List of tables	v
		List of figures	vi
		Acronyms	vii-viii
1		INTRODUCTION	1-13
	1.1	Background: Bangladesh and fisheries	1-2
	1.2	Aquaculture	3
	1.3	Community-based management	3
	1.4	Co-management	4
	1.5	Development and evolution of community based fisheries management in Bangladesh	5
	1.6	Governance system associated institutions in Bangladesh	5-8
	1.7	Development and evolution of shrimp culture	8-9
	1.8	Social-ecological systems	9-10
	1.9	Impacts from the shrimp industry on Socio economy and environment	10-11
	1.10	Sustainable development	11-12

			and Sustainability	
	1.11		Importance of the study	12
	1.12		Objectives of the study	13
2			METHODOLOGY	14-25
	2.1		Study area	14-16
	2.2		Design of the research	16-17
	2.3		Method of sampling	17
	2.4		Composition and size of the sample	17-18
	2.5		Methods used for data collection	18-20
	2.6		Data collection	21-22
	2.7		Methods of data analysis	22-24
	2.8		Reliability of the research	24-25
3			RESULTS AND DISCUSSION	26-65
	3.1		Profiles of shrimp farmers	26-33
		3.1.1	Demographic information	26-28
		3.1.2	Farming related information	29-33
	3.2		Structure of community based associations at local level	33-37
		3.2.1	Community A	33-34
		3.2.2	Community B	35-36
		3.2.3	Community C	36-37
		3.2.4	Community D	37
	3.3		Resource governance process of the communities	37-38
	3.4		Management process of the farming	38-39
		3.4.1	Management by the farmers	38
		3.4.2	Management by	38-39

			community association	
	3.5		Flow of information in management process	40-41
	3.6		SWOT analysis	41-57
		3.6.1	Internal environment	43-52
		3.6.2	External environment	52-57
	3.7		Weaknesses analysis	57-60
	3.8		Threats analysis	60-63
	3.9		Feasibility of community-based culture	63
	3.10		Pick out tactical direction	63-65
4			CONCLUSIONS	66-67
			REFERENCES	68-73
			APPENDICES	74-80

LIST OF TABLES

Table Number	Title	Page Number
1	Profile of Bangladesh	2
2	Sector profile at a glance	2
3	Numbers of farmer's interviews, focus groups and key informant interviews	22
4	Comparison of profiles of selected community associations	34
5	SWOT matrix	42-43
6	Categorization of weaknesses	59

LIST OF FIGURES

Figure Number	Title	Page Number
1	Map of Khulna division	14
2	Map of Satkhira and Khulna district	15
3	Deriving findings under objective two	24
4	Age distribution of the farmers.	26
5	Number of years of experience in shrimp industry	27
6	Highest level of education of the shrimp farmers	28
7	Farm land ownership type	29
8	Types of business operations farmers carried out	29
9	Sizes of the ponds in community B and C	30
10	Source of seed	31
11	Involvement of the family members in farming operations	32
12	Nature of involvement of family members	32
13	Structure of community association-based communication mechanism	40
14	Lack of quantity and timely production throughout production cycle	49
15	Price determiner in the supply chain	54
16	Feedback taken from the farmers on weakness	58
17	Feedback taken from the farmers on threats	60
18	Matrix for threat analysis	62
19	Tactical direction based on sustainability of social-ecological	64

ACRONYMS AND ABBREVIATIONS

ADB: Asian Development Bank
AGM: Annual Group Meeting
BFDC: Bangladesh Fisheries Development Corporation
BFRI: Bangladesh Fisheries Research Institute
BMP: Better Management Practices
BWDB: Bangladesh Water Development Board
DC office: Deputy Commissioner's Office
DFID: Department For International Development
DFO: District Fisheries Officer
DoF: Department of Fisheries
EC: executive Committee
EU:European Union
FGD: Focus Group Discussions
GAP: Good Aquaculture Practice
HACCP: Hazard Analysis and Critical Control Points
HSC: Higher Secondary Certificate
IMF: International Monetary Fund
JICA: Japan International Cooperation Agency
LF: lead farmer
MBV: Monodon Baculo Virus.
MoFL: Ministry of Fisheries and Livestock
MoL: Ministry of Land
NFMP: The New Fisheries Management Policy
NGO: Non-Government Organization
NORAD: Norwegian Agency for Development Cooperation
NSF: National Science Foundation
PCR:Polymerase Chain Reaction
PG: Producer Group
PL: Postlarvae
SaFaL: Sustainable Agriculture, Food Security and Linkages
SLADA:Sri Lankan Aquaculture Development Association
SPF: Specific pathogen free

SSC:Secondary School Certificate

SWOT analysis: Strength, Weaknesses, Opportunities, and Threats analysis

UFO : Upozella Fisheries Officer

WCED:World Commission on Environment and Development

WSS: White Spot Syndrome

CHAPTER 1: INTRODUCTION

This chapter will focus on describing the study context, followed by the study purpose and objectives; country and sector profiles; theoretical background and significance of the study; and the thesis plan and outline. It will describe the aquaculture in the global context as well as within Bangladesh. Community-based management, co-management, social ecological systems, and sustainable development. This chapter will summarize the relevant findings from other research studies conducted so far.

Collective management and/or community-based management could be an alternative approach (or part of an alternative approach) in ensuring long-term sustainability. In Bangladesh, there is evidence of the existence of collective groups called *Somity*, translated as cooperatives/societies. The Bangladeshi Government recognizes and supports community-based organizations. For example, there are community associations in the communities of Southwest region of Bangladesh.

1.1 Background: Bangladesh and fisheries

Bangladesh is a tropical country consisting of various climatic and topographical conditions within a relatively small land area is a country in South Asia, bordered by India and Myanmar, at the apex of the Bay of Bengal It is the world's eighth most populous country and the ninety-third largest country by area, making it one of the most densely populated nations on Earth. The majority of the population are Bengali Muslims, followed by Bengali Hindus, with diverse Buddhist and Christian communities. The official language is Bengali. Dominated by the fertile Bengal delta, Bangladesh is rich in biodiversity and is home to the world's largest mangrove forest, a mountainous east and a 710km coastline that has one of the world's longest beaches. Table 1.1 shows the socioeconomic profile of Bangladesh. The country is an island with a land area of 1,47,570 km²including an inland water area of 4699394 Ha(46993.94km²) . It has a population of 15.79 million with the literacy rate of 62.3%. The GDP growth rate is 6.51%.(table 1)

Table 1: Profile of Bangladesh (Sources: MoF, 2015 and DoF, 2015)

Description	Statistics (2015)
Land area (including inland water area)	1,47,570 km ²
Inland closed water area	789341 Ha
Inland open water area	3910053Ha
Marine area	1,18,813 km ²
Coastal belt	710 km
Population	157.9 million
Literacy rate	62.3%
GDP at market prices (in Bangladeshi taka)	8,24,532 crore
GDP growth rate (%)	6.51%

Table 2 shows that 3.69% of total GDP came from fisheries sector in 2013-14 economic year, which is 22.60% of the agricultural GDP. The total production in fisheries sector is 35.48 lakh metric tons. (table 2)

Table 2: Sector profile at a glance (Source: DOF, 2015)

Description	Statistics (2013-14)
Total production	35,48,115 tons
Total inland sector production	29,52,730 tons
Total aquaculture production (closed water body)	7,89,341 tons
Total shrimp production (closed water body)	2,16,447 tons
Contribution of Shrimp to total fisheries production	6.10 %
Contribution of fisheries to GDP	3.69 %
Annual export earnings (Fisheries)	4,776.92 crore taka
Annual export earnings (shrimp)	4118.8 crore taka
Fisheries contribution to the annual export earnings	2.09%
Employment in sector (direct and indirect)	1.78 million
Land area-shrimp farming	2,75,274 ha

1.2 Aquaculture

There are diverse definitions for aquaculture. Among them, this definition from the Food and Agriculture Organization (FAO) of the United Nations is detailed and recognized worldwide: “Aquaculture is the farming of aquatic organisms: fish, mollusks, crustaceans, aquatic plants, crocodiles, alligators, turtles, and amphibians. Farming implies some form of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc. Farming also implies individual or corporate ownership of the stock being cultivated. For statistical purposes, aquatic organisms, which are harvested by an individual or corporate body, which has owned them throughout their rearing period contribute to aquaculture; while aquatic organisms, which are exploitable by the public as a common property resource, with or without appropriate licenses, are the harvest of capture fisheries” (FAO, 2011). However, country to country and province to province, based on the political visions, etc., the definitions vary.

In china, back to 2000 BC, The history of aquaculture began (Rabanal, 1988). The world aquaculture industry has significantly expanded during last 50 years, volume-wise, from less than one million tons to more than 50 million tons produced per year in 2006 (De Silva and Davy, 2010). The role played by the aquaculture industry is vital due to exponential world population growth and the resulting consistent increase in world food demand.

The aquacultural food production mainly is for human consumption (FAO, 2010). Currently, aquaculture contributes more than 50% of the world seafood supply (De Silva and Davy, 2010; Muir, 2005) of which more than 90% comes from the Asian region (Muir, 2005). Aquaculture provides direct and indirect sources of income for millions of people, especially in rural communities (De Silva and Davy, 2010). In certain Asian countries, the aquaculture sector serves as a main source of foreign exchange earnings and contributes to strengthening food security and alleviating poverty as well (De Silva and Davy, 2010). As a result, aquaculture is considered to be a successful primary food sector on a global scale (De Silva and Davy, 2010).

1.3 Community-based management

Community based management is a people-centered management approach (Pomeroy and Rivera-Guieb, 2006). This is a way to control access to the resource and to make and enforce the regulations among users to reduce their impact to others (Berkes *et al.*, 2001,

p.173). It can be defined community-based resource management as “a process by which the people themselves are given the opportunity and/or responsibility to manage their own resources; define their needs, goals, and aspirations; and to make decisions affecting their well-being” (Sajise, 1995). Tragedy of the commons can be solved through the community-based management by addressing the excludability and subtractability problems (Berkes *et al.*, 2001).

According to Korten (1987), community-based management has several elements: a group of people with common interests, a mechanism for effective and equitable management of conflict, community control and management of productive resources, local systems or mechanisms for capturing and using available resources, broadly distributed participation in control of resources within the community, and local accountability in management.

A community based fisheries approach describes “improvement of inland open-water fisheries management through the development of sustainable, community-based institutions and supporting them in undertaking a program of adaptive management of their fisheries resources using technical measures such as stock enhancement of floodplain fisheries, restoration of fisheries habitats, establishment of fish sanctuaries, and construction of fish passes” (DoF ,2003).

1.4 Co-management

co-management is defined by the World Bank as “the sharing of responsibilities, rights and duties between the primary stakeholders, in particular, local communities and the nation state; a decentralized approach to decision making that involves the local users in the decision-making process as equal with the nation-state” (Carlsson and Berkes, 2005; World Bank, 1999). Co-management is the collaborative approach to manage commons or the common-pool resources. Co-management is defined as “the sharing of power and responsibility between the government and the local resource users” (Berkes *et al.*, 1991). The central element of co-management is the community-based resource management (Berkes *et al.*, 2001). The difference between community-based resource management and co-management is based on the level and timing of the government participation in the management process. In addition, community-based resource management is more people-centered and community-focused. Co-management is focused on these issues and additionally on the partnership arrangements of the

government and local communities. Co-management is broader than community-based management in terms of the scope and the scale. Further, the government plays a major and active role in co-management and a minor role in community-based management (Berkes *et al.*, 2001).

1.5 Development and evolution of community based fisheries management in Bangladesh

In Asian region initiatives in community-based resource management are not new rather this type of programs and policies have been popular throughout most of twentieth century under different names (Pomeroy,1995).The community-based fisheries management approach was innovated, piloted and practiced by different donor funded development programs during the mid-1990s and early twenty-first century in Bangladesh. Like other developing countries, the government of Bangladesh also adopted the CBFM (Community Based Fisheries Management) policy in 1992 for the betterment of the distress fisher's group by ensuring sustainable exploitation of fisheries resources from river and other public water bodies Government involved the NGOs to operate this programme with the collaboration of local fisher groups and Department of Fisheries .The Community Based Fisheries Management Project, Phase 2 has been implemented by the Department of Fisheries of the Government of Bangladesh with the assistance of the World Fish Center over the period 2001 to 2007 (Dickson andBrooks,2007) The CBFM and CBFM 2 (runs from 2001-2007) clearly highlights the importance of promoting a bottom-up approach in managing fisheries and aquatic resources.

Ministry of land announced some certain area as shrimp production area under the act of 'Chingri mohal management policy 1992'(memo no land/ Sa-8/Shrimp/227/91/217). These are is known as chingri mohal under the act. Farmers of chingri mohal can easily get loan for shrimp culture and this business of culture is totally taxes free. Farmers of that area are inspired to take government land by leasing from associated DC office. Community based culture and management is the condition for taking a lease. After the success of two CBFM project, government started taking community based management in many sectors. Communitybased management and co-management is currently practiced in the fisheries and aquaculture sectors of Bangladesh.

1.6 Governance system associated institutions in Bangladesh

The Ministry of Fisheries and Livestock (MoFL), Department of Fisheries (DoF), Bangladesh Fisheries Development Corporation (BFDC) and the Bangladesh Fisheries Research Institute (BFRI) are the main organizations responsible for aquaculture and its development. Universities, organizations within other ministries and local and international NGOs are also involved in this area.

The following institutional bodies are involved in aquaculture and fisheries in Bangladesh:

- Department of Fisheries (DoF) under the Ministry of Fisheries and Livestock (MoFL) is the sole authority with administrative control over aquaculture in Bangladesh. The DoF is managed by a Director General and has two main sub-departments namely, inland and marine. The main responsibilities held by the DoF include planning, development, extension and training, DoF has six divisional offices, 64 district offices and 497 upazilla (sub-districts) offices and in addition it has 118 hatcheries and four training centers (Mazid, 2002).
- BFDC was established in 1964 as East Pakistan Fisheries Development Corporation through an ordinance and later on repealed and replaced by an Act of 1973, Bangladesh Fisheries Development Corporation is a public sector organization under the Ministry of Fisheries and Livestock of the Peoples Republic of Bangladesh. Since then the corporation remained fully dedicated to the development of fisheries in Bangladesh especially in the field of marine fisheries. To develop the infrastructure and to do commercial and social work is the main aim of BFDC.
- Bangladesh Fisheries Research Institute conducts and coordinates research and to some extent training. In pursuance of the Ordinance “The Fisheries Research Institute Ordinance, 1984” the Institute was established in July 1984. In 1997 the Institute was renamed as BFRI. Through the institute was established in 1984, it actually started functioning in 1986 with the recruitment of required manpower and creation of initial research facilities. Since then, the institute has been playing

a key role in assisting the nation to achieve the goal of fisheries development as set out in successive development plans.

The institute is an autonomous research organization and linked up administratively with the Ministry of Fisheries and Livestock. The general direction, administration and supervision of the affairs of the institute is vested in the Board of Governors. The headquarters of the institute is located in Mymensingh. The institute has 5 stations and 5 substations based on different aquatic ecosystems. The overall research, training and management activities of the Institute are carried out in close cooperation and linkages with various national and international organizations/agencies. The institute pays much importance to strengthening its capabilities of its scientists, administrative and management personnel through in country and overseas long and short term training, study tour etc

- Bangladesh Rural Development Board is responsible for the fisheries component of integrated rural development.
- Land Administration and Land Reform Division is responsible for the leasing of public water bodies.
- Export Promotion Bureau is responsible for export of fisheries products, along with the Bangladesh Frozen Foods Exporters Association which is also involved in the export of frozen shrimp, fish and fish products.
- The country's universities are responsible for higher level fisheries education. Now nearly all public universities are providing degree on fisheries.
- External Resource Division under the Ministry of Finance is responsible for external aid for aquaculture development.
- Bangladesh Krishi (Agriculture) Bank, Bangladesh Samabay (Co-operative) Bank and some other commercial banks are responsible for issuing credit to the aquaculture sector.

- Many of the national and international NGO's provides credits to the fish farmers and as well as takes up projects for aquaculture extension and development.
- International organizations (DFID, Danida, NORAD, JICA, World Bank, IMF, ADB etc.) provide grants and credits for aquaculture and shrimp sector development.
- Youth Development Training Centers, under the Ministry of Youth, deals with extension and the training of unemployed young people and fish farmers.
- Bangladesh Water Development Board is responsible for the development barrage in the local area. Many farmers use to cut the barrigae of polder to enter the saline water to the farm area. So this board is associated with shrimp activity.

1.7 Development and evolution of shrimp culture

Shrimp farming in the south and southeastern coastal belt of Bangladesh began in the early 1970s. From less than 20 000 ha of brackishwater ponds in 1980, the area under cultivation expanded to approximately 140 000 ha by 1995 (Wahab, 2003). The last complete survey to estimate the total area under shrimp cultivation was carried out in 1993–94; it has not been updated since then. DoF (2005) estimated that the total area under farming has expanded to 203 071 ha in 2003–2004. The major shrimp producing districts are Bagerhat, Satkhira, Pirojpur, Khulan, Cox's Bazar and Chittagong, recently farmers especially in the Bagerhat and Pirojpur districts have begun shrimp farming in their paddy fields. Traditionally shrimp farming began by trapping tidal waters in nearby coastal enclosures known as 'gher' where no feed, fertilisers or other inputs were applied, with an increasing demand from both national and international markets farmers started to switch over into improved extensive and semi-intensive systems.

Semi intensive farming began in 1993 in the Cox's Bazar region, with this system ponds were stocked with 10–35 post larvae (PL)/m² using supplemental pellet feed but without reservoir tanks. The first outbreak of a viral epidemic in shrimp farms occurred in 1994 in semi intensive farms in the Cox's Bazar region (Larkins, 1995; Karim and Stellwagen, 1998). In 1996 it was discovered to have spread to other coastal districts affecting

extensive shrimp farms (Karim and Stellwagen, 1998). In 2001, the disease once again caused the collapse of shrimp production in both the Cox's Bazar and Khulna regions, the disease has not yet been completely eradicated and can still cause havoc for shrimp producers. The type of management system found in the 70s and 80s was a corporate-based management system. There were a few multi-national companies. These companies were the beginners in culturing shrimps in Bangladesh. To begin with, all the operations were done in an integrated fashion, where shrimp breeding (hatcheries), farming and processing, as well as exporting activities were managed by the same company. According to available records, these companies were powerful and influential, as they managed to earn lucrative profits. There was minimum involvement and supervision (control) by central, provincial, and municipal government institutions, despite significant environmental impacts.

From the beginning of 90 government started encouraging shrimp culture and export through the liberalization of trade policy. In July 1997 EU imposed a ban on imports of shrimp products from Bangladesh into the EU on the ground that exports of this commodity did not meet the stringent provisions of EUs HACCP regulations. But after that incidence small scale shrimp farmers became more active. In the end of 90s political leaders and influential persons controls the total business through his power. But this situation has been changed. Social and institutional support to shrimp culture and management has been increased .small scale farmers came to the limelight.

1.8 Social-ecological systems

Resilience Alliance defines social-ecological systems as “complex, integrated systems in which humans are part of nature” (Berkes and Folke, 1998). Anderies *et al.* (2004) defines ecological systems and social systems separately to provide better explanation for social-ecological systems. Jahn *et al.* (2009) and Glaser *et al.* (2008) provided a working definition for the social-ecological systems: “a social-ecological system consists of a bio-geo-physical unit and its associated social actors and institutions. Social-ecological systems are complex and adaptive and delimited by spatial or functional boundaries surrounding particular ecosystems and their problem context”. Accordingly, social-ecological systems are defined as systems intricately linked with and affected by one or more social systems. Further, ecological systems are identified as an interdependent system of organisms or biological units (Anderies *et al.*, 2004). Social

systems can be the interdependent systems of organisms (Anderies *et al.*, 2004; Glaser *et al.*, 2008). Units of both social and ecological systems interact interdependently and each may contain interactive sub-systems and overriding systems as well (Anderies *et al.*, 2004). Bush *et al.* (2010) identifies how social-ecological systems can be applied in the context of shrimp aquaculture. These authors identify shrimp aquaculture as complex socioecological systems. Further, their paper focuses on resilience, uncertainty, and risk of the social-ecological systems to study four aspects of shrimp aquaculture: interaction between coastal landscape and shrimp farming; disease management of shrimp farming; decision making under uncertain situations; and resource governance related to shrimp farming.

1.9 Impacts from the shrimp industry on Socio economy and environment

In terms of environmental, social, and economic aspects the impacts from shrimp aquaculture are diverse. The extent of the level of impacts is also dependent upon factors such as scale of production (commercial large-scale, medium-scale, small scale, etc.) and type of operation (farms, hatcheries, processing plants, etc).

The social impacts from the shrimp industry also directly affect the surrounding communities. There are many land ownership disputes between the shrimp farmers and the community land owners (Primavera, 1997; Tennakoon, 2009). Certain shrimp farming properties (lands) belong to the government and are used illegally (Munasinghe *et al.*, 2010). Moreover, there are many unrecorded thefts, harassments, and socially unacceptable behaviours taking place in most of the commercial large-scale aquaculture operations in the world (EJF, 2004). Most of the shrimp farmers have to focus on protecting their harvest once the shrimp stocks are grown up to a marketable size (Tennakoon, 2009). There is evidence to show that large-scale profit-oriented companies often unilaterally decide to leave the industry, leading to economic uncertainty (Cattermoul and Devendra, 2002). They also shift from place to place looking for better profit prospects. Shrimp farming is an operation consuming a large amount of resources (soil and water) (Nirodhawardane *et al.*, 2003;), making land and water unusable for any other economic activity such as rice farming, ornamental fish farming, etc. This is the reason companies tend to shift around looking for new lands (Galappaththi, 2010). These kinds of unethical business practices create economic instability in those communities,

leading to unemployment and social issues (Cattermoul and Devendra, 2002; Rönnbäck, 2001). Large-scale shrimp aquaculture is generally not sustainable (Pa'ez-Osuna, 2001).

There is solid evidence to prove that the large commercial-scale shrimp aquaculture operations make significant adverse social-ecological impacts to the environment (EJF, 2003; Huong and Berkes, 2011; Muir, 2005; Nayak and Berkes, 2010). The environmental impacts from the shrimp industry are often negative. For instance, mangrove deforestation is an issue in shrimp farming areas as mangroves serve as a base for socio-economic activities of the surrounding community. Mangrove ecosystems are also important for sustainability of the fishery in those areas (Munasinghe *et al.*, 2010). Shrimp farming may lead to severe water pollution in nearby lagoons, canals, wells, and groundwater sources (Pa'ez-Osuna, 2001). For example, sometimes the waste water from the ponds is directly discharged into these natural water bodies, contaminating them with the chemicals used in shrimp aquaculture. As a result, the water becomes artificially nutrient-enriched leading to algae blooms and eutrophication conditions in surrounding water bodies (Rönnbäck, 2001). Release of water from the grow-out ponds also spreads diseases into the external natural environment (Cattermoul and Devendra, 2002; Pa'ez-Osuna, 2001), such as White Spot Syndrome (WSS) or Monodon Baculo Virus (MBV). Furthermore, cultured shrimps get mixed with the wild ecosystems, thereby creating an ecological imbalance (Galappaththi, 2010; Tennakoon, 2009). Primavera (1997) have reported that 6,500 ha mangrove forest were destroyed due to shrimp farming in Bangladesh.

1.10 Sustainable development and Sustainability

The Brundtland Report (WCED, 1987) also known as "Our Common Future" is considered to be the most important catalyst for worldwide appreciation of the idea of sustainable development (Sikdar, 2003; United Nations, 1987). In this report, sustainable development is defined as "the development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Spangenberg, 2002; WCED, 1987). Key ideas within this definition are the needs and the limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs. It is evident that different disciplines have adapted the concepts of sustainable development and sustainability to meet the key aspects of focus

under each of those. Moreover, there is no agreed upon definition for either of these concepts, resulting in ambiguity.

World Business Council on Sustainable Development (2001) defined sustainable development as “It is about ensuring a better quality of life for everyone, now and for generations to come. Thus it combines ecological, social, and economic concerns, and offers business opportunities for companies that can improve the lives of the world’s people” (Molnar and Morgan, 2001).

On the other hand Sustainability in corporate terms means a business approach that creates long-term shareholder value by embracing opportunities and managing risks deriving from economic, environmental and social developments. (Molnar and Morgan, 2001) .Two definitions mentioned above are focused on business context.

Definitions focused on social context is quite different. International Council for Local Environmental Initiatives (1996) defined that “Sustainable development is a program to change the process of economic development so that it ensures a basic quality of life for all people, and protects the ecosystems and community systems that make life possible and worthwhile” (Molnar and Morgan, 2001, p.18) There are three pillars to sustainable development; namely, economic development, social development, and environmental protection (The United Nations World Summit Outcome Document 2005). On the other hand, the constituents of sustainability are the economy, society, and environment. Sustainable development is a pattern of resource use that aims to meet human needs while preserving the environment, so that these needs can be met not only in the present, but also for generations to come (Rajarathnam, 2010). It shows how both the economy and society are constrained by environmental limits and the capacity to endure (Scott and Kennet, 2009). Sustainability is an approach to decision making that considers the interconnections and impacts of economic, social, and environmental factors on today’s and future generations’ quality of life (Rajarathnam, 2010). It is a dynamic and evolving notion, and a process. It strives to be participatory, transparent, equitable, informed, and accountable (Molnar and Morgan, 2001).

1.11 Importance of the study

The presence of community-based shrimp aquaculture operations is limited and Existing operations seem to be undocumented in the contemporary world (Galappaththi, 2013) so

this study is important to be done. First, the study provide a overview of the community and community-based shrimp aquaculture management through institutions work in southwestern Bangladesh. Finally this study inspires us to think about application of the current community based resource management system as an alternative to anyunsustainable aquaculture systems. Moreover, the study allows for comparative studies with other countries such as Vietnam, Thailand, India, and Srilanka . Therefore, it is worthwhile to investigate collective management and/or community based management as an alternative approach. So far, published studies on community based management in small-scale shrimp aquaculture in Bangladesh seem to not be available.

1.12 Objectives of the study

The specific objectives of the study were

- (1) to understand profiles of the farmers and common institutions associated withcommunity based shrimp culture in south west region of Bangladesh;

- (2) to identify the Strengths, weakness, threats and opportunity of community based shrimp culture and management system and to explore the policy implications of community based shrimp aquaculture as an alternative approach.

CHAPTER 2: METHODOLOGY

This chapter provides a detailed description as to how the research was conducted. It discusses relevant research design, data collection methods, sampling techniques and, finally, how the data was analyzed to accomplish each research objective. It also provides the reasons and justification for adopting such a methodology.

2.1 Study area



Fig.1. Map of Khulna division

(Source:http://en.banglapedia.org/index.php?title=Khulna_Division)

In the coastal area of the greater Khulna region having a tropical climate, productive and unpolluted estuarine areas is considered to be a suitable natural habitat for shrimp culture

Satkhira, Bagerhat and Khulna districts are the most productive zones for Shrimp culture. (Ali *et al.*, 2000). In the study area, most of the shrimp farming is practiced in traditional way. However the changed situation of shrimp farming towards community based practices was identified.

Firstly, I collected information about where community based shrimp culture is practised from different sources including district fisheries offices, districts cooperative office, deputy secretary's office, districts social service office of south west regions. Then four places or community was selected for collecting data. The member of the local community association is considered as a community because the 4 community functions under 4 different community associations. The communities are Bashdaha, Parulia, Jolma and dhuliara which is titled as Community A, B, C and D respectively.



Fig. 2. Map of Satkhira and Khulna district (Community is identified with white stars; Source : Edited, taken from <http://pfyweb.blogspot.com/>)

Criteria used in selecting communities:

The communities A, B, C and D (Bashdaha, Parulia, Jolma and dhuliara respectively) were included in the sample. There were few considerations in selecting these four

communities. One of the main selection criterion for consideration was the diverse nature of the community. Two community are government initiated with leasing government lands, one is cooperative type and one is NGO based community.

2.2 Design of the research

The methodology of the research is clearly related to the objectives. The main aim of this study is to understand shrimp aquaculture carried out by community-based institutions or cooperative body. Therefore, as the first step, evidence was searched to confirm the presence of community-based shrimp aquaculture in Southwestern Bangladesh. Secondly, common institutions related to shrimp culture were explored to identify how operations can be connected through common rules into community operations. Thirdly, the Strengths, weakness, opportunity, threats against community based shrimp culture and management were identified. Finally, it was investigated how community-based shrimp aquaculture can be used as an alternative to large-scale commercial operations to ensure the sustainability of the industry and environment.

To meet the above-mentioned objectives and requirements, it was determined that qualitative research was the most appropriate form of research to be used in this study. Qualitative research is designed to reveal a target audience's range of behavior and the perceptions that drive it with reference to specific topics or issues. It uses in-depth studies of small groups of people to guide and support the construction of hypotheses. The results of qualitative research are descriptive rather than predictive. (Strauss and Corbin, 1990)

Qualitative research is a naturalistic approach (Golafshani, 2003) to understanding a particular context-specific setting. Qualitative research is capable of discovering the truth attached to a problem (Carr, 2008). Further, qualitative research fairly expresses a social phenomenon since the data occurs naturally and there is no need to have an experimental type of design (Hancock, 2002). Both qualitative and quantitative research designs are valuable, despite their pros and cons, in discovering key findings. It is about experiences, understandings, opinions, and feelings of the individuals of the study, which is a holistic perspective (Groenewald, 2004).

Each of these features of qualitative research can act as a strength and/or weaknesses of the design. So it can be mentioned that one criticism attached to qualitative research is the generalizability. The study results and lessons learned could be difficult to apply to a large population. This is due to the generally small sample group and selection of subjects on a non-random basis. However, most of the time, the original research question is narrowed to a specific area or subgroup of the population. (Hancock, 2002).

Woods (2006) identified five features of qualitative research: a) it focuses on natural settings; b) it has interest in meanings; c) it involves perspectives and understandings; d) it emphasizes on process; and e) it involves concerns related to inductive analysis and grounded theory. Moreover, qualitative research helps in developing theoretical concepts and provides a better understanding of the social world (Golafshani, 2003).

2.3 Method of sampling

On the basis of objectives of this research, the sampling technique used was snowball sampling. During the snowball sampling, one sample unit is located/tracked and that sample unit will reveal the details as to how to access a similar unit (i.e., the next sample unit). Likewise, the sample group appears to grow like a rolling snowball (Faugier and Sargeant, 1996; Golafshani, 2003). As a research data collection method, the snowball sampling method has many advantages. Snowball sampling is an informal and easy method to reach the target population (Atkinson and Flint, 2001) and to reach populations which are difficult to enumerate through descending methods such as household surveys (Atkinson and Flint, 2001; Faugier and Sargeant, 1996). Within the shrimp aquaculture sector snowball sampling has been used for qualitative studies by Galappaththi (2010) and Tennakoon (2009).

2.4 Composition and size of the sample

Structured interviews were conducted among farmers of southwest region of Bangladesh. Sample size was determined based on a thorough analysis of the population involved. Accordingly, there were 88 individuals in the sample representing four different communities (community A: Bashdaha; community B: Parulia; community C: Jolma and community D: Dhuliara) in the southwestern part of Bangladesh. This sample size was

determined based on the repetitiveness of data, that is, the samples were collected until the researcher realized that addition of one more unit would not add a significant value or a knowledge-wise contribution. These shrimp farmers also represented community-level shrimp farmer's associations.

2.5 Methods used for data collection

Data collection methods of this study were: a) participant observations; b) structured interviews; c) focus group discussions; and d) key informant interviews. Focus group discussions and key informant interviews were conducted to explore the common institutions as well as to validate the data gathered through participant observations and structured interviews. SWOT analysis is done based on participant observation, FGDs and key informant interviews. A questionnaire was used as the tool to gather data from individual farmers.

a) Structured interviews

Unstructured, semi-structured, and highly structured Interviews are the three main category of the interviews (Hancock, 2002). A structured interview, also known as a standardized interview or a researcher-administered survey, is a quantitative research method with the aim of this approach is to ensure that each interview is presented with exactly the same questions in the same order. The choice of answers to the questions is often fixed (close-ended) in advance, though open-ended questions can also be included within a structured interview. It is said that structured interviews might narrow down the scope of data and the interviewee might not give their own natural answers to the questions (Creswell, 2009).

Total 88 structured interviews were conducted in four communities.

b) Participant observation

Participant observation is one type of data collection method typically done in the qualitative research paradigm. According to Mack *et al.* (2005) participant observations were used during data collection as this method allows obtaining insights into the context, relationships, and behaviour of the sampled community. It can provide the researchers with previously unknown information that is crucial for research design, data collection, and interpretation. Woods (2006) identified the advantages of the participant

observation method as “it blends in with natural activity; it gives the researcher access to the same places, people and events as the subjects; it gives access to documents relevant to the role, including confidential reports and records; it facilitates the use of mechanical aids, such as tape recorders and cameras; it provides personal first-hand experience of the role and thus improves the understanding; and it makes a worthwhile contribution to the life of the institution”.

Some research methods like questionnaires highlight the problem of the researcher not becoming personally involved with the respondents. This method, however, involves the researcher to know the people being studied by entering their world and participating either openly or secretly in that world. However, in the method of participant observations, the researcher has to maintain both a personal and a social distance between him/her and the individuals being researched.

Mack *et al.*(2005) also explains the disadvantages of this method by mentioning that is very time consuming. There is the potential for conflicts between the roles of a person as researcher and as the participants, which could affect the research (Creswell, 2009; Woods, 2006). In this research, two community-level meetings were observed as an observer.

c) Focus group discussions

FGDs involve a “small group of people discussing a topic or issues defined by a researcher” (Cameron, 2005).FGDs bring about group interaction, which may be lacking in a one-to-one interview (Darlington and Scott, 2003) and allow different meanings that the local farmers may have about climate change and variability to be fully explored (Bryman and Bell, 2007).

To gain knowledge on a particular topic or need is the purpose of FGDs by interviewing a group of people directly affected by the issue (Creswell, 2009). Collection method is more suitable for relatively smaller samples and it enables the researcher to ask a variety of questions and explore the answers as they arise (Mack *et al.*, 2005). As a result, focus group data can be used to explore the depth and gravity of opinions regarding the subject; understand differences in perspectives; understand what factors influence opinions or behaviour of the community; evaluate reactions to proposed services; and learn about participants by observing their interactions (Hancock, 2002).

Moreover, focus group discussions provide depth over breadth of the subject (Hancock, 2002). This type of data it is also a good method to validate findings of a study while

collecting qualitative data. Hancock (2002) identifies the number of people that should be included in a focus group as 6 to 10, in order to have an effective group discussion. Moreover, he suggests having more than one focus group during data collection for a better representation.

In total four focus group discussions were done in each of the four communities after collecting data through interviews.

d) Key informant interviews

According to Mack *et al.* (2005), key informant interviews can be carried out individually or as a group. Based on NSF (1997), a strength of the key informant interview method is its ability to provide insider information, which is difficult to obtain by other qualitative methods like participant observations. Key informants can be someone who can effectively represent the target research sample (participants) and their activities to the researcher (Mack *et al.*, 2005).

Key informants are the individuals, or a group of people, who possess specific skills, knowledge, experience, and/or specialized background on the research project or project participants (Sofaer, 2002). However, NSF (1997) identifies some drawbacks of this method. It requires considerable time and effort to identify and select the correct key informants. Further, the relationship between researcher and key informant can influence the type of information obtained. Moreover, it can result in disagreements among individuals, leading to frustration in analysis.

During the FGDs and structured interviews individuals who showed appreciable knowledge on shrimp farming and community based management were selected for key informant interviews. The key informants were selected from inside and outside the communities. From inside the communities, community leaders (e.g., secretary, president of the local somity, lead farmer of community B) who have knowledge about the issues for this study were selected. Whereas, from outside the communities, some officials (e.g. Officers from DoF, Upozella fisheries officer, districts fisheries officer, official from Solidaridad), who were associated with the communities was selected. In total 9 key informant interviews were conducted.

2.6 Data collection

Primary data collection took place during May–September, 2015 in the Southwestern area of Bangladesh. Prior to the arrival in the area, several persons involved in the shrimp farming sector were contacted to figure out a method to enter the field. As a result, the study area was first approached through these previously arranged contacts. The government institution related to fisheries sector (DOF) showed guideline to properly approach the shrimp farming communities for research data collection purposes. Initially, the plan was to stick to one type of community for data collection. However, after observing the diverse nature of the farming operations and management systems, four communities were chosen for collecting data. After performing reconnaissance survey in the study area, clear and structured questionnaire was developed. The draft questionnaire will be pre-tested and performance of that questionnaire will be reviewed. After that final questionnaire was developed with the help of the experience of the pre tested questionnaire. Data were collected through personal interview.

Questionnaire Development:

After performing reconnaissance survey in the study area, clear and structured questionnaire was developed. The draft questionnaire will be pre-tested and performance of that questionnaire will be reviewed. After that final questionnaire was developed with the help of the experience of the pre tested questionnaire. Data were collected through personal interview

The data from participant observations helped to get a better contextual understanding on the shrimp farming areas. Accordingly, two community-level meetings were observed as an observer. Table 2.1 shows the numbers of other types of interviews conducted. Accordingly, 88 structured interviews, four focus groups, nine key informant interviews were conducted.

Table 3: Numbers of farmer's interviews, focus groups and key informant interviews:

Data collection Method	Number of interviews conducted	Description
Structured interviews	88	The questionnaire was offered to farmers on an individual basis after getting to know them. (Number of farmers from each community: A=20; B=25; C=30 and D = 13)
FGDs	4	Focus group discussions were arranged at the end of the data collection period in each community.
Key informant interviews	9	The most knowledgeable and experienced people in the arena were purposely interviewed including the current UFO, DFO, officer of DOF ,Lead farmer from community B and NGO members from Solidaridad.

2.7 Methods of data analysis

Data gathered through participant observations and structured interviews were documented immediately in the field. This helped to distinguish the differences and similarities. The contextual understanding obtained from the field helped to develop mind maps on some concepts. Experiences and Insights gained through the participant observations also helped the researcher to simplify the analysis process. Descriptive statistics were used to investigate the first objective. The data from questionnaires were entered into Microsoft Excel 2007® software program and used in developing tables and graphs.

SWOT analysis is an informative tool (Gupta, 2001) for assessing the potential of aquafarming. It provides a complete picture of its potential strengths (S), weaknesses (W), opportunities (O), and threats (T). It helps in problem identification, planning, decision making, appropriate technology implementation, precautionary measures for sustainable level. SWOT analysis and matrixes were used to assess the viability and identify the strategic direction of the existing governance system. Moreover, comparisons were carried out to explore the option of community-based shrimp aquaculture as an alternative to commercial operations.

Feasibility of community-based aquaculture in southwestern Bangladesh is explored based on SWOT analysis of the current community based governance system. For the purpose of this analysis, internal and external environments are defined. The internal environment involves community associations, the Upzella Fisheries office, District Fisheries office and the relevant government institution like DoF. Beyond the limits of these entities is considered to be the external environment. The rest of the stakeholder organizations in the shrimp farming sector fall under this category. The direction given by SWOT analysis is what weaknesses of the system should be converted into strengths and Identified threats need to be analyzed thoroughly. Threats, which can be predicted ahead of time, can be converted into opportunities. The next step becomes identification of strategic direction of the shrimp farming sector in the long run. Figure 3. shows the methods used to derive findings under Objective Two. After finding the weakness and threats of the community based shrimp culture, feedback from 88 farmers were taken to evaluate the intensity of threats and weakness available there.

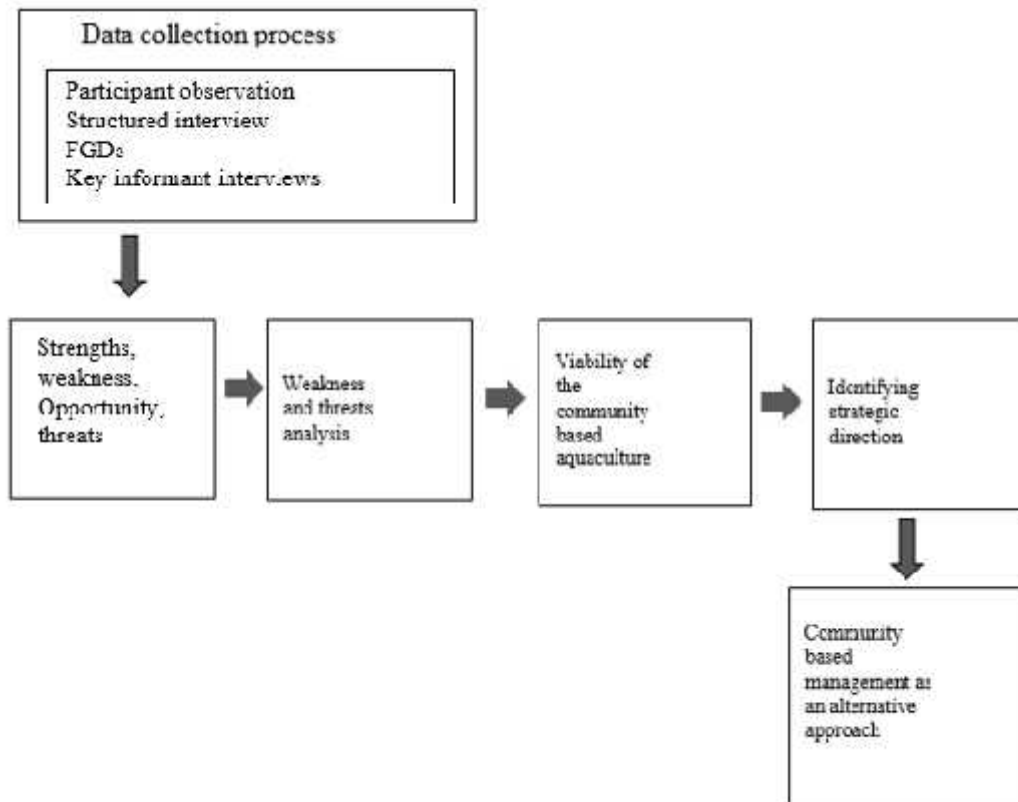


Fig.3. Deriving findings under objective two. (Adopted from Galappaththi, 2013)

2.8 Reliability of the research

The tool “Reliability” is also a tool to evaluate the quality of research (Golafshani, 2003). If someone repeats the same study (following the same methodology), the extent to which it repetitively demonstrates the same findings is explained as research reliability (Cohen and Crabtree, 2008; Golafshani, 2003). Reliability of this study was ensured by properly documenting the entire methodology and by maintaining a consistent approach during the research project. The validity of this study was ensured by adopting the following strategies by taking some steps. The use of several data collection methods, (participant observations, structured interviews, FGDs, and key informant interviews) known as 360° approach, is done; Draft findings were shared with the respondents for validation purposes and their feedback was obtained; Samples were collected from four different communities and sample size was determined in field in the southwestern part of Bangladesh

In this chapter, the research methodology was described in detail. The research was conducted in the form of a qualitative analysis. Mainly primary data was collected through participant observations, structured interviews, key informant interviews, and focus group discussions. Sampling was done using the snowball sampling technique.

CHAPTER 3: RESULTS AND DISCUSSION

This chapter reveals the analysis and results related to the research objective by understanding the community-based shrimp aquaculture in the Southwestern communities of Bangladesh. The chapter explores the existence of community-based shrimp aquaculture in the study area, and background information on individual shrimp farmers (their demographic and farming related profiles) and any affiliations to community-based organizations is documented.

Data on the above aspects are qualitatively analyzed and findings are presented using narratives, descriptive statistics, and graphical representations. Objective number two deals with a variety of policy-related matters. This chapter determines the viability of community-based culture. Here, there is no assumption that large-scale shrimp production could be totally replaced by community-based operations; rather, the thesis explores a potential approach for building sustainability for the future. A SWOT analysis is used to identify current strengths, weaknesses, opportunities, and threats of the existing system. This analysis also captures the desired policy direction of the shrimp farming sector.

3.1 Profiles of shrimp farmers

3.1.1 Demographic information

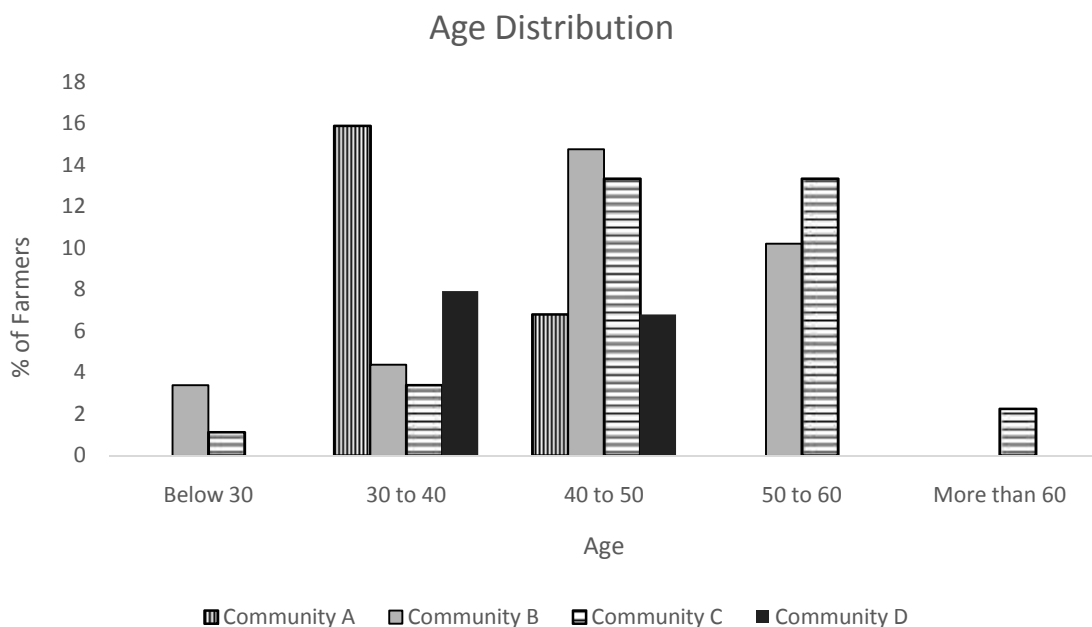


Fig.4. Age distribution of the farmers.

Fig.4. shows the farmers of communities B and C had a similar type of age distribution. The majority (42%) of farmers were between 40 and 50 years old. In community B and community C, there were 3 farmers (3.41 %) and one (1.13%) farmer respectively who were less than 30 years old. Interestingly Two farmers (2.27%) of community C were more than sixty years old. The oldest farmer was 65 years old. The sample interviewed included entirely male farmers. Female are associated in other activities, but not in farming.

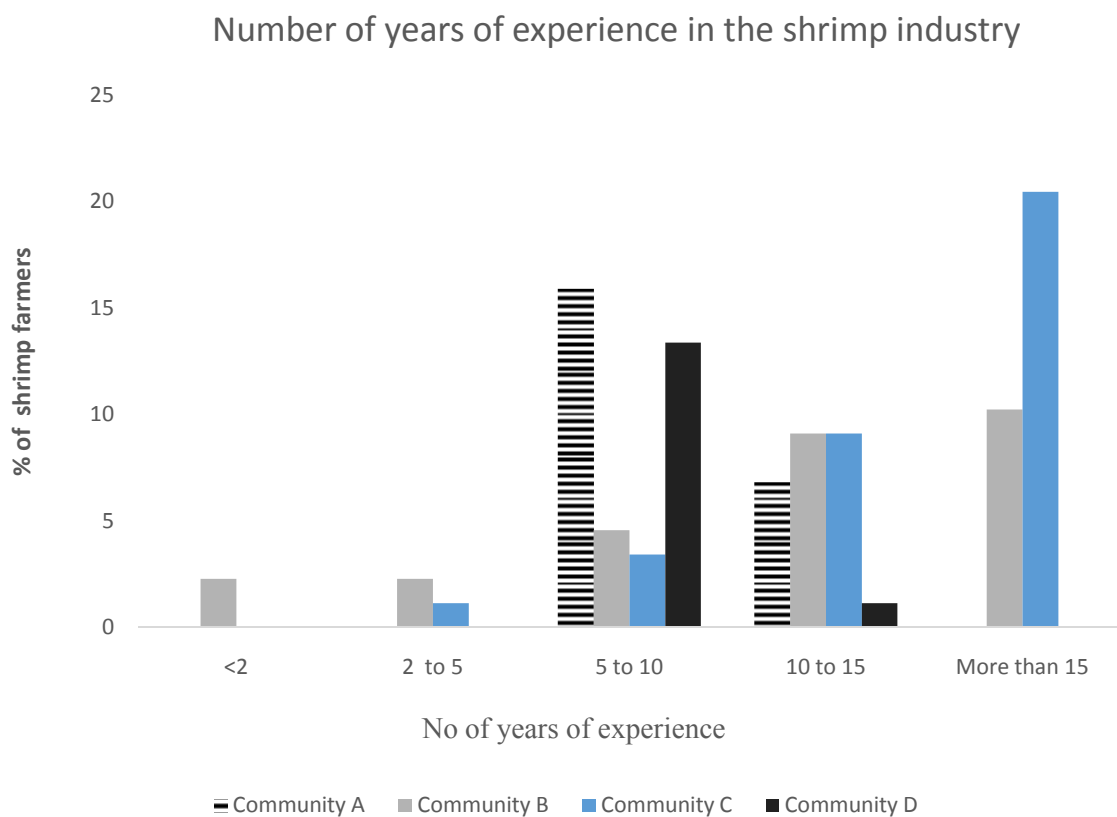


Fig.5. Number of years of experience in shrimp industry

In terms of the industry experience (number of years) of farmers, all four communities were not similar. Within the community B experience ranged from below two years to more than 15 years. The majority of shrimp farmers (37.23%) having 5 to 10 years of experience. The most experienced shrimp farmer I met had 26 years of farming experience. There were only 2.27% of farmers with less than two years of experience. In total 30.68% farmers have more than 15 years of experience. .But in the community C most of the farmers are having more than 15 years of experience. 60% of the farmers of

that community have more than 15 years of experience, which was 20.45% of the total sample. The farmers of Community A and D have similar types of experience. They don't have very low or very high experienced farmers. All the farmers of these two communities have 5 to 15 years of experience.(Fig.5.)

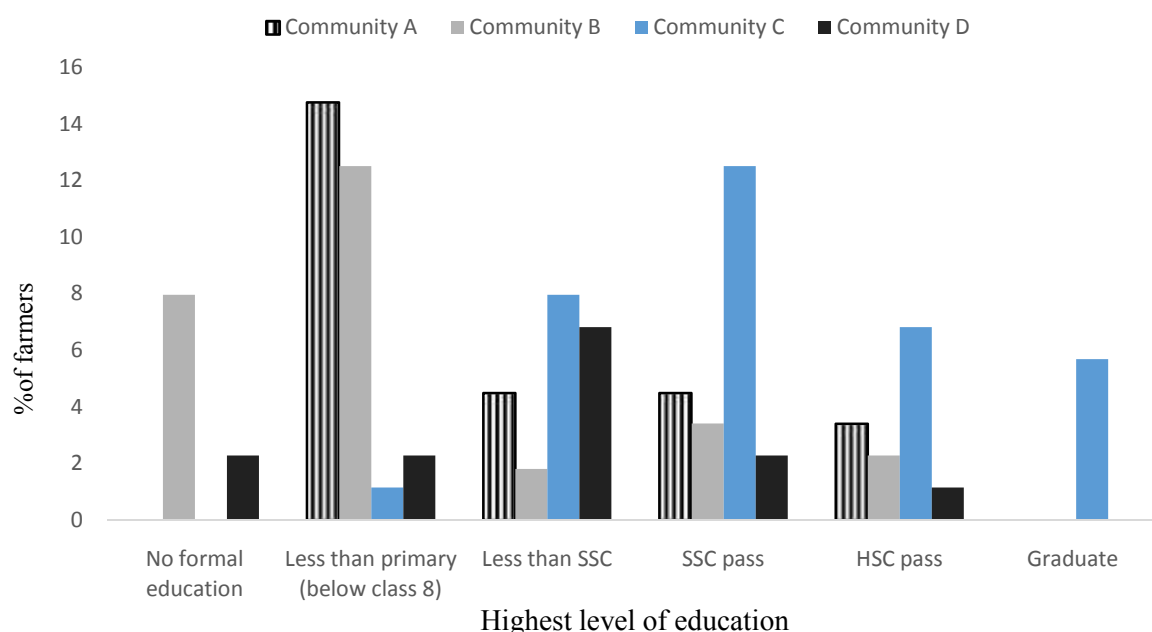


Fig.6. Highest level of education of the shrimp farmers

Data on the highest level of education of shrimp farmers from all three communities (Fig.6.) Showed that most of the farmers have formal education below primary level. Here primary means up to class eight according to the new education policy of the government. The majority (30.68%) of farmers had some level of primary education while 22.68% of them were SSC passed. 10.22% had no formal education. Most of the farmers without having any formal education is from community B.35% of the farmers of that community have no formal education which was 7.95 % of the total sample. 21.06 % had taken their primary education but are not SSC passed while 13.63% are HSC passed. Nearly all the members of community C are educated. 96.67% farmers of that community have education more than primary level. Graduate members are found only in that community which is 5.68% of the total sample.

All the farmers of four communities are male (100%) and all of them have mobile phones (100%)

3.1.2 Farming related information

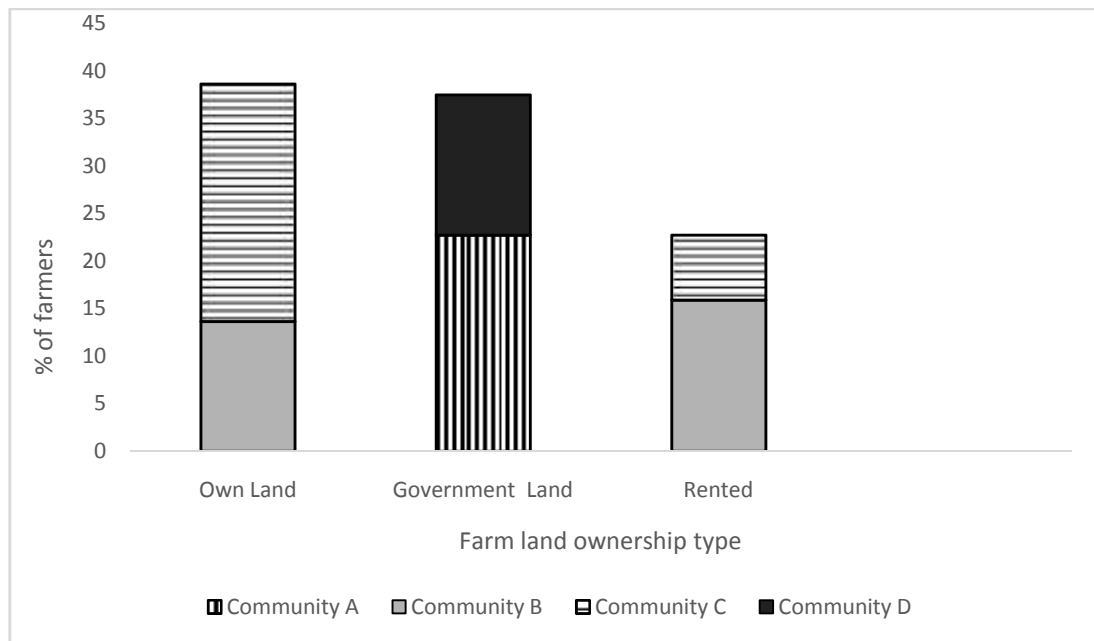


Fig.7. Farm land ownership type

The majority (38.64%) of the shrimp farmers used own lands while 37.49% of farmers used their state owned lands, and the remaining farmers (22.73%) used rented lands. Among the communities, the majority of farmers from community C carried out farming in own lands. All the members of community A and Community D used government owned lands by taking lease according to legal procedures under the MoL.(Fig.7.)

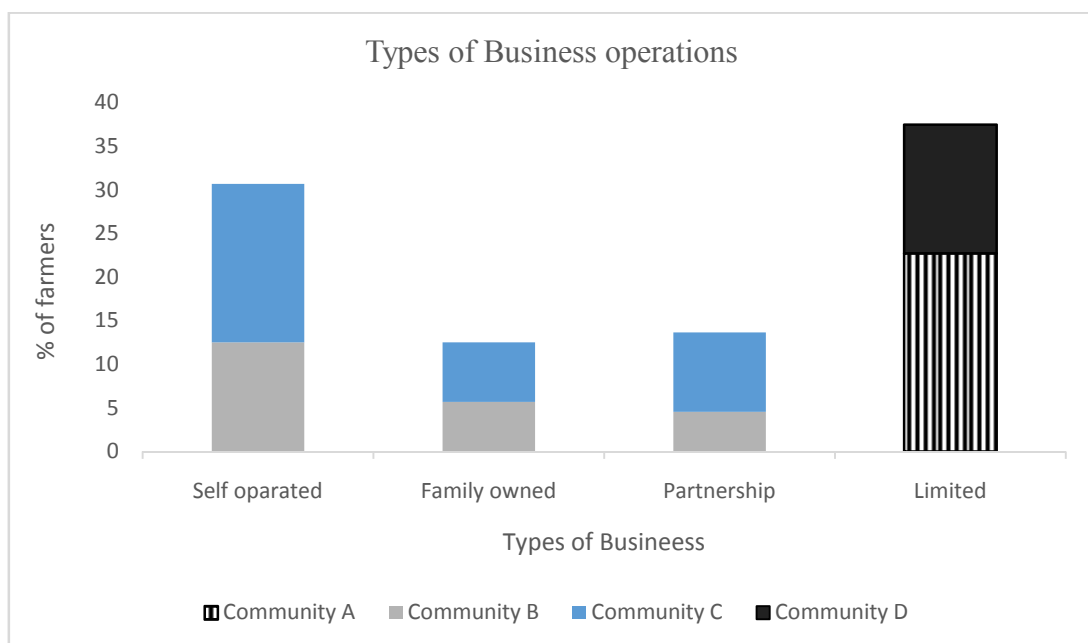


Fig.8. Types of business operations farmers carried out

In terms of types of business operations 30.68% farmers carried out their farming activities on their own, while 12.5% farmers carried out farming activities as family-owned businesses, and 13.68% were in partnerships. The percentage of farmers who operated the businesses as private limited companies was 38.5% but this type of business was absent in community B and community C. All the farmers (100%) of four community do Shrimp- fish culture (Fig.8)

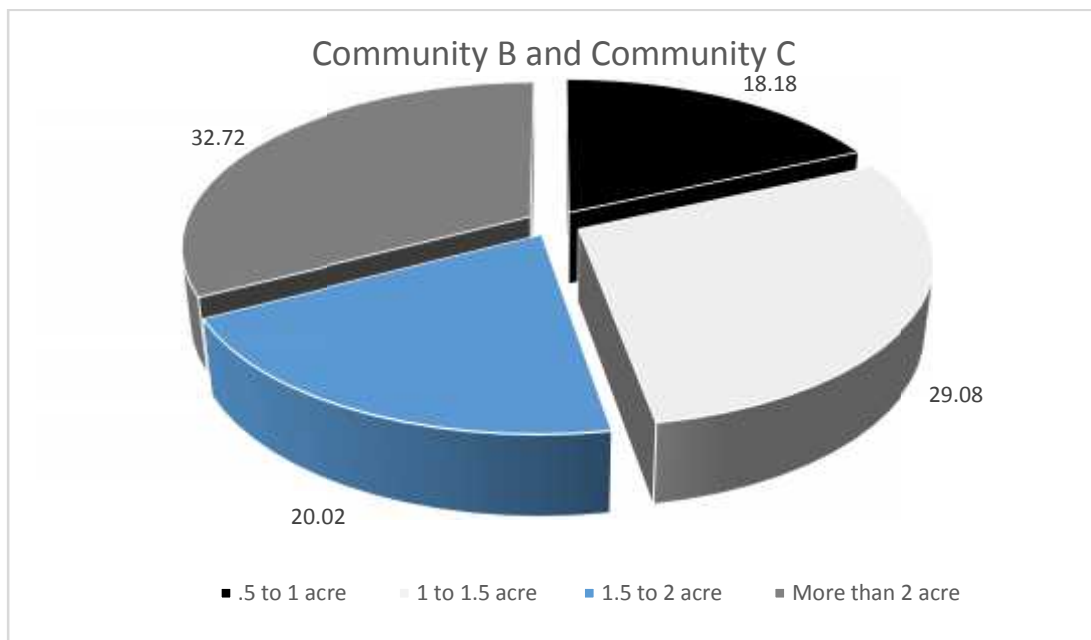


Fig.9. Sizes of the ponds in community B and C

Fig.9. shows that 32.72% of the Sizes of the pond under two communities is more than 2 acre. 18.18% have ponds below 1 acre. 29.08% and 20.02% of the ponds are 1 to 1.5 and 1.5 to 2 acre respectively. The total are is 14.75 acre and 62.42 (a river area) acre under community A and D respectfully.

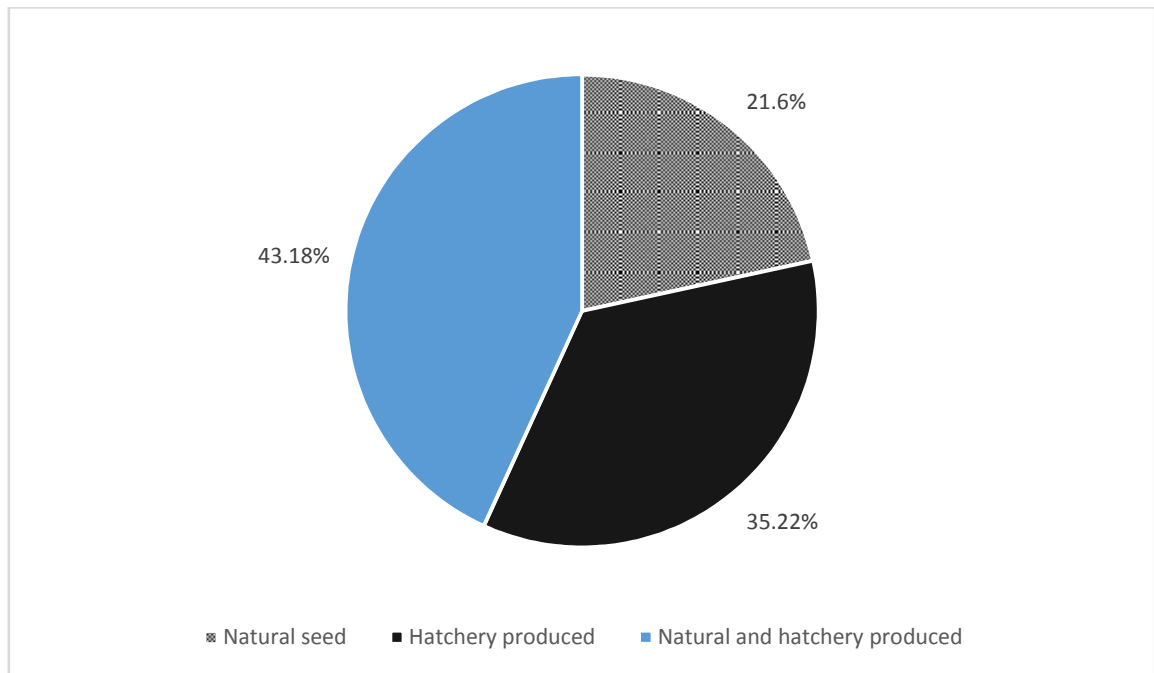


Fig.10. Source of seed

Fig.10. shows that most of the farmers used both type of seeds which was 43.18%. But 21.6% of the farmers collected the seeds from natural sources (sometimes illegally). Most of that category were from community C. By doing that they are destroying other seeds as by product. 35. 22% of the farmers have full reliance on hatchery produced seeds. Community B has striated rules that seed must be from hatchery to ensure sustainable development.

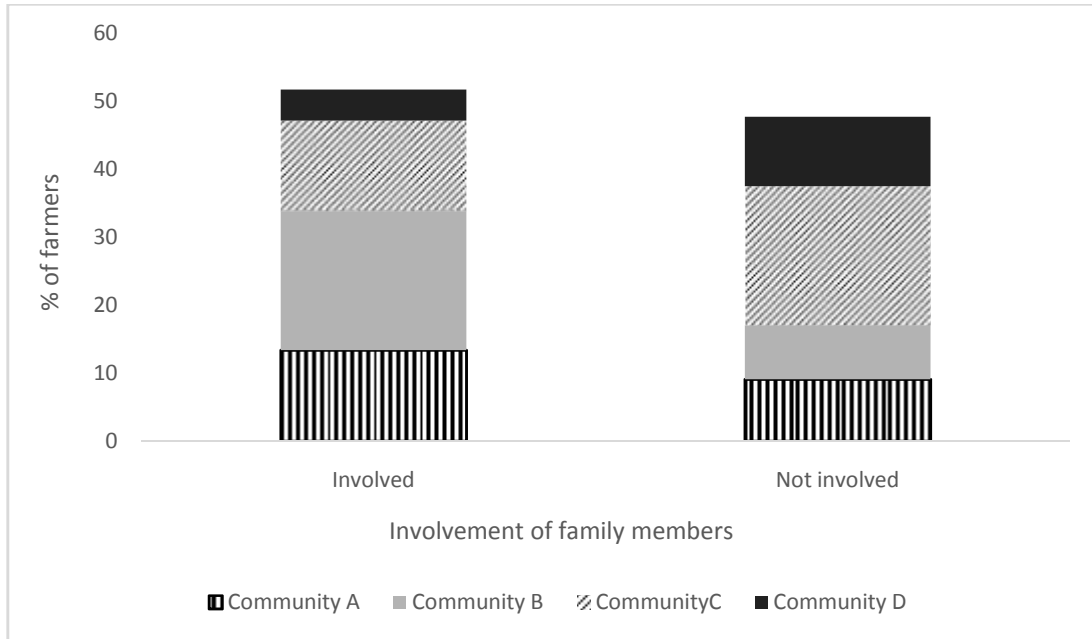


Fig.11. Involvement of the family members in farming operations

Fig.10. shows that Involvement or noninvolvement of family members in the farming operation was a nearly fifty- fifty phenomenon .51.72% of shrimp farmers said they receive the support of their family members and/or close relatives but the rest (48.28%) did not have any involvement of family members/relatives. Among the four communities, community B had the most involvement of family members in farming operations compared to the other three communities.

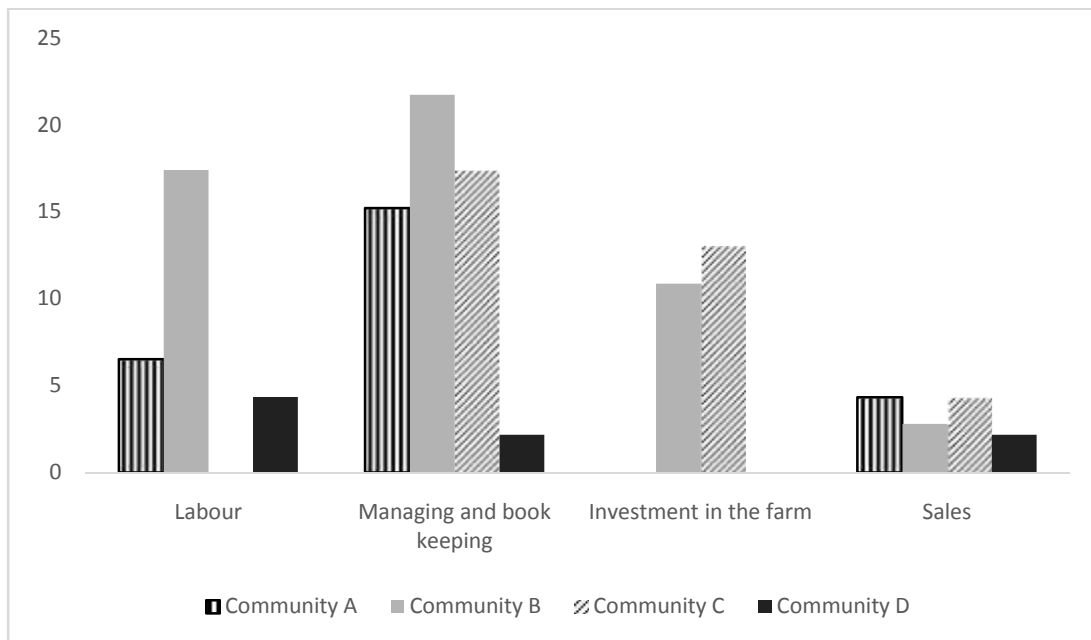


Fig.12. Nature of involvement of family members

Some of the farmers from community B and C have the investment in the farm though those farms are operated as a family business. Figure 12 shows 56.5% of the involved members are involved in managing the farm and/or book keeping activities.

3.2 Structure of community based associations at local level

Four community associations were studied. As shown in Table 4, these four communities are located in four separate zones in 3 Upozellas of 2 Districts

3.2.1 Community A

Community A (*bashdaha*) is located under Kushkhali union of sadar upozella of satkhira. This is a rural and cohesive community officially named as ‘Vorosha Motshojibi Somobai Somity’. The nearest town of the community is Satkhira. The community shrimp farmers’ association was established in 2008 as a result of active involvement of government. In August 2008, this community association was registered under Department of Social Service (registration no: 99/Sat, 07.05.08) There are 27 members and six official position. Official positions are: president; vice-president; general secretary; treasurer; and two committee members. The Executive committee members are elected by the vote of all community members. At initial level, it has 27 members and still the number is same. There is constitutional scope to enter member but it is not wanted by anyone. If entry of new member happens, it will hamper the profits of the other member because the area is fixed by the government.

Table 4: Comparison of profiles of selected community associations

Characteristics	Community A	Community B	Community C	Community D
Official name of the community association	Vorosha Motshojibi Somobai Somity.	Parulia chingri Utpadonkari Dol 1	Pipramari Gher Malik Somobai Somity	Ramchandrapur Motshojibi Somobai Samity Ltd
Place	Bashdaha, Satkhira Sadar	Parulia, Debhata	Jolma, Batiaghata and Dumuria	Dhuliara, Satkhira Sadar
Year of establishment	2008	2014	1998	2010
Nature of origin	Government initiated	NGO Initiated	Farmer initiated	Government initiated
Registered Year	2008	Not yet as a distinctive community	2004	2010
Registered Under	Department of Social Service (reg no : 99/Sat ,07.05.08)	Not yet as a Community. (NGOs are registered under NGO Affairs Bureau)	Cooperative Act, Department of Cooperatives	Department of Social Service (reg no : 73/Sat,20.07.10)
Current Members	27	52	60	22
Availability of a constitution	Yes	Yes (fixed by the project of the NGO)	Yes	Yes
Bank Account	Yes	Yes	Yes	Yes
Official Rubber Stamp	Yes	Yes	Yes	Yes

3.2.2 Community B

Community B (*parulia*) is located in Southwestern side of satkhira district. This is a real rural community of debhata upozella. Reaching this community is difficult due to poor road conditions and longer distance from the main road . Community B is different type of community and recently initiated. The name of the community is Parulia Shrimp producer group 1 (parulia bagda utpadonkari dol 1). This community is NGO initiated.Solidaridad, an international organization , has taken the initiative with the help of local NGO Uttaran.

Solidaridad ,started as a Dutch ecumenical development agency in 1969,has more than 25 years of experience in creating fair and sustainable supply chains from producer to consumer Solidaridad believes that fair and sustainable trade can be a powerful catalyst to reduce poverty, build communities and protect the environment. Solidaridad is a network of ten regional affiliate offices worldwide. The organization partners with companies, financial institutions, investors and other NGOs to develop supply chains with added value that enable producers, such as farmers and miners, to lift themselves out of poverty. Solidaridad also fosters support among the general public and consumers by building awareness of the opportunities that sustainable trade offers.

Solidaridad Network Asia in partnership with the Embassy of the Kingdom of the Netherlands in Bangladesh has started implementing the ‘Sustainable Agriculture, Food Security and Linkages (SaFaL)’ programme in the south west of Bangladesh. SaFaL tries to trigger and facilitate bio and ecosystem-based economic development making farmers better agricultural entrepreneurs. It supports farmers and workers to adopt global sustainability standards and eco-system based agricultural practices in livestock, horticulture and fisheries to improve productivity and quality that will create availability and access to nutritious food for the rapidly growing population in Bangladesh. With the spirit of transition from aid to trade. SaFaL envisions to develop sustainable supply chains contributing to economic, social and environmental gains in the long run. The broader objective of the programme is to ensure food and nutrition security and developing sustainable market linkages to raise productivity, quality and income for smallholder farmers, disadvantaged landless workers and women. The programme is work in rural communities of Bagherhat, Khulna, Jessore, Satkhira and Narial districts in the southwest Bangladesh targeting 250,000 smallholder farmers and landless workers,

unable to carve out a decent livelihood from agriculture due to salinity of land, unsustainable agricultural practices and lack of access to markets. Solidaridad works in partnership with companies, governments, aid agencies, foundations and individuals to achieve its objectives.

The researcher has taken one of the group (community B) under this project. Each group is called PG (producer group). The community B is formed with 52 members in 2014. This community is not registered under government rules and regulation as a community. But the plan is when Solidaridad finish their project in June of 2017 then they will try to register each group as a community association. Once the process of community management is known to them and the bonding be strong, they can take initiative themselves. The executive committee of this community is formed with 7 members including the post of president; vice-president; general secretary; treasurer; and three committee members. The Executive committee members are elected by the vote of all community members. The constitution says if any woman member wants to be in executive body, she will get precedence. The NGO have plan to create a fixed post, which must be fulfilled from woman farmer. But woman farmer is rare in the community. The constitution has been fixed under the regulation of the project. There is opportunity of entering new members. At AGM (annual group meeting) it is decided that new member is permitted or not. To support the group technically, a LF (lead farmer) is selected for two groups. SaFal provide training to the LF and LF provide training and technical knowledge to the PGs under him with interval of three months. After formation of PG, the selection process of LF is done. EC choose a eligible member for the post of LF.

3.2.3 Community C

Community C (*Jolma*) is located on the western side of the Khulna districts. The official name of the institution of community is “Pipramari Gher Malik Somobai Somity Ltd”. The main office is situated at Batiaghata thana.. Most of the members are solvent and live in the Khulna city. So there is a temporary office in Sonadanga. The gher, included under this cooperatives, are situated in batiaghata (80%) and dumuriya thana. There are sixty members in this community association. It is registered under Department of Cooperatives by the cooperative acts. A executive committee of 7 members is elected

yearly. Official positions are: president; vice-president; general secretary; treasurer; and three committee members. Mr Emdadul haque khalashi is the president of the association. The Executive committee members are elected by the vote of all members of the association. This association is a farmer-originated association. Even today, this is one of the most active associations in the study area. This association was established in 1998 and was registered under the Cooperative Act of Bangladesh.

3.2.4 Community D

The Official name of the institution of community D (*Dhuliara*) is Ramchandrapur Motshojibi Somobai Samity Ltd. The community is located in Dhuliara, Satkhira Sadar. It is registered under Department of Social Service (registration no : 73/Sat,20.07.10) There are 22 members and six official position. Official positions are: president; vice-president; general secretary; treasurer; and two committee members. Mr Shaikh Abdul Momen and Mizanur Rahman are the president and general secretary of the association respectively. The Executive committee members are elected by the vote of all community members. It has 22 members from the beginning with zero opportunity for the new members.

3.3 Resource governance process of the communities

The entire system functions to synchronize with the production process of shrimps. Farming operation starts with pond preparation. Prepared ponds are supposed to be inspected by a member of EC of community association (president, secretary, or treasurer) and the field extension officer from district fisheries office (in community A and D) . If they are not satisfied with the pond based on GAP (good aquaculture practice) requirements, the farmer is asked to re-do or adjust the pond within a given period of time. If the pond is satisfactory, then the farmer can commence stocking/filling of water, etc. This procedure is common to two communities visited (community A and D). The next type of farm visit done by EC members of community association (only in communities C) is for water quality parameters like salinity. In community B, NGO officer visit to monitor water quality and pond preparation. After water stocking, the farmer starts searching for shrimp postlarvae in hatcheries. As part of GAP, the farmer has to bring a sample of postlarvae for testing from the hatchery/supplier they are willing

to buy from. Samples are tested for both white spot disease (PCR test) and PL quality. PCR test report results should be negative. After establishment of PCR lab in Khulna and Satkhira, all communities do PCR test. An acceptable PL quality report should show negative results for disease with an acceptable score for PL body quality. Farmers can proceed only if these reports are satisfactory. If not, the farmer then has to look for another hatchery/supplier and repeat the same testing process. Currently, there are about 7 registered hatcheries in the Satkhira area.

Once stocked, if pond is infected by disease then the farmer has to inform both the relevant community association and fisheries office immediately. Then the infected pond(s) should be disinfected using chemicals (chlorine). Only community B use probiotics as 'bio-friendly agents' to control and compete with pathogenic bacteria as well as to promote the growth of the cultured shrimp. Most of the communities (except community D) have few cycle so partial harvesting is done. Partial harvesting is done when community association is permitted to do so. Farmers have to provide details on the harvest (date of harvest, average weight of a shrimp, etc.) to the community association.

After each harvesting together, the community association calls for a meeting to discuss how the recent crop went. Any suggestions on improving the next crop are discussed in detail. Feedback from this meeting is told to field officer of fisheries office and NGO officer for community B.

3.4 Management process of the farming

3.4.1 Management by the farmers

Decisions are mostly operational in nature made by individual farmers are in community B and community C. These decisions do not involve the community association and/or government institution.(only valid for community B and C).Personal contacts and previous experiences are the major influences on individual farmer decisions. Types of such decisions include how many ponds are to be operated; go for PL sample testing; which hatchery to buy PLs from; which feed brand and supplier, energy source, and types of labour and financing will be used; when and how many PLs to stock; when to harvest; and whether to rent or sell farm lands.

3.4.2 Management by community association

All four associations in the sample have their own customized constitutions. In particular, contents of constitutions vary according to the act/institution they have been registered under. For example, community A and Community D association have simple constitution, basically to satisfy registration requirements under Department of social services and the rules of taking lease of Government land in association with DC office. In contrast, community C has a detailed constitution, as it has been registered as a cooperative. Community B's association constitution is also a detailed document in compliance with Solidaridad and Uttaran. The Both NGO performs under The NGO affairs bureau.

Similar to any other association, EC has the authority to make decisions on behalf of the members. This decision making power is granted by a collective agreement specific to an association. However, any decision should be clearly explained and justified to the membership during the meeting. If a particular decision is highly important, EC can call a special meeting. During meetings, members openly express their ideas and concerns as there is no/little power difference among members. A community association (community C) has made it a rule to issue fines if a member is absent for two consecutive meetings. Usually, special meetings are called for Disease spreading this purpose. Most of the operational decisions of community A and community D are association based because the farmers of that two community associations have no private lands.(Total land is leased from government).

Even though consensus is the primary principle, based on researcher observations during community association meetings, it seems that associations sometimes tend to make decisions based on emotions/personal matters. These emotion-based decisions even lead to the breaking of their own rules and procedures. This situation was noticed in almost all of the community meetings attended, except for community C. For example, community A decided to go for a 10-day extension period for PL stocking based on a request made by two members (who were planning to engage in some other type of income-generating activity)

All four associations operate bank accounts for administrative and financial purposes. Moreover, they possess customized letterheads and official rubber stamps. All four of the associations conduct regular meetings and special meetings depending on the

requirements. Most frequently meeting are organized by community B in biweekly basis. Least meeting are organized by community A and D, but at least once in every two months. Bangla is the most commonly used language during meetings in all the associations (all members are fluent in Bangla).

3.5 Flow of information in management process

Most importantly, community associations play a major role in sharing information with community shrimp farmers on daily farming operations as well as on long-term resource management. In this setting the majority of farmers are dependent on information shared through community associations. Major types of information shared are: shrimp PL prices; feed brands and prices; selling prices; production (volume of harvest in community A and D); and stocking densities (number of PLs that can be added per m² of pond); stocking dates; partial harvesting time and disease prevalence/spread.

Figure 13 was developed to exhibit the structure of the existing information sharing network as understood by the researcher. It is a ‘hub and spike’ type network, where the community association is the hub playing the driving role. Spikes are represented by other sector stakeholders. Both informal and formal communication arrangements are available

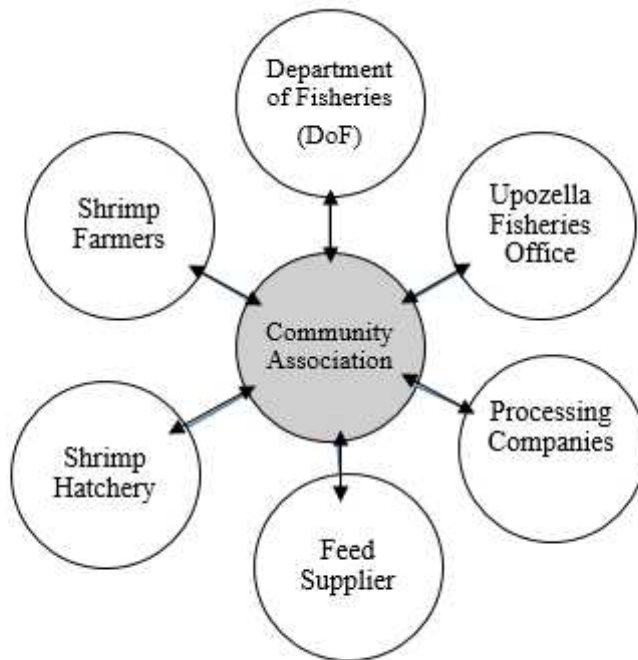


Fig.13. Structure of community association-based communication mechanism

in the existing communication platform. Even though much of the communication happens during association meetings or over cell phones. Community B organize meeting frequently (2 meeting in a month). Least meeting are organized by community A and D, one meeting in every two months. All the four community based associations have the arrangement to call up special meeting by EC. Mobile phones are used to communicate with farmers and other stakeholders in order to maintain a close, on time linkage with them. Use of cell phones is very common among shrimp farmers (100%).All of them have atleast one.

By constitution, each community association has a separate officer and/or a member who is responsible for sharing information, messages and other correspondences.

3.6 SWOT analysis

Table 3.2 is the matrix type presentation of the identified strengths, weaknesses, opportunities, and threats. In this study SWOT analysis provides the present stand of existing management system. It analyzes strengths and weaknesses of the internal environment and identifies unique capabilities of the system. Opportunities and threats that are prevalent in the external environment was evaluated. This analysis speaks to socioeconomic and environmental aspects.

Table 5: SWOT matrix

Internal environment	
Strengths	Weaknesses
<ol style="list-style-type: none"> 1. Educated shrimp farmers 2. Bottom-up management approach is recognized 3. Collectivism and collaboration is practiced in decision making process 4. No Taxation and chingri mahal 5. Small-scale shrimp farms with lower impact to the environment 6. Long acquaintance with Shrimp industry with the good will in producing high quality shrimps 7. Natural water body and the soil available provide landscape and resources needed 8. Lessons learned and experiences gained in the past on managing resources 9. Well established multi-level institutional structure 10. Government's annual budgetary allotment 	<ol style="list-style-type: none"> 1. Lack of coordination and information gap about registration 2. No Zonal system and zonal crop calendar system 3. Lack of timely production 4. Less government attention on the use of power sources 5. Gender issue is neglected in the sector 6. Connected nature of the common water body 7. To increase production is the main priority of Government with a minimum/no effort on protecting environment and natural resources 8. Decisions made in community-level associations are driven by emotions 9. Lack of expertise and poor infrastructure 10. Lack of reliance on seed of hatchery 11. Members are associated with illegal activities

External environment	
Opportunities	Threats
<ol style="list-style-type: none"> 1. Opening up of new niche markets 2. Opportunity for the landless to cooperate in culture 3. Supply chain is improving 4. Expanding demand for the export markets 5. International market become known 6. Getting bargaining power to control price 7. Good reputation for the unique taste and quality 8. Possibilities of increasing capacity 9. Salt manufacturing as an alternative 	<ol style="list-style-type: none"> 1. Lack of price bargaining power to farmers 2. Impacts of global climate changes and natural disaster 3. Creating an onerous working environment By Political influences 4. Less research activities 5. Regional instability influencing sector decision making 6. Impact of inflation 7. Malpractices by businessman 8. Lack of financial cooperation 9. New rules by exporter countries like EU,USA. 10. Unpleasant position of the sector due to past experiences and some adverse impacts.

3.6.1 Internal environment

Strengths

1. Minimum Formal education of the farmers :

Based on the data gathered in this study, most shrimp farmers in these communities are educated. Level of education is important when it comes to community-level management activities. The majority (30.68%) of farmers had some level of primary education while 22.68% of them are SSC passed. 10.22% have no formal education. Most of the farmers without having any formal education is from community B which is 7.95 % of the total sample. 21.06 % had taken their primary education but are not SSC passed while 13.63% are HSC passed. Nearly all the members of community C are educated. 96.67% farmers of that community have education more

than primary level. Graduate members are even found only in that community which is 5.68% of the total sample. (Figure 6). That means nearly 90% of the farmer have some level of formal education which is very important for community based management as well as sustainable development.

2. Government statutory bodies recognized the bottom-up approach :

Bottom up approach of involving community associations is recognized by government statutory bodies as resource management approach. NFMP (The New Fisheries Management Policy) was introduced in 1986 having the main aim to divert the maximum benefit to the genuine fishers by ensuring the sustainability of the fish stock by limiting exploitation to the maximum sustainable yield level. Another idea in the New Fisheries Management Policy was the gradual abolition of leasing fisheries by open auction. But NFMP was abolished in 1995. Like other developing countries, the government of Bangladesh also adopted the CBFM (community Based Fisheries Management) policy in 1992 for the betterment of the distressed fisher's group by ensuring sustainable exploitation of fisheries resources from river and other public water bodies. Government involved the NGOs to operate this programme with the collaboration of local fisher groups and Department of Fisheries. The Community Based Fisheries Management Project, Phase 2 has been implemented by the Department of Fisheries of the Government of Bangladesh with the assistance of the World Fish Center over the period 2001 to 2007. The CBFM and CBFM 2 (runs from 2001-2007) clearly highlights the importance of promoting a bottom-up approach in managing fisheries and aquatic resources. Cooperative arrangements (associations/societies) are well recognized by the constitution of Bangladesh. This background provides a platform for the current shrimp aquaculture governance system to function smoothly. This system can be related to Ostrom's (1990) fourth design principle, which emphasizes the importance of community members having the right to devise their own rules that are respected by external authorities.

3. Existence of a collective and collaborative decision making process

Examples for collective decision making on resource management aspects are available at governance structure. In community level, regulatory and operational decisions are collectively made. Four communities have their own constitutions. Most frequently meetings are organized by community B on a bi-weekly basis. Least meetings

are organized by community A and D, but at least once in every two months. Most of the farmers agreed that the outcome of the meetings are very useful to take decisions. All the four community based associations have the arrangement to call up special meeting. On the other hand, National level decisions are mainly related to aquaculture resource management and are collaboratively made through a participatory approach.

4. Chingri mohal and no Taxation:

Ministry of land (MoL) announced some certain area as shrimp production area under the act of 'Chingri mohal management policy 1992'(memo no land/ Sa-8/Shrimp/227/91/217).These are known as chingri mohal under that act. Community A(bashdaha) and community D (Dhuliara) has taken lease under the rules of this act .Community C uses the facility under the cooperative acts of Department of Cooperatives. Farmers of 4 community can easily get loan for shrimp culture and this business of culture is totally taxes free.

5. Low impact to the environment:

Most existing shrimp farms are small in scale in the southwest regions of Bangladesh. Small-scale shrimp farming is known to make a relatively low impact to the environment compared to large or medium-scale operations.(key informant interviews) .When community based is done, one cannot hampers the natural environment by his farming activities. In community A and Community D the total profit is equally distributed among the members. The whole leasing government land belongs to the community as a single authority. So legally and financially they are bound to manage the environment. In community C, one cannot do any activity which hampers the naturality of others farms because then the EC of cooperative will take actions. One does not wantto hamper the normal relations with other member of this community. So it is said in community based management, the bad impact on nature is low due to legal, social and financial bounding.

6. Long acquaintance with Shrimp industry with the goodwill to produce high quality shrimps quality shrimps for niche-markets:

Bangladesh is well known and reputed for a period of about three decades in supplying high quality shrimps. From the beginning of 90 government started

encouraging shrimp culture and export through the liberalization of trade policy. Niche markets are: USA, EU countries, and Japan. According to shrimp processors(key informant interviews) there is a specific taste and texture to Bangladeshi cultured shrimps, which attracts a specific customer group.

7. Well established and organized multi-level institutional structure:

The governance structure is organized as multi-level associations (community, District and national level) with involvement of DoF at the top level. Separate roles and responsibilities are fulfilled by those institutions. (Key informant interviews). This structure can be related to Ostrom's (1990) eighth design principle on nested enterprises; i.e., appropriation, provision, monitoring and sanctioning, conflict resolution, and other governance activities are organized in a multi-level institutional structure.

8. Topographically supportive natural water body and soil the southwestern area provide landscape and resources needed

Shrimp aquaculture is fully dependent on available natural water bodies as the culture medium. The system running through the area distributes water to farming areas and provides a natural landscape required for shrimp farming. The type of soil available in this area is the suitable soil type needed for constructing ponds, as it is capable of holding/retaining water for a long period time (with less seepage). Shrimp farming areas should be divided into zones and community-level sub-zones. It is mentioned in 'shrimp policy 2014'. If zonal system is introduced, it can be used in developing the seasonal crop calendar and water management in order to manage farming operations.

9. Government's annual budgetary financial allotment for shrimp farming-related activities:

There is an annual budgetary allocation for improving shrimp farming activities and uplifting livelihoods of farmers. Currently, this money is being used for PCR testing, monitoring and extension services, etc. Funds are administered through DoF. According to DFO of Satkhira 6.91 million taka are given as loan under microcredit programme to the farmers of Satkhira.

10. Lessons learned and Experience gained from adaptation of different management practices over the years:

The resource management process adapted in shrimp aquaculture is an ongoing learning process. It started three decades back and has resulted in several cycles of successes and failures. Existing shrimp farmers have learnt a lot from these experiences and they contribute their experience and knowledge for the development of the sector through community associations. The majority of shrimp farmers (37.23%) having 5 to 10 years of experience. The most experienced shrimp farmer I met had 26 years of farming experience. The lead farmer of community B is also very experienced (more than 15 years of experience) but in the community C most of the farmers are having more than 15 years of experience. 60% of the farmers of that community have more than 15 years of experience, which is 20.45% of the total sample. The farmers of Community A and D have similar types of experience. They don't have very low or very high experienced farmers. All the farmers of these two communities have 5 to 15 years of experience. (Figure 5)

Weaknesses

1. Lack of coordination and information gap about registration with overall poor managed institutions :

Among the Four communities, two (A and D) are registered under Department of Social Service of Bangladesh. Community B (Parulia Chingri Utpadonkari Dol 1) has not been registered as a community yet but the mother organizations of it (both the NGOs, Uttaran and Solidaridad) are registered under NGO Affairs Bureau. Its Functions under the secretariat of Prime minister. Community C (jolma)) is registered as Pipramari Gher Malik Somobai Somity Ltd under the cooperative act of Department of cooperatives. The Community A (Bashdaha) and D (Dhuliara) are also registered under DC office as a leasing authority of two government lands. The upozella and district fisheries office could not provide information to the researcher about the community because they don't have information about those community.

There should have a rule if the community is doing fisheries related activity is must be registered under fisheries department or the interconnection between the departments should be in a way that if a new community is registered, it will automatically (with the help of software based programme) added to the fisheries department. Most of the inefficiencies in performance of the shrimp aquaculture sector can be associated with weak intuitional management. Inefficiencies are common to both bottom level community associations as well as the top-level participatory/collaborative arrangements. Weak institutional management results in corruption, egoism, relativism, favoritism (nepotism), harassments, political influence, etc. (Hanna, 2007). These forms of mismanagement mostly affect enforcement of policies and procedures.

2. No Zonal system and zonal crop calendar system:

Zonal system is a system of geographically demarcated boundaries designed by considering natural shrimp disease-spreading patterns. Zonal crop calendar is a defensive shrimp disease management approach which limits environment degradation. There is no zonal crop calendar system in Bangladesh for fisheries though there is crop calendar for agriculture, known as agriculture calendar. The principle behind the zonal crop calendar system is the learning-by-doing approach, whereby the learning/experiences from previous crop(s) are incorporated into the plan for the next crop. It is practiced by the shrimp farmers in northwestern Sri Lanka. It was initially introduced by the Sri Lankan Aquaculture Development Association (SLADA) in 2004 and the implementation was legalized by the fisheries ministry of Sri Lanka. (Galappaththi, 2013). The uncontrollable nature of shrimp disease conditions and the resulting impacts to the shrimp farmers and other stakeholders led to the development of the crop calendar. The objective of the crop calendar is to minimize the damages caused by shrimp diseases (mainly white spot viral disease) in order to increase national-level shrimp production. (Galappaththi, 2013). The crop calendar system minimizes disease spreading potential as well as environmental damage. Most of the farmers are not well known about this type of system. Fisheries officer and officials of NGOs thinks zonal system should be introduced.

3. Lack of timely production to satisfy market demand

From an economic perspective, the main weakness is lack of on-time production to retain the market and to get a good price. The problem starts from shrimp hatcheries. Hatcheries are unable to produce the forecasted level of PLs due to lack of proper management practices and disease problems. Actual shrimp farm production volume is also below the forecasted level mainly due to diseases and environment degradation and lack of proper management. As a result, aquacultured production of shrimp harvest available for processing is always below the forecasted level. See the illustration in the following Figure.

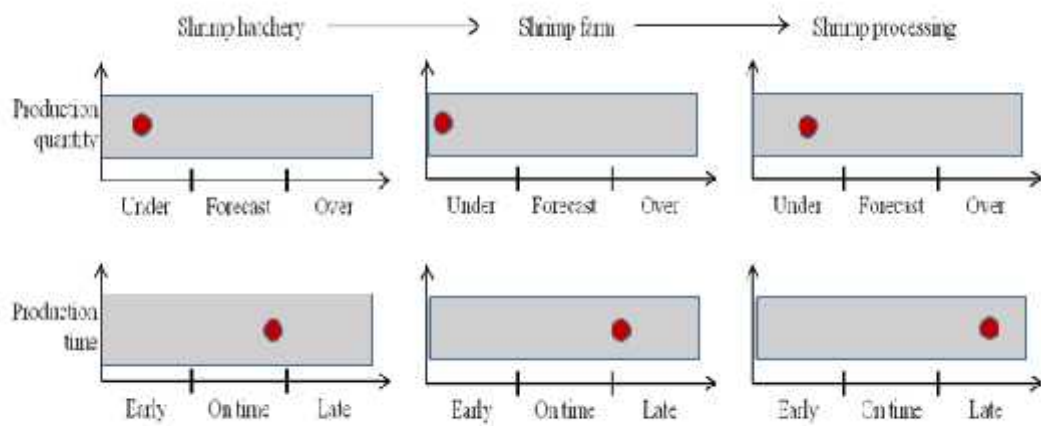


Fig.14. Lack of quantity and timely production throughout production cycle.

In terms of timing of production, most hatcheries delay production due to: unavailability of on-time breeding stocks (parent shrimps); delayed receipt of laboratory test results; and sometimes unfavorable weather conditions. As a result, the entire cycle gets delayed. Processing companies do not get required amounts of harvest on time; despite the fact that export demand for processed shrimps is seasonal. All the above-mentioned factors collectively affect the profit making potential of the shrimp industry.

4. Use of power source and Lack of government attention

Based on the researcher's interviews with representatives of government institutions, it seemed that they pay less/no attention to the issue of shrimp farmers totally depending on diesel generators during their production cycle. The use of diesel generators is not friendly to the environment. This situation is more critical in certain remote communities (community A and D). During community association meetings, there were many discussions on the difficulty of getting solar electricity services. If the government can intervene and make sure that electricity services are available in these areas, then use of diesel generators will go down. It will also reduce the reported illegal electricity thefts from common electricity lines. Farms will become more secured during night time against theft taking place mainly due to lack of power during night. Already farm A has established a solar system and get some electricity from it.

5. Women empowerment or Gender balance is not visible:

All the shrimp farmers I met are males. Even though there is no female representation as farmers, female family members help in farming operations in different ways. The SaFaL project by Solidaridad in collaboration with Uttoron (community B) is going to implement the rule that each PG should have 7% of female members. They are also going to implement the rule that one of the member of EC must be woman. It is mentioned at Shrimp policy 2014(Chingri nitimala 2014) that women empowerment should be done at this sector (Sector of implementation,section 4.7 and strategy of implementation, section 5.1.6; Shrimp policy 2014). Women are involved in as labour, bookkeeping and management activities in all of the four communities.

6. The connected nature of the water bodies can be responsible for quick spreading of diseases:

Interconnected natural water body, the rivers and the canal system increase the potential and speed of disease spread. Some of the farmers cut the barrage of polder to ensure the entry of saline water. It's also hamper the infrastructure of government.

Most of the farmers from community B have complained that the sluice gate are not properly working and some are damaged. Water management is very weak and responsible for disease spreading.

7. To increase production is the main priority of Government with a minimum/no effort on protecting environment and natural resources:

The way government institutions contribute in the shrimp farming sector implies that their priority is to increase production. Less/no attention is given to protection of the environment and natural resources. For example, proper handling of waste is an ignored component, despite its significance in terms of sustainability. Fisheries office can provide the information related to production but they have no measurement system to measure the impact of farming on environment or the change of environment. For example, Fisheries officer of Satkhira showed a report named 'Fisheries report of Satkhira district, 2015' on the overview of fisheries sector of that district. On the report it was mentioned that the total shrimp production of Satkhira was 20680 metric tons in 2014 and the target production was 22800 metric tons. But no environment improvement related target was not included in the report.

8. Emotion-based decisions made at community-level associations

Emotion based nature of decision making is common in the bottom level of the existing resource management structure. Some member of the community are so intimated that they take decisions on personal conditions. Decision making under the influence of emotional conditions (anger, Sympathy, empathy, etc.) could lead to incorrect decisions. For example, community B decided to go for a 10-day extension period for PL stocking based on a request made by two members (who were planning to engage in some other type of income-generating activity).

9. Lack of expertise and poor infrastructure :

Lack of human resources/expertise (such as aquaculturists, farming consultants, field extension officers, general labour), laboratory facilities, new technology, etc. limit the potential for a smoothly run resource management process and the development

of the sector. Poor rural road network affecting input supply delays and quality of inputs (e.g., PL quality, harvest quality).

10. Lack of reliance on seed of hatchery:

Most of the farmers think that if the PL are collected from nature they can produce more shrimp. Some of them don't have reliance on Government policies and the hatchery PLs and try to collect seed from natural sources illegally. Gravid mother shrimp should be collected from Bay of Bengal by following Code of Conduct for Responsible Fisheries. For the first time, Bangladesh has imported Specific pathogen free (SPF) broodstock from Hawaii of USA. (DoF, 2015). SPF broodstock should be ensured for the production of PL. 'Fish hatchery Act 2010' and 'Fish hatchery rules 2012' is not strictly maintained by the Hatcheries. It is mentioned at Shrimp policy 2014 (section 5.5) government will introduced shrimp seed certification process. 21.6% of the farmers still collects the seeds from natural sources illegally. By doing that they are destroying other seeds as by product. 43.18% of the farmers use both type of seeds. 35. 22% of the farmers have full reliance on hatchery produced seeds. (Figure 10)

11. Members are associated with illegal activities:

There are some members in community A and community D who are only exist in reality. For example community A and Community D have 27 and 22 members respectively. But in reality 20 and 13 members have been found by the researcher. 29.78 % members are missing in reality, which is a very bad sign for the empowerment of marginalized farmers. Few member from executive body of community A and C told that some farmers had given sublease of the rented land or the government land. Two farmers from community A has been found who are not the members in the written format of membership list. But practically they are involved by their political force and financial backup. By doing that marginalized people could not enter in the community. But it was one of the aim of the government initiated community associations. (Community A and D).

3.6.2 External environment

Opportunities

1. Opening up of new niche markets for Bangladeshi shrimps such as South Korea, China, and India.
2. Landless and resource poor farmers have the opportunity to undertake fish culture in leased out ponds
3. Expanding the demand from export markets (such as Japan, USA, and some EU countries) on Bangladeshi cultured shrimps
4. The NGO (Solidaridad) is looking forward for the direct linkup between farmers of community B and the buyers. The target of them is to shorten the supply chain. Solidaridad used a slogan 'aid to trade'. Under this slogan they are encouraging both the farmers and the buyers.
5. By the community association the less educated farmers can know the rate of shrimp in international market which can be factor to determine price in the supply chain.
6. Under community B,a collection point has been established from where the processors can collect the shrimps of all community members. By doing it farmers can get bargaining power and influence supply chain.
7. Good reputation due to unique taste and quality (texture, size, appearance) of Bangladeshi cultured shrimps among potential buyers
8. Room for improving industry capacity. Currently, all of the shrimp farms are not functioning. There is a potential to expand production by using abandoned ponds
9. Salt manufacturing can be an alternative to effectively use abandoned shrimp farms in certain areas to create an alternative income source

Threats

1. Inconsistency in the supply chain results in substantial and rapidly changing price for shrimp in local and international market. In the supply chain of shrimp there is no control over the price of shrimp. For this uncontrolled price some time producers are not getting the right price for shrimp. Shrimp farmers do not possess power to influence the price of any input or output during the entire production process. The following Figure illustrates the actors who have the power to determine prices of inputs/outputs. Accordingly, all the other actors in

the production process, except farmers, possess price-determining power. A farmer becomes a 'price taker' in immediate transactions in either side of the production process (i.e., PLsupplying hatcheries and harvest-buying processors). Therefore, famers are in a vulnerable position in bargaining for the price. Farmers of Community C has some bargaining power because of their education level. 96.67% farmers of community C have education more than primary level. 5.68% member are even Graduate members. They have a position in the society and can influence the supply chain. The NGO associated with community B is working to shorten the supply chain having the slogan 'aid to trade'

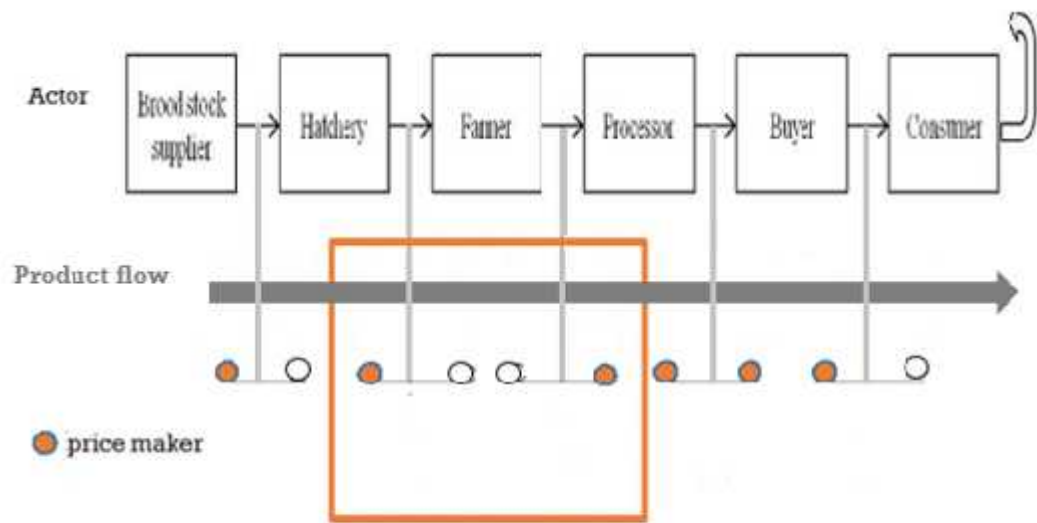


Fig.15. Price determiner in the supply chain.

2. Global climate changes and natural disaster impact shrimp farming. For example, mass shrimp PL destruction happens due to sudden temperature variations. Further, due to unexpected rainfall patterns, disease spreading is more complicated and unpredictable. According to the Third Assessment Report of IPCC, South Asia is the most vulnerable region of the world to climate change impacts (McCarthy *et al.*, 2001). The natural calamities like flood, salinity, Sidre can fully destroy the cultured shrimp. Over rainfall can also change the salinity of the brackish water
3. Political influence creates a difficult environment for institutions to function independently in fulfilling their responsibilities. This can be observed throughout the resource management structure, especially at the field enforcement level.

Politically backed people, locally known as muscleman don't want the establishment of community. If a strong community is established they will not be able to collect money (chada) from the farmers. In some places the local leader works as a middleman and gain huge profits. Even the area (locally known as 'Gher dokhol') and the production of a cycle of an individual farmer has been captured by big leaders. This type of oppression was experienced by some members from all communities directly. It is mentioned earlier that two farmers from community A has been found who are not the members in the written format of membership list. But practically they are involved by their political force to have profit.

4. There are several number of research studies has been done on shrimp farming. Few of them are on social-ecological systems and technical aspects of shrimp aquaculture. But sadly most of the researcher and academic institutions of Bangladesh are not aware of shrimp farming as a community-based, participatory, and collaborative management approach, but a commercialized business activity.

According to my understanding, the art and science of aqua culturing and the outlook towards social matters have largely evolved over time. This development is mainly due to the individual and collective efforts of shrimp farmers, rather than government institutions. Government played little role in this process. Later, the idea of collaborative governance system came into the picture. Still, there was no dramatic contribution from the government towards technical or operational knowledge advancement of the sector. However, research is costly but it should be done.

5. Political instability is a common phenomenon in the third world countries. Regional political instability and actions influence the sector decision making and performance. The members of EC of selected communities think that this type of political influence has affected the shrimp sector since its outset.
6. Farmers from community C had mentioned that there are certain threats due to the Impact of inflation (percentage changes in major cost components) in shrimp

farming. The inflation of last year was 6.46 (MoF, 2015) .Farmers mentioned that costs of electricity, fuel and labour have increased significantly over the years, even though the selling price remains more or less the same. The monetary policy should be in such a way that the exporters can get enough profits. If they get much profit, then the selling price will increase.

7. Sometime some dishonest shrimp producer or businessman malpractices like push of unhygienic liquid and solid bar. These types of adulteration in shrimp create a bad image for shrimp industry in overseas market
8. The financial cooperation from the government is not enough: Though the interest rate for the fisherman is lower (11% interest rate for fish farmers) but many of them thinks it should be lower than the present interest rate. Some farmers said that single digit interest rate can be imposed.
9. In case Lack of modern machinery, instruments and methodology for testing quality parameters of exportable shrimp. Laboratory is not enough facilitated with modern and sophisticated, machine, instruments and methodology for testing quality parameters of exportable shrimp. Various new and stringent regulations regarding quality assurance are introduced by the importing countries like EU and USA. That creates complexities in shrimp export.EU imposed a ban on Bangladesh shrimp imports in 1997 because of a failure to comply with EU quality regulations. These events have resulted in a bad image of Bangladeshi shrimp in foreign markets. As a result Bangladesh cannot demand the same price as its competitors can in the international market
10. Shrimp farming has earned a bad reputation in history due to its environmental and social impacts. Rapid development of shrimp farming brings a series of negative environmental impacts, like ecological imbalance, environmental pollution and disease outbreaks etc (Hossain et al, 2013). Commercial operations have badly affected coastal ecological systems such as mangroves. Many research has proved that it already has harmed our agriculture, land fertility and environmental balance because of salinity intrusion(Stonichand Bailey,2000; Alam et al. 2005).The process of mangrove destruction in South-Western districts of Bangladesh started two decades ago, which harm the natural environment,

ecosystem and social systems (Deb,1997).It is said that shrimp culture made the land a salt desert. Thus, shrimp farming is facing management-related difficulties which lead to greater concerns about its sustainability.

As the next step, identified weaknesses and threats need to be thoroughly studied to understand how each component affects the viability of the existing shrimp aquaculture management system. Sometimes, it can be unrealistic to convert weaknesses and/or threats into strengths and opportunities. Such weaknesses/threats decrease the viability of a community-based aquaculture management approach.

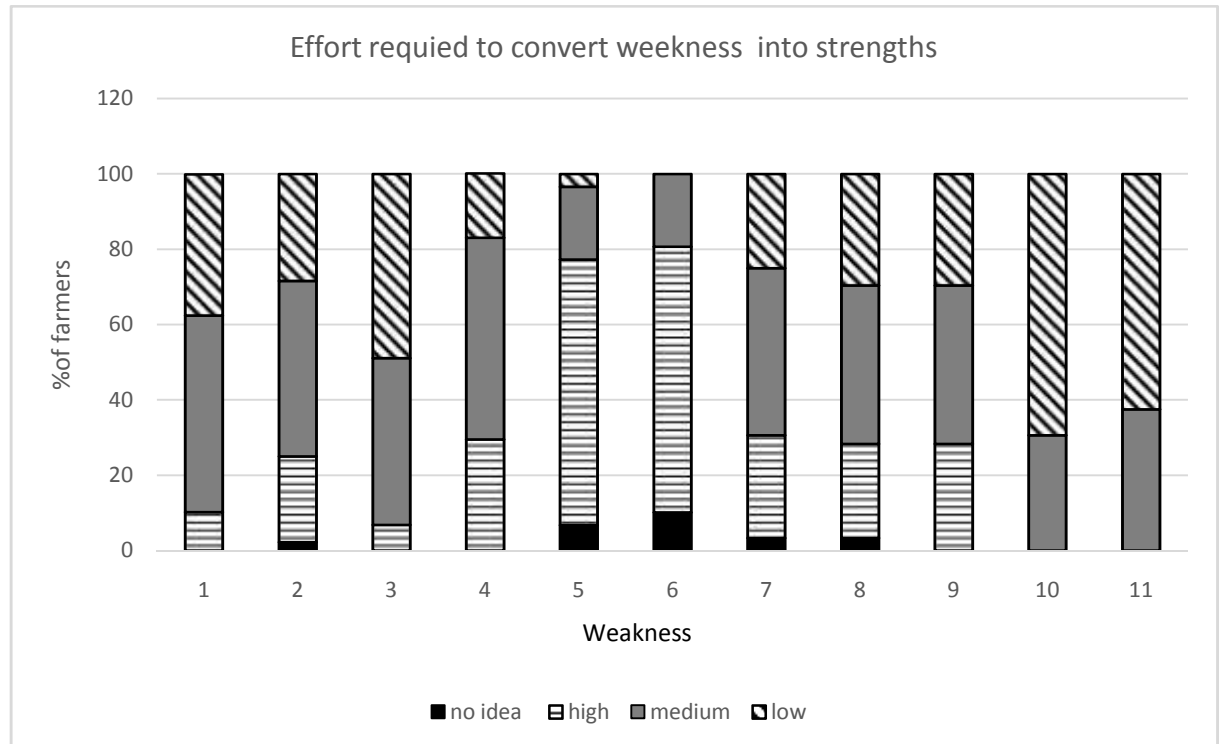
3.7 Weaknesses analysis

Figure 16 shows that most of the farmers (70.48%) thought weakness like gender issue and connected water bodies require high effort to convert into strengths. Weaknesses like Lack of reliance, illegal activities and timely production required low effort to convert into strength according to 69.31%, 62.5% and 48.86% of the farmers respectively. All the other type of weaknesses required medium effort according to the farmers.46.59%, 44.31%, 53.56%, 44.31% and 42.04% of the farmers think medium efforts is needed to convert weaknesses like Zonation and crop calendar, lack of timely production, less attention on power source, government priority on production without considering effect on natural resource and emotion based decisions respectively.

Weaknesses requiring low effort can be converted into strengths through collective interventions of DoF and Community associations. For example, the zonal crop calendar can be effectively planned by focusing on zonal boundaries and making regular updates like Srilanka, Thailand. For this at first a clear zonation for shrimp farming should be done. In shrimp policy, section 5.8, it is mentioned that land zoning will be done. Government priority on produce volumes with no consideration for protection of social-ecological systems can be addressed through a policy change. Three weakness can easily be converted. Lack of timely production, lack of reliance on PL source and members illegal activity fall under this category.

Based on Table 5, the level of effort needed from the existing management system to convert its weaknesses into strengths is medium in most cases .Government's production

focus is due to the budgetary allocation, which is tied to annual shrimp production and annual export amounts. There is a timely need for revising this indicator to include long-term environmental sustainability aspects. Lack of timely production can be addressed by improving coordination among sector stakeholders. To improve production, shrimp aquaculture management structure should ensure participation of all stakeholders.



1. Lack of coordination and information gap about registration
2. No Zonal system and zonal crop calendar system
3. Lack of timely production
4. Less government attention on the use of power sources
5. Gender issue is neglected in the sector
6. Connected nature of the common water body
7. Increase production is the main priority of Government with a minimum/no effort on protecting environment and natural resources
8. Decisions made in community-level associations are driven by emotions
9. Lack of expertise and poor infrastructure
10. Lack of reliance on seed of hatchery
11. Members are associated with illegal activities

Fig.16. Feedback taken from the farmers on weakness

Table 6: Categorization of weaknesses

Weakness	Level of effort required to convert into strengths
Lack of timely production to satisfy market demand	Low
Lack of reliance on seed of hatchery	
Members are associated with illegal activities	
Lack of coordination and information gap about registration and poorly managed institution	Medium
Decisions made in community level associations are driven by emotions	
Less government attention on the use of power source	
Government priority on production without considering effect on natural resource	
No Zonal system and zonal crop calendar system	
Lack of expertise and poor infrastructure	
Connected nature of the common water body	High
Lack of gender balance	

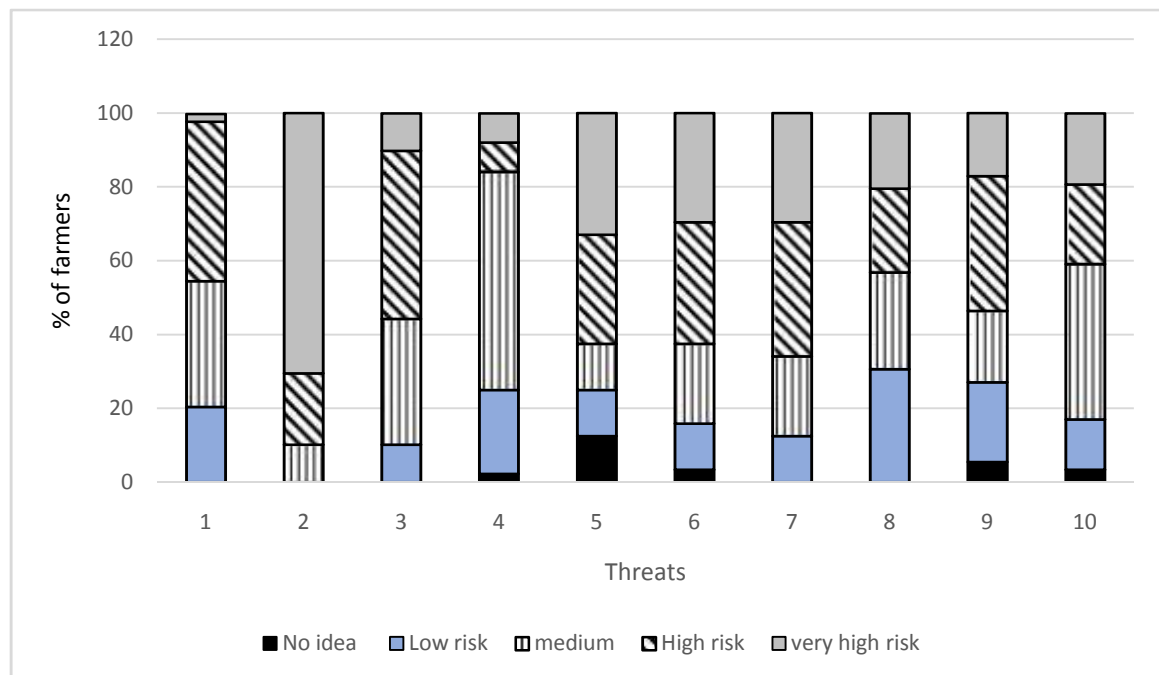
Weaknesses falling under the medium level require a considerable effort and time to be converted into strengths. Institutional structure and coordination among organizing bodies needs to be strong enough to deploy more resources. Emotion-based decisions at the community level seem to be easily dealt with but in real sense it is not so easy. Emotion-based decision making embedded features in most Bangladeshi rural communities. Hence, it is relatively difficult to address.

Longer time and a high level of effort are needed to convert weaknesses falling under the third category. In some cases, such weaknesses can only be partially addressed and converted. For example, only the issues related to interconnectivity of the water body can be addressed, but the water body itself will remain connected. A solution for this problem may not be found within the shrimp farming governance system; rather, this is a national-level concern. Lack of gender balance is a serious problem in our country.

Researcher found no farmers which is a very negative sign. National level policy enforcement and community level awareness is needed to convert this weakness.

Based on the above analysis, overall, most of the weaknesses can realistically be converted into strengths. This implies that the existing community-based management system is viable in the long run.

3.8 Threats analysis



1. Lack of price bargaining power to farmers
2. Impacts of global climate changes and natural disaster
3. Creating an onerous working environment By Political influences
4. Less research activities
5. Regional instability influencing sector decision making
6. Impact of inflation
7. Malpractices by businessman
8. Lack of financial cooperation
9. Weak product quality in comparisons with new rules by exporters.
10. Unpleasant position of the sector due to past experiences and some adverse impacts.

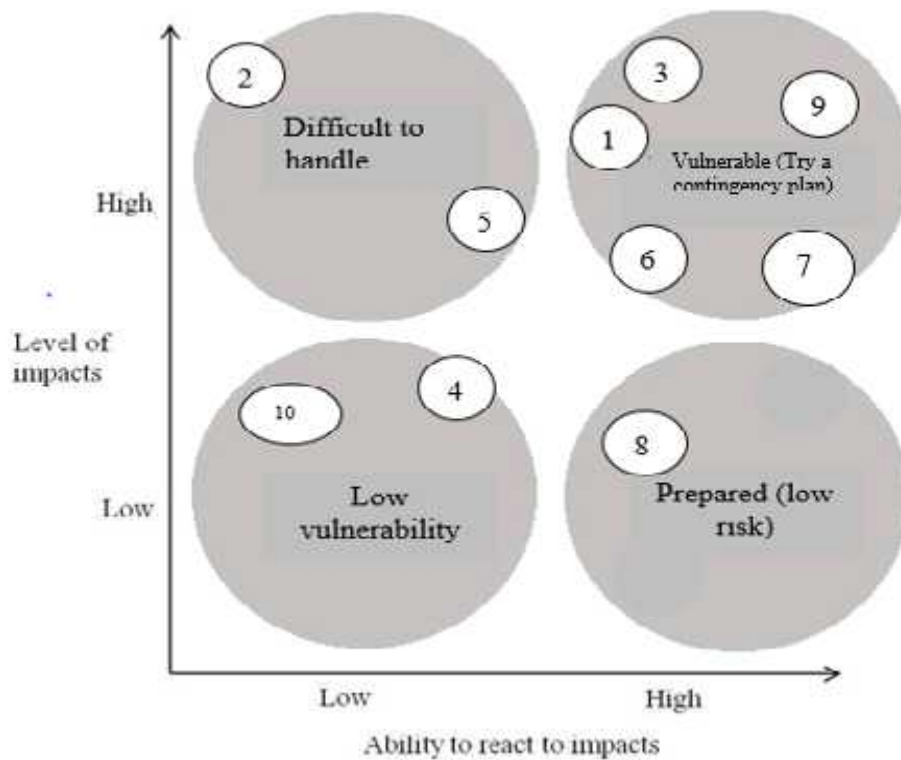
Fig.17.Feedback taken from the farmers on threats

Figure 17 shows that 70.48% farmers had identified climate change and 32% identified Regional political instability is very high risk. About Lack of financial cooperation, 30.6% thought as low while 20.4% think as very high risk. Lack of price bargaining power and Local political influences were identified as High risk by 43.18% and 45.4 %

respectively. Nearly 36.36% identified introduction of new rules by exporter and malpractices by businessman as high risk.

Threats are not within the purview of control of the shrimp sector governance system because it is originated in the external environment. Figure 18 analyzes the threats identified in SWOT analysis. Two axes/variables of the graph are: level of impact from a threat and ability of the internal environment to react to the impact. Accordingly, four quadrants can be identified in the matrix/graph. If both the impact and ability to react are low, then the system becomes less vulnerable to such threats. If impact is low and ability to react is high, then the risk is low and the system can prepare in advance for such threats. An area with a high level of impact and an ability to react is a vulnerable area. To address such threats, the system needs to develop a contingency plan. If the impact from a threat is high and the ability to react is low, then it is a high-risk situation and it is difficult to handle. In this case, there is nothing that the system can do to make a difference.

Identified threats were positioned in the matrix in Figure 18. A low level of impact from a threat with a low level of ability to react creates a less vulnerable situation. However, lack of financial cooperation fall in this category. A low impact with a high level of ability to react brings low risk and the system can prepare to face such threats. Financial cooperation is such a threat and it can be addressed by systematically planning for distribution of aid and loan at low interest. A low impact with a low ability to react is less vulnerable. Lack of research, bad reputations or unpleasant position due to historical experience of commercial-based shrimp farming fall under this section. Research studies on the shrimp farming sector associated with community based management and sustainable development is a timely need. Improving awareness among others on community based culture initiating research studies in collaboration with academia and government institutions, like BFRI, seem to be a good approach to address the bad reputation (due to impacts caused by commercial-based shrimp farming on socio-ecological systems).



1. Lack of price bargaining power to farmers
2. Impacts of global climate changes and natural disaster
3. Creating an onerous working environment By Political influences
4. Less research activities
5. Regional instability influencing sector decision making
6. Impact of inflation
7. Malpractices by businessman
8. Lack of financial cooperation
9. Weak product quality in comparisons with new rules by exporters.
10. Unpleasant position of the sector due to past experiences and some adverse impacts.

Fig.18. Matrix for threat analysis (adopted from Johnson *et al.*, 2008)

Most of the identified threats fall in the category of high impact with a high ability to react. These are: creating burdensome working environment due to political interference in local contexts; lack of power for farmers to bargain for prices, Malpractices by businessman, the update rules and regulations by export countries, Inflation rate. In Bangladesh it is difficult to independently continue farming operations due to the nature of the country's political behavior. Political leaders intervene at the macro-level policy making process as well as in micro-level policy enforcement efforts. The o way to address this situation seems to be strategically handling political influences by

establishing/maintaining a good relationship with political leaders on an individual/collective basis through the community associations. If community relationship is strong, it can be handled. Moreover, collective bargaining power to farmers can be created through community associations. Malpractice like adulteration can be controlled by enforcing law. The awareness of the processing industry would be more effective in that case. Our country is trying to maintain a good monetary policy to control inflation.

Political and economic instability of South Asian region can be identified as a threat that has a high impact with a low level of system's ability to react. Political instability affects current funding programs. Other threats of this nature are the country's economic inflation and global climate change. These threats are very difficult to make an influence on.

The analysis of threat shows that there are some threats which can be converted. There are many threats but the reaction of studied system is high.

3.9 Feasibility of community-based culture

SWOT analysis provides a sound understanding of the environment within which the existing governance system operates. Based on the SWOT analysis, there is a long list of strengths and a few attractive opportunities to materialize on. Based on the above detailed analyses on weaknesses and threats, it seems that most of them have the potential to be converted into strengths or opportunities. Therefore, overall, the current community based shrimp culture governance system in southwestern Bangladesh is rare but viable in the long run. Moreover, this governance system is socially acceptable due to its community-based and environment friendly nature.

3.10 Pick out tactical direction

To pickup a tactical direction, the two major variables determining current and future positions of the sector are: level of impact on natural resources and level of dependency on community associations.

Identifying Tactical direction means to find out where the sector wants to be in the long run. In this journey, the main focus of attention should be on the sustainability of social-ecological systems within which farming operations are carried out. Based on study

findings, it is apparent that community-based operations are capable of controlling social-ecological impact .Tactical direction of the sector should be based on sustainability of social-ecological systems, in order to continue farming operations in a community-based setting.

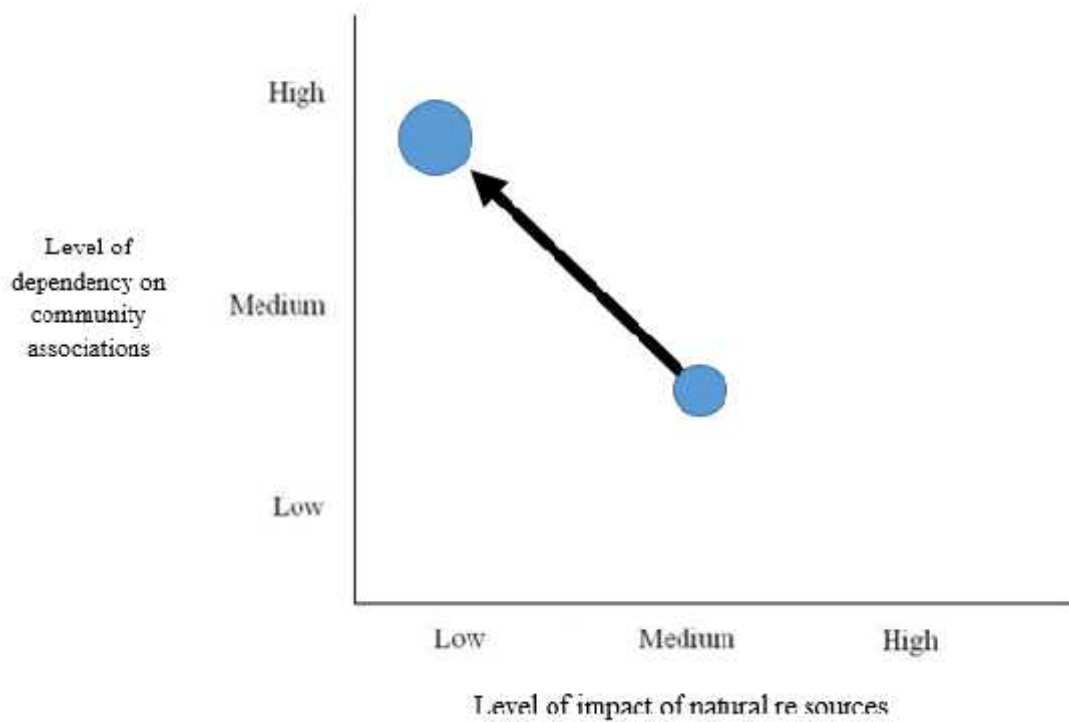


Fig.19.Tactical direction based on sustainability of social-ecological systems (adopted from Galappaththi, 2013)

Figure 19 is based on these two variables. The horizontal (x) axis represent Level of impact on natural resources,the vertical (y) axis represents the level of dependency on community associations. Both axes of the matrix are divided into three levels: low, medium, and high. Based on study findings and the researcher’s contextual understanding, there are nine possible areas where shrimp farming can be placed.

In terms of dependency on community associations, the four studied communities can be placed at in between low and medium position. Strengths like Multi institutional structure, Collectivism in decision making as well as weakness like emotion based decision and association with illegal activities are taken into consideration to fix up the

position in the graph. Its direction is decided with the consideration that it has a potential for further improving its role. Based on the four sampled communities, it can be said that community associations have evolved a lot by making farmers more dependent on them. However, there is potential for further improving the role of community associations. There are space to make themselves as price maker in supply chain, improve bargaining power in seed and feed buying. Contribute to the national level shrimp policy

The position of the Level of impacts on natural resources can be identified as medium. It is based on the system practiced by the community associations. Common natural water body including river and the canal system; wetlands; mangrove forest etc. are main natural resources directly affected by shrimp farming. When farming was geographically spreading, there was a huge impact on coastal ecosystems, agricultural ecosystems, mangroves, government-owned lands and areas, due to construction of shrimp farms. At that time, there were relatively large-scale commercial operations running in full capacity throughout the year. Even by cutting the local barrage of BWDB (Bangladesh Water Development Board) local influential persons did culture. Such operations consumed a large amount of water from the common water body while releasing waste water back, making it difficult for the natural ecosystem to absorb the waste. By doing these activities the south part of that area became a Salt desert. The present position is considered as medium because of the current situation is changing as only small-scale shrimp farms remain in the southwestern area. By contrast, community-based aquaculture farmers do not have the option of relocating. They cannot afford to act in unsustainable ways, as they are part of the local social-ecological system, and they have been living in these communities for a long time. Therefore, by design, community based culture has built-in incentives to be sustainable. So the Level of impacts on natural resources can be identified as medium.

The desired future position of the sector should be in the left hand side upper part of the matrix (Figure 19). In order to do this, dependency on community associations need to be further increased. The sector should be in a better position in the future than it is today. Based on the matrix, there is enough possibility that the impact on natural resources should be further reduced, if community based management can be encouraged properly.

CHAPTER 4: CONCLUSIONS

The main characteristics of the studied shrimp culture governance system are community-based institutions and collaborative approach. Community people and associated groups have specific roles and responsibilities in managing shrimp aquaculture resources. The participatory collaborative decision making body DoF, through fisheries office at Upozella or districts level, plays a significant role in the decision making structure.

Among the four communities each have different types of strengths and weakness. Community A and B were more or less similar in function and resource management. Community C had many experienced farmers, most of the farmers are having more than 15 years of experience (60%) with nearly 96% of which having education more than primary stages. They had comparatively strong influence on supply chain and decision making. The majority (38.64%) of the shrimp farmers used own lands while 37.49% of farmers used their state owned lands.. A great threatening findings is all the farmers of four communities are male (100%). But Community B is working on gender issues associated with women empowerment and to shorten the supply chain and trying to convert farmer from price taker to price maker.

In community B and C decisions made by individual farmers are operational in nature. They can do operational activity collectively like community B and C. Most of the farmers thought weaknesses like 'gender issue' and 'connected water body' require high effort to convert into strengths .46.59%, 44.31%, 53.56%, 44.31% and 42.04% of the farmers thought 'medium efforts' is needed to convert weaknesses like Zonation and crop calendar, lack of timely production, less attention on power source, government priority on production without considering effect on natural resource and emotion based decisions respectively.70.48% of the farmers had identified climate change as very high risk . Lack of price bargaining power and Local political influences were identified as High risk by 43.18 and 45.4 % respectively. Nearly 36.36% identified introduction of new rules by exporter and and malpractices by businessman as high risk

Based on the SWOT analysis, the current community-based aquaculture governance system can be considered to be viable in the long run. According to the feedback of the farmers most of the weaknesses need medium level of efforts and can realistically be converted into strengths. Most of the threats are high but there are possible contingency plan to change it into opportunities. Tactical direction was identified by considering the sustainability of social-ecological systems within which shrimp farming is done as a community-based operation. The current position of the sector has a medium level of impact on natural resources with a medium level of dependency on community associations. The desired future position of the sector should have a low level of impact on natural resources. This can be achieved with a high level of dependency on community associations.

The result would be more relevant if directive or semi directive interview was conducted. If the comparative data of production between community based culture and commercial culture were managed to gather it would reveal another view.

This study suggests that the community based governance system is acceptable, to a greater extent. Overall, the current community based shrimp culture governance system in southwestern Bangladesh is rare but viable in the long run. Therefore, community-based operation can be widely introduced as an alternative to large-scale operation for country like Bangladesh.

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APPENDICES

Appendix A: Questionnaire Structured questionnaire

General questions for demographic and farming related information

Case no.....

Date and time of inspection:

.....

Location: Union.....District.....

Are you a member of a cooperative/Samity? Yes /No

If yes, the name of the cooperative

.....

Age range (Years):

- <30
- 30-40
- 40-50
- 50-60
- >60

How long have been in the shrimp farming (years):

- <2
- 2-5
- 5-10
- 20-15
- >15

Education level:

- Cannot read and write
- Less than primary (class 8)
- Less than ssc

- Ssc pass
- Hsc pass
- Graduate

Do you a personal contact number ? Yes /No

Gender: Male/Female

Number of ponds operated:

Unit area (Acres)	Number	Total area
<0.5		
0.5-1		
1-1.5		
1.5-2		
>2		

Ownership

- Owner Farmer
- Taken rent
- Government land(lease)

Tpes of Business

- Individual
- Family-owned
- Partnership

- Private limited

Type of culture

- Salt-shrimp
- Shrimp-paddy
- Shrimp-fish

Fry source:

- Natural
- Hatchery produced
- Natural and hatchery produced

Are there any family members involved in the business: yes/no?

If yes, numbers:

- Wife
- Son
- Daughter
- Others

How (if yes):

- Labour
- Bookkeeping
- Managing
- Selling
- Investing
- Other

After founding the result of SWOT analysis feedback are taken from the individual farmer:

Weakness

- No idea
- Low
- Medium
- High

Threats

- No idea
- Low
- Medium
- High risk
- Very high risk

General Questions about the community associations (samity)

Questions for key informant interviews (To the members of EC of the community)

- What is the official name of the community association(samity) associated with shrimp culture ?
- Where are they located?
- How many farmers the members of the association?
- When was it established?
- Is it associated with other organization? What are they?
- How was the association established? Who took the initiative?
- Is it registered? If yes, where is it registered?
- Year of registration? Registration no?
- How is the organizational structure?
- Does the samity have bank accounts?
- Does the samity have rubber stamps?
- When does the samity call up meetings??
Weekly/Biweekly/Monthly/Bimonthly/Yearly/Special

- How is the accountability in place and practiced? Compliance to rules?
- What decisions are taken by the samity?
- What is the process for decision-making in cooperative level? How strong is the member-cooperative relationship?
- Who make the rules? Who has the responsibility of monitoring?
- What type of farming related decisions/ common resource management decisions are taken by the community?

Questions discussed on focus group discussions (also asked for key informant interviews)

- What are the strengths attached to the existing cooperative governance system?
- What are the weakness attached to the existing cooperative governance system?
- What are the opportunities attached to the existing cooperative governance system?
- What are the threats attached to the existing cooperative governance system?
- Do u think this weakness can be converted to strengths? possible, how much effort is required to convert into strengths?(very high/High/medium/low)
- What are the challenges faced by the community institutions and how have they been dealt with?How they react to the external threats?

Appendix B :Pictures captured during field work



Plate 1:Shrim farm area of community C (Jolma).



Plate 2: Interviewing a EC member from shrimp community association at community C (*jolma*)



Plate 3: Special meeting on NGO members at Debhata Solidaridad office. (Participant observation)



Plate 4: Lead farmer associated sale office at Debhata, Satkhira.