Progressive Agriculture 28 (2): 156-166, 2017 **ISSN: 1017 - 8139**

Progressive Agriculture
Journal homepage:http://www.banglajol.info/index.php/PA

Strength and weakness of existing traceability system of seafood production in Bangladesh

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Abstract

Gher farming with shrimp and prawn (seafood) is blooming in the south-west region of Bangladesh, impacting positively on household level nutritional security, employment generation and foreign currency earning. Such positive impacts increased the importance of seafood production and trade to the international market from Bangladesh. Out of several food safety requirement of international market, seafood traceability is a key issue for Bangladeshi producers. To develop a traceability system about 200,000 *gher* farmers were registered by DoF with the support of UNIDO project and a paper based traceability system was developed since 2009. This study was designed to understand existing traceability system, trend of *gher* ownership changes and its impact on the traceability in term of its strength and weakness. Three *gher* farming clusters in three upazilas of Bagerhat district were selected to carry out this study to assess the facts above using focus group discussion, key informant interview, questionnaire survey, physical observation, and literature review. The micro-level observation on the *gher* and its ownership changes were critically analyzed taking the Google Earth images from the farming cluster in the selected upazilas. The study revealed that *gher* farming has huge positive impacts on total farm productivity, income, and farmers' well-being however, land ownership changes impacting negatively on existing traceability of farms. It was found that out of 167 *ghers* in three clusters, a massive change of *gher* ownership happened over the last 10 years. Under this situation existing traceability system cannot sustain for a long time. Therefore, land administration system should be brought under digital system and e-traceability needs to be implemented by the collaborative initiative of the Department of Fisheries and the Ministry of Land.

Key words: Seafood, traceability, *gher*, shrimp, *Penaeus monodon,* prawn, *Macrobrachium rosenbergii,* Bangladesh

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Introduction

Seafood is the commercial term used internationally to denote all the aquatic products including cultured and captured finfish, shellfish and other aquatic edible animals and plants. Shrimp and prawn as seafood are mainly cultured in the south-western part of Bangladesh. Shrimp and prawn culture is very popular in south-western region of Bangladesh because of its market demand and suitability to culture with other commercially important species. Thousands of farmers have converted their paddy fields to farms locally called *gher*s to accommodate a profitable shrimp culture practice (William, 2003).

Shrimp and prawn have a great role in the economy of Bangladesh. Bangladesh is earning a lot of foreign

exchange by exporting them. According to the latest statistics, shrimp and prawn alone contributed 90% of seafood export earning by exporting 43,953 MT frozen shrimp and prawn (DoF, 2014). There is a noticeable increase in export market price of shrimp particularly in USA and European countries.

Prawns and shrimps are mainly exported to EU (45%), followed by USA (35%), and Japan (4%). This increasing trend of foreign currency earning shows the importance of seafood production and trade from Bangladesh to the international markets in terms of various social, environmental and economic issues for the producers. The importing countries (e.g. EU countries) are increasingly requiring to improve the seafood production and trade traceability system. That is why food safety and traceability are important issues for Bangladeshi producers.

According to EC (2007) traceability means the ability to track any food, feed, food- producing animal or substances that will be used for consumption, through all stages of production, processing and distribution. For implementing traceability system the Department of Fisheries (DoF), Bangladesh with the support of UNIDO project between 2006-2009, has registered about 2,07,000 shrimp and prawn farms under traceability plan. Registration form includes information about farmers name, area code, location of farm (District, Upazila, Union, Mouza), registration number of farm. There was no information about ownership (own land, leased land or mortgage) in the traceability system.

The current traceability system has the numeric code consisting of Division, istrict, Upazila, Union, Mouza, *gher* number following the name of farmers. As for example, the traceability system is used as 88-468-09-05-30-71 (Country, District, Upazila, Union, Mouza, pond number) where the basic unit is pond number. The pond number is actually not realistic and there are a lot of ponds in a village. It is difficult to identify which one is the pond number 7. Moreover, ownership of ponds can be changed, ponds can be divided into two or multiple shares, it can be converted to rice field or vice versa or used for other purpose and different physical changes can be happened. The land ownership in Bangladesh is very fragile which is being changed in various ways with in the family tree. This due to the fragmentation of land after death of family head and ownership of land is taken by the following generation. In some cases, temporary land ownership including leased in, lease-out, mortgage systems could negatively affect the land ownership and traceability systems in Bangladesh. Under this situation, this was the main interest of the present study to look into the trend of changing *gher* ownership, its impact on traceability system and reality how the existing traceability system would sustain.

Materials and Methods

***Description of the study area*:** The study was conducted in three upazilas of Bagerhat district of Bangladesh (Figure 1). This study site was considered because it is one of the most important shrimp and prawn farming areas of south-west region. This district covers about 30% of the shrimp and prawn producing land of the country. There are nine upazilas in Bagerhat district. The study was conducted in Badukhali under Bagerhat Sadar upazila, Kumarkhali under Fakirhat Upazila, and Alipur under Kachua Upazila. All of these three villages are about 1 hour drive from Bagerhat Sadar.

Community selection: This research interest was to address the changes of traceability of farms. The farmers of these communities were already registered by the UNIDO project and the area was well accessed to do the field work in terms of road communication, farmer participation and local support from Shrimp Research Station, Bagerhat which is a new station of Bangladesh Fisheries Research Institute (BFRI). Community selection was done under the following criteria (Table 1). Out of three communities, the culture system of Alipur and Badukhali were more or less equal. But the scenario was little bit different in Kumarkhali village. It is a low land area and for

freshwater logging, bagda production was found very less. In all of these three villages they could not grow monsoon rice because of high water level but they grow *boro* (irrigated dry season rice) rice.

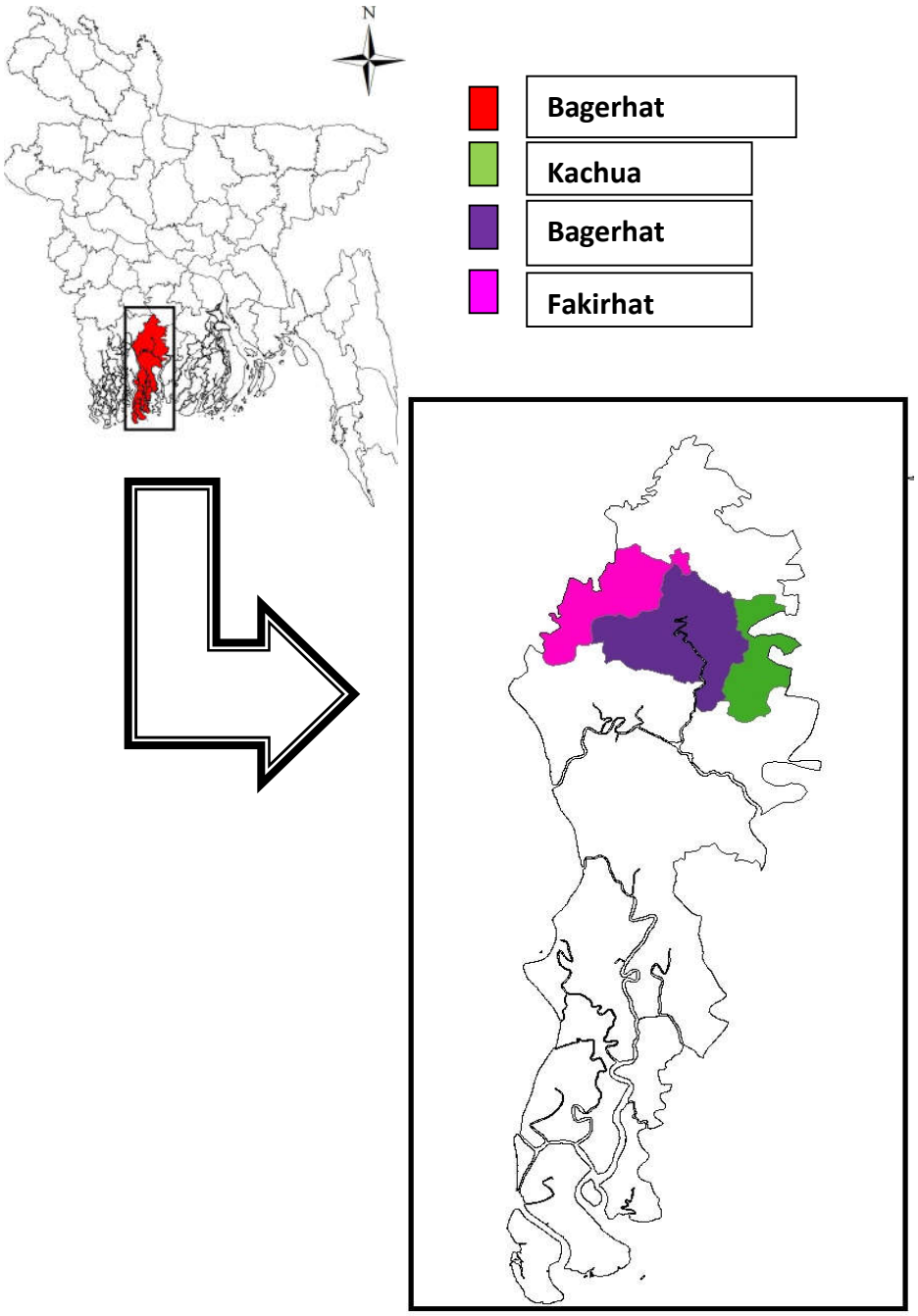

Figure 1. Map of Bangladesh showing the position of Bagerhat district

Cluster selection: Cluster selection was done by using Google Earth software (Figure 2).

Figure 2. Cluster selection by using Google Earth image.

A cluster of about 50 *gher*s from all of these 3 villages were selected for the study. Historical photos of the same cluster of *gher*s were also taken by using the same software to compare the physical changes with time. From the cluster, the *gher*s were individually numbered and the owners were identified. Then detail investigation was done to assess the change of *gher* ownership over the last 10 years.

***Data collection*:** Data were collected by focus group discussion, key informant interview (n=6), questionnaire survey (40), physical observation, and literature review.

Table 1. Community selection criteria for the proposed study

Community	Location	GPS coordinates	Farming type
Alipur	Kachua upazila	22.746223°N; 89.842974°E	* Bagda, golda and carp polyculture * Dyke cropping for horticulture * Rice production during *boro*
Kumarkali	Fakirhat upazila,	22.6856 °N; 89.5959 °E	* Golda and carps polyculture * Dyke cropping for horitculture * Rice production during *boro* * Low land and, freshwater logging, lack saline water, poor scope of bagda culture and poor productivity
Badukhali	Bagerhat Sadar upazila	22.697971 °N; 89.746896 °E	* Bagda, golda and carp polyculture * Dyke cropping for horticulture * Rice production during *boro*

The collected data were also crosschecked by people of local NGOs working in the area and government officials. Data related to *gher* size, type of ownership, change of ownership were collected. Shrimp and prawn farming household well-being ranking was carried out in the time-scale of 10 years before and after with the participation of key informants.

***Primary data source*:** The primary data were assembled through field survey at the village level by using a structured questionnaire. The data were collected by both physical observation and interview with *gher* farmers at household, field and market level.

***Secondary data source*:** Further relevant information were collected from books, thesis papers, journals, government officials like District and Upazila Fisheries Officer, school teacher, local leader like Union Parishad member and chairman, doctors of union health complex, and local surveyors for land related information.

***Data analysis*:** Collected information obtained from the survey was accumulated, grouped and interpreted according to the objective. They were entered into MS Excel spreadsheet and analyzed following the requirements of the objectives.

Results

Traceability of shrimp and prawn farms

***Traceability framework*:** In corporation with DoF, the UNIDO project developed traceability framework and introduced a complete traceability system in shrimp farming areas since 2009. About 207,000 prawn and shrimp farms were registered on the basis of area coding under the traceability scheme (Figure 3). In this current traceability system, farm code number is the root of the chain of custody of the product for the consumers in the importing countries.

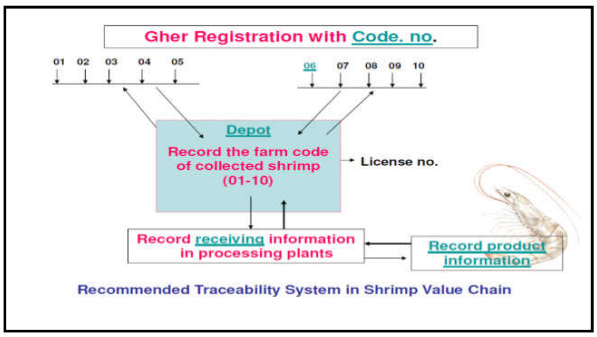

Figure 3. Layout of traceability system in shrimp value chain designed by DoF.

***Farm registration form*:** In the farm registration form, the information includes area code, registration number of farm, location of farm (District, Upazila, Union and Mouza), name of owner/farmer, telephone/mobile no., nearby ice factory and farm information (no of pond, size of the pond in ha and farming practices) (Figure 4).

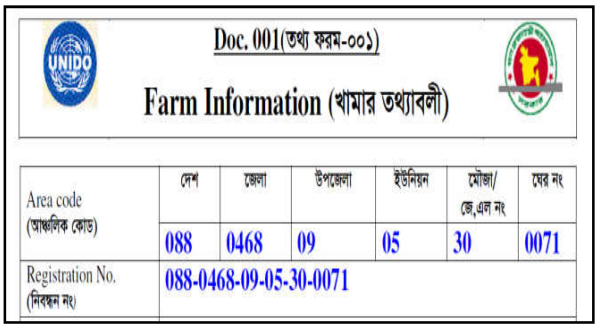

Figure 4. Farm registration form given by DoF as a proof of traceability to the farmers.

By using this area code, it can be traced back up to the Mouza level. In Bangladesh and Pakistan, a Mouza or Mauza is a type of administrative area, corresponding to a specific land area within which there may be one or more settlements. Before the 20th century, the term referred to a revenue collection unit in a pargana or revenue district. As populations increased and villages became more common and developed, the concept of the Mouza declined in importance. Currently, it has become mostly synonymous with the *gram* or village. Most censuses and voter lists, for example, now use the names of villages rather than Mouzas. However, it is quite difficult to find out a *gher* from a village numbered as 71 as the number of *gher*s is very high. Depending on this code number, it is difficult to find out a particular *gher* when there is no information about ownerships either it is own, leased or mortgaged land.

Conversion trend of rice fields into *ghers*

***Conversion by year*:** Almost all interviewed farmers confirmed that they converted their rice field into *gher* for freshwater prawn cultivation because it is more profitable than that of rice cultivation. The study was done in 167 *gher*s of those three villages. All those *gher*s were individually numbered and owners were identified. Then they provided information about conversion, ownership change and culture techniques. Out of 167 *gher*s, most of them were converted from rice fields to *gher*s over last 10 years. However, the massive conversion period was between 2000 to 2006. In Alipur, most of the rice plots were converted to *gher* in 2005. The change in the conversion of rice field into *gher* in 2010 after registration in 2009 indicates the weakness on the accuracy of traceability system (Table 2).

***Spatial pattern of rice fields converted into ghers*:** In all three villages, the massive conversion of rice field into *gher* was very recent. Before *gher* farming they used their land only for rice cultivation. But farmers experienced *gher* farming more profitable than rice production because they got rice, fish, prawn and

vegetables from same land. Moreover, there was a continuity of satisfactory income over the year. This was the main reason for which people converted their rice fields into *gher*.

Table 2. *Gher* conversion trend into rice fields in the study villages

Year	Study villages			
	Alipur	Badukhali	Kumarkhali	Grand total
1993			2	2
1994			2	2
1996			1	1
1997			1	1
1998			3	3
1999			2	2
2000		1		1
2001			3	3
2002		3	1	4
2003		8	5	13
2004		11	16	27
2005	61	13		74
2006		16	7	23
2007			1	1
2008			2	2
2009			1	1
2010			3	3
Fish pond			2	2
No use			2	2
Grand total	**61**	**52**	**54**	**167**

In few cases, farmers converted their rice field into *gher* because other farmers around their land converted into *gher* as well. This type of conversion by the neighbors was due to the problems in rice field irrigation. From the historical image taken from Google Earth, the conversion of rice field into *gher* was found very clear. The massive conversion of rice field into *gher* occurred during the last 10 years (Figure 5).

In Alipir, most of the land converted from rice field into *gher* during 2005. Farmers of Aliupur confirmed that they learn this technique of *gher* farming from other place outside of the village.

Socio-economic characters of the *gher* farmers contributed to traceability

***Well-being status*:** About 10 years ago most of the farmers were poor and in lower middle class in three study villages. Only one farmer among 96 was rich and some of them were in upper middle class (Table 3).

Table 3. Well-being status of the *gher* farmers 10 years ago

Community	Rich	Upper middle class	Lower middle class	Poor	Grand total
Alipur	1	4	8	28	41
Badukhali		3	9	15	27
Kumarkhali		1	13	14	28
Grand Total	**1**	**8**	**30**	**57**	**96**

After 10 years (during the study in 2014) the frequency distribution of rich and upper middle class farmers has been increased to a greater extent (Table 4).

Table 4. Well-being status of *gher* farmers after 10 years

Community	Rich	Upper middle class	Lower middle class	Poor	Grand total
Alipur	15	10	9	7	41
Badukhali	5	13	9		27
Kumarkhali		8	10	10	28
Grand Total	**20**	**31**	**28**	**17**	**96**

This reflects the impact of integrated *gher* farming in these three villages which influenced the changes of land ownership and farming practices. In addition to *gher* farming, some farmers were found engaged in small business. Some farmers had additional earning from cattle, poultry, betel leaf, nut, and trees. The sort

of positive changes in well-being status of *gher* farmers contributed to purchase new lands, and the traceability systems negatively.

Badukhali 2003

Badukhali 2013

Kumarkhali 2005

Kumarkhali 2009

Alipur 2003

Alipur 2009

Figure 5. Historical Google Earth image showing massive conversion of rice field into *gher*.

***Land ownership*:** Most of the *gher* farmers (64.14%) had their own farms in Kumarkhali but in Badukhali and Alipur (28.33%), most of the farmers were found to have leased-in land (Figure 6). In Kumarkhali, shrimp production was found very poor but in Alipur, farmers cultured both shrimp and prawn. The potential of double crops of shrimp and prawn farming in Alipur makes a big difference in the leasing cost of *gher* farming. Due to low leasing price, farmers in Kumarkhali are not interested in leasing out their land. Although the leasing cost was high in Alipur, farmers were tended to lease-in land for the potential of the profitable investment in shrimp and prawn farming (Figure 6).

***Changes of gher ownership*:** Out of 167 *gher*s identified from Google Earth Image, it was found the massive changes of *gher* ownership over the last 10 years. In all three villages, most of the land ownership

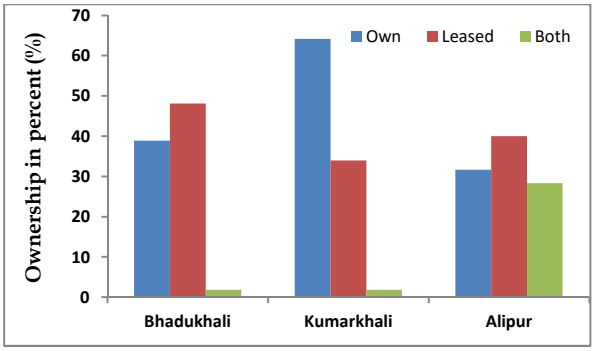

Figure 6. Ownership patterns (%) of *gher*s in the study area.

changes occurred one and two times over the last 10 year. Some of the *gher* ownerships changed three times and even four times in that period (Table 5).

Table 5. Frequency distribution of changes in *gher* tenure over the last 10 year

Community	No change of ownership	1 time	2 times	3 times	4 times	Grand Total
Alipur	46	12	3			61
Badukhali	30		20	2		52
Kumarkhali	32	4	8	7	3	54
Grand Total	**108**	**16**	**31**	**9**	**3**	**167**

Owners leased out their *gher*s at the rate of BDT. 71,500/ha/year in Badukhali and the maximum period of leasing land was found for three years. Most of the rich farmers leased out their *gher* because they are not interested to operate *gher*s because of lack of household labor. Most of the upper middle class and lower middleclass households were found to lease out their *gher*s. This sort of changes in land tenure was identified as one of the main threatening factors to the traceability system.

Discussion

Gher farming has capacious impacts on the economic status of the farmers. There is a regular flow of income through *gher* farming. They can produce both rice and vegetables along with fish and shrimp. Moreover, it made possible to involve the female members of the family in *gher* farming. Ahmed *et al.* (2010) stated that women are also involved in feeding of prawns, dyke cropping, farm supervision, prawn harvesting and post harvesting handling. In the present study it was found that all the farmers indicated that they were able to improve their socio-economic status after being involved in the *gher* farming. That is why *gher* farming is becoming very popular instead of rice cultivation in the south-west Bangladesh.

These above indicate that the *gher* farming has huge positive impacts on the income and food security of the local community. Apart from this, it has direct relationship with the international trade. The European countries, USA and Japan are the main importers of the shrimp and prawn being produced in *gher* (Uddin, 2008). Importing countries are increasingly asking to improve seafood production and trade traceability system to ensure food safety. Accordingly the increasing importance of *gher* farming emphasized the significance of traceability system in Bangladesh.

Traceability is very closely related with food safety. Monterio *et al.* (2008) investigated traceability in the context of food safety. They mentioned traceability as a food safety risk management tool. Food must be free from pathogenic bacteria, prohibited antibiotics (nitrofurans and chloramphenicol) and other hazardous chemicals: pesticides, heavy metals, hormones, histacin, and of course filth and darts etc. The requirement of the consumers in the importing countries is to know where the product comes from.

The standard requirement of quality of and safety issue of the EU countries are based on bacteriological quality, contaminants, residues, additives and traceability. EU rejected many shrimp consignments from Bangladesh for the presence of banded nitrofuran and other hazardous chemical. Islam (2010) stated that during the period of 2005 to 2009 about 100 shipments of frozen shrimp product exported from Bangladesh were rejected by EU which causes a loss of about US$ 500 million.

When something has gone wrong it needs to find who is responsible to avoid the same mistake. That was a

great threat to the economy of Bangladesh in terms of exports earning. About one million people are employed in this sector for full time and another 6 million for part-time. This incidence seriously affected the image of Bangladesh frozen food and threatened international export market.

To ensure continuous access to export markets for Bangladesh seafood and in particular to EU (EC Regulation N 178/2002), Bangladesh needed a proven traceability system. It is particularly difficult in Bangladesh and other exporting countries, due to the large number of very small suppliers and a complex and irregular system of intermediaries.

A paper based traceability was developed by FIQC/DoF and BFFEA, BQSP/UNIDO project and a complete traceability system was introduced since 2009. They registered about 200,000 shrimp and prawn farms under traceability plan. With the active participation of DoF, BFFEA formulated area coding followed by District code, Upazila code, Mouza and finally individual farm. During the study period, it was observed that some farmers sell only a few pieces of shrimp. When all the shrimps mixed together in depot it is almost impossible to find out from which farm they come from. According to Datta *et al*. (2011), the small and fragmented farmers sell various amounts of shrimp to the local landing center (chatal) those impacts on the chain of custody of the products negatively.

Due to the large number of small farmers it is very difficult to achive field level traceability. This is because it is not clear in the *gher* registration form who is what kind of farmer (i.e. own or leased). It is likely to be changed with the change in ownership. So, through the existing traceability system is possible only to trace back till mouza level.

Farmers were converting their rice fields into *gher* in the study area. Number of shrimp and prawn *gher*s are increasing every year. Data collected from the District Fisheries Office, Bagerhat also shows that the number of golda and bagda *gher*s was increasing. This trend was moving slowly from 2008 to 2010. This is perhaps due to the cyclone Sidr (2007) and Aila (2009) affected this area. According to Ito (2004) number of golda and bagda *gher* was found increasing from 1996 to 2002. Historical photos taken by using Google Earth software clearly shows the conversion. Ahmed (2010) reported that farmers started prawn cultivation in low-lying agricultural land and rice fields during early 1990s and during late 1990s they started converting low-lying rice fields into *gher* in Bagerhat.

Lower middle class and poor farmers were dominating in the study villages 10 years ago however, during study period the reversed scenario was found. This impacted to the *gher* farming community positively in terms of social development but negatively loosing the traceability as better-off farmers tended to buy new land with changed ownership which is not instantly registered by DoF. *Gher* ownerships were found to be changed very frequently. Out of 167 plots of *ghers*, about 35% ownerships were changed within 10 years. The main reason of ownership changes was due to increasing trend of lease ownership between original land owners and the farmers. The historical legacy of land acquisition and tenancy has a complex relationship with land ownership in Bangladesh. According to CARE (2003) during 1888 to 1940 a Cadastral Survey was undertaken, and 90,000 cadastral maps were published covering whole Bangladesh. These are still considered as the most reliable cartographic map. After abolishing of *Zamindari* system in 1950, the control of land passed to Revenue Department, which became current Ministry of Land (MoL) subsequently. Later, by East Bengal State Acquisition and Tenancy Act (EBSATA) 1951, farmers got their first right to purchase land and prohibit others to use with a limit of 33.3 acre following a number of changes. Thereby farmer can purchase and sell their land anytime and this change in ownership negatively impacts the traceability system. This is a threat to the current traceability system because *gher* registration was done without mentioning either he is owner or lease holder. Therefore, for

establishment of a sustainable traceability system it is necessary to develop a digital land management system.

Conclusion

Integrated *gher* farming system is blooming in the south-west region of Bangladesh very fast and the crops specially shrimps and prawns have consistently high value in the international market. Integrated *gher* farming system is becoming popular among farmers for its profitability than the traditional farming system. Farmers are getting various types of crops from their land at a time and there is continuity in earning round the year. This has a great positive impact on their socio-economic status of farming households.

This integrated farming system has very high potential to be expanded in other part of Bangladesh meeting the demand of seafood from the international market. The increasing demand of import market about food safety requirement is pressing Bangladeshi producers to comply with several requirements. One of the requirements is to ensure the traceability systems of farms produces from farm to fork. The DoF with the funding support of UNIDO has implemented traceability system but field level traceability was found very challenging. At the field level, it is possible to trace back from consumer to Mouza level. However, upto the farmers level it is not unique having several errors. This was mainly due to the the changing pattern in *gher* ownership over time has which was identified as a big constraint of implementing on the existing traceability system.

To overcome this obstacle, e-traceability system could be adopted based on the cluster approach being used by Organic Shrimp Farming Project in Bangladesh where every pond is registered using GPS system. Considering this e-traceability approach, the following recommendations are suggested:

- Farmers should be provided with training on scientific methods of seafood farming emphasizing the compliances of export market demand;
- Local level farmers' clusters need to be organized for strengthening the requirement of traceability;
- The Department of Fisheries should take an initiative with the Ministry of Land to establish zoning system keeping the existing land shape inert for e-traceability.
- Bangladesh Government has taken initiative of digital land administration system, which needs to be specialized for shrimp farming area for establishing e-traceability system.
- Farms should be registered in GPS system with all other relevant information to integrate with e-traceability.

References

Ahmed N, Elisson EH, Muir JF (2010). Rice field to prawn farms: A blue revolution to Bangladesh*? Aquaculture International.,* 18: 555–574.

Ahmed N, Brown JH, Muir JF (2008). Freshwater prawn farming in *gher* system in south-west Bangladesh. *Aquaculture Economics & Management.,* 12: 207-223.

Ahmed N, Demaine H, Muir JF (2008). Freshwater prawn farming in Bangladesh: history, present status and future prospects. *Aquaculture Research.,* 39: 806-819.

Ahmed N, Hossain MAR (2000). A Study on marketing of freshwater prawn (*Macrobrachium rosenbergii*) from Bangladesh to international markets. *Bangladesh Journal of Fisheries Research,* 23: 25-31.

BEST (2011). Traceability, Hygiene and Sanitation for Depot and Ice Factory. [Onlne]. Available:http://www.best-bfq.org/publication-reports.php [Date of Access on 17 January, 2015].

BFFEA (2010). Annual report of Bangladesh Frozen Foods Exporters Associations Dhaka, BFFEA monthly newsletter, January. pp. 5.

CARE (2003). Land Policy and Administration in Bangladesh: A Literature Review. Care Rural Livelihoods Programme. pp. 3-5.

Chowdhury AR (2007). Farming practice and marketing of shrimp at farmers level in Bagerhat district. An unpublished M.S. thesis submitted to the department of Aquaculture, Bangladesh Agricultural University, Mymensingh. pp. 17.

Datta UK, Ali H, Haque MM, Murray FJ, Little DC, Wahab MA (2011). Development of auction market (Chatal) as an additional tire in the value chain of farmed shrimp and prawn in Bangladesh. A poster for an EU funded research project, Sustainable Ethical Aquaculture Trade (SEAT).

DFID (1997). DFID Fisheries Bangladesh, Issue 2-1997. Department for International Development (DFID) of Bangladeh, Dhaka-1212. pp. 18.

DoF (2005). National Fisheries Fortnight (Swaronika, Jatio Matshya Poksha), Directorate of Fisheries, Ministry of Fisheries and Livestock, Dhaka, Bangladesh.

DoF (2014). Fisheries Statistical Yearbook of Bangladesh 2012-2013.Fisheries Resource Survey System. Department of Fisheries, Ministry of Fisheries and Livestock, The Government of the People's Republic of Bangladesh. pp. 52.

EC (2007). Directorate-general for Health and Consumer Protection. EC Fact Sheet., 6: 1-4.

Islam L (2010). Bangladesh shrimp and prawn value-chain stakeholder workshop. Organized by Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh. Hotel royal international, Khulna.

Islam MS, Wahab MA, Miah AA (2002). Socio-economic and environmental impacts of alternative shrimp-crop farming in Bangladesh, Department of Agricultural Economics, Bangladesh Agricultural University, Mymensingh.

Pokrat B, Bhuiyan S (2001). The coastal shrimp sector in Bangladesh: Review of literature with annotated biography, BCAS, Dhaka, Bangladesh. pp. 35-40.

Rahman MM, Hossain MM (2009). Production and export of shrimp of Bangldesh: Problems and prospects. *Agriculture, Ecosystems and Environment.,* 20: 163 – 171.

William D (2003). Small scale freshwater prawn culture boosts Bangladesh economy, household income. Global Aquaculture Advocate. pp. 45.