PRICE

POVERTY REDUCTION BY INCREASING THE COMPETITIVENESS OF ENTERPRISES

SECTOR ENVIRONMENTAL ANALYSIS

31 July 2008

This publication was produced for review by the United States Agency for International Development. It was prepared by SRGB for Chemonics International.

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Contract No. 388-C-00-08-00021-00

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ACRONYMS

BOD	Biological Oxygen Demand
CETP	Central Effluent Treatment Plant
COD	Chemical Oxygen Demand
DCC	Dhaka City Corporation
DO	Dissolved Oxygen
DOF	Department of Fisheries
EMP	Environment Management Plan
EMS	Environment Management System
ETP	Effluent Treatment Plant
FFYP	Fifth Five Year Plan
FGD	Focus Group Discussion
GAP	Good Agriculture Practice
GDP	Gross Domestic Product
GMP	Good Manufacturing Practice
HACCP	Hazards Analysis for Critically Control Point
HYV	High Yielding Varieties
ICM	Integrated Crop Management
IDI	In-Depth Interview
KII	Key Informant Interview
MDG	Millennium Development Goals
NEMAP	National Environmental Management Action Plan
PCR	Polymerase Chain Reaction
PG	Pituitary Gland
POP	Persistent Organic Pollutant
PRICE	Poverty Reduction by Increasing Competitiveness of Enterprises
PRSP	Poverty Reduction Strategy Paper
SME	Small and Medium Enterprises
SRGB	Survey Research Group Bangladesh
UN	United Nations
USAID	United States Aid for International Development

1. PROJECT BACKGROUND

Increased awareness of the impact of modern society and manufacturing production on both nature and the quality of human life has brought about a concern for sustainable or green production. Along with initiatives to increase production and facilitate market access of the small and medium business enterprises (SME), health and environmental safety standards should be improved, maintained, and ensured at all stages of the supply and production chain. Such greening of business may support longer term competitiveness, increase access to market share, and prevent the imposition of regulations.

In Bangladesh, a sustained level of development of SMEs is needed to reach the targets set by the United Nations (UN) in the Millennium Development Goals (MDGs) to alleviate poverty. This urgency is reflected in the Bangladesh government's pro-poor policies, especially in the poverty reduction strategy paper (PRSP). Considering the country's level of economic growth, composition of resources, level of global integration, urbanization, etc, there is ample scope for development of diversified and non-traditional SMEs in the country. However, low productivity, lack of access to information, high import of finished products, non-compliance to health safety, and few environment-friendly standards have put the SMEs in a challenging situation.

The Poverty Reduction by Increasing Competitiveness of Enterprises (PRICE) project will help Bangladeshi SMEs increase their presence globally. PRICE, a five-year USAID pro-poor competitiveness project with a mission to increase sales, jobs, and investment throughout the value chains of three sectors: aquaculture (shrimp and fish); horticulture; and leather products. The project aims to focus on women, young adults, and SMEs. PRICE will enhance the competitiveness of Bangladeshi firms, products, and services in global markets and reduce inequities that prevent the poor from reaping greater benefit from economic and income growth. PRICE will make linkages between SMEs and larger producers and exporters, which typically have direct and more efficient access to markets.

PRICE will intervene directly through strategic sector-wise activities that deal with a key industry opportunity or constraint. It will facilitate sales transactions across the value chains through training and technical assistance, linking firms and SME suppliers to specific buyers that may lead a multiplier effect in sales, jobs, and investment through backward and forward linkages, as well as the "copy-cat" effect. PRICE will also work on policy advocacy by identifying and advocating policy or regulatory changes, through USAID or other partners, to increase growth in PRICE value chains.

USAID Bangladesh is committed to environmental sensitivity in all of its activities. Accordingly, PRICE has undertaken an environmental analysis with a view to develop an environmental management plan for each sector. The present study reports the environmental analysis of the fish-shrimp aquaculture, leather, and horticulture sectors. The information from the environmental analysis will shape implementation decisions that promote environmental sensitivity.

2. SCOPE AND OBJECTIVES

The scope of this document is limited to the identification of significant environmental issues and concerns at in the sector of fish-shrimp aquaculture, horticulture; and leather production, for developing Environmental Management Plan (EMP) for the respective sectors. We will recommend actions for intervention so that businesses follow certain protocols to safeguard the environment complying with national and international environmental safety standards, obtain certification to add value; and acceptance of their products in international markets.

The objective of this assignment is to:

A. assess the environmental issues in the fish-shrimp aquaculture, leather; and horticulture sectors
B. identify issues and concerns related to environment where PRICE can intervene in mitigation or management aspects for these sectors and
C. recommend how PRICE will take environmental issues into account when considering future project interventions in these sectors.

3. METHODOLOGY

The study required some field study for primary information (for quantitative data) to verify and support qualitative information from secondary sources. Areas known for having significant supply and production in the respective sectors were selected for primary data collection (Table 1). The geographical locations of the sites visited are depicted in Fig 1.

Structured questionnaires were developed and tested prior to address the stakeholders at various nodes of the product value chain. Data gathered were analyzed for presentation. In addition to the In-depth Interviews (IDI), Focus Group Discussion (FGD), Group Discussion (GD) and Key Informant Interviews (KII) were also conducted. Published materials were consulted as secondary sources for relevant information.

Production Sectors	Sites Visited
Fish Aquaculture (Tilapia, Carp, Pangus)	Mymensingh, Bhaluka, Trishal, Sambhuganj
Shrimp (Bagda) Aquaculture	Satkhira
Prawn (Golda), Baor culture, Carp, Magur	Jessore, Manirampur, Khulna
Fish & Shrimp Processing	Bagerhat
Leather Tannery	Hazaribagh
Leather & Footwear Products	Gazipur
Leather & Footwear Products	Ashulia, Savar
Horticulture Products (Potato, vegetables)	Munshiganj
Horticulture Products (Mango, other fruits)	Chapai Nawabganj, Paba, Kalyanpur
Horticulture Products (Vegetables, fruits)	Rajshahi, Godagari, Narsingdi

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4. LIMITATIONS

The amount of time available limited the number of site visits that the EMP team was able to undertake. Similarly, time placed a constraint on the number of IDIs and KIIs that could be conducted. Nevertheless, the EMP team was able to gather a significant amount of information and research the environmental issues and concerns in the three PRICE sectors.

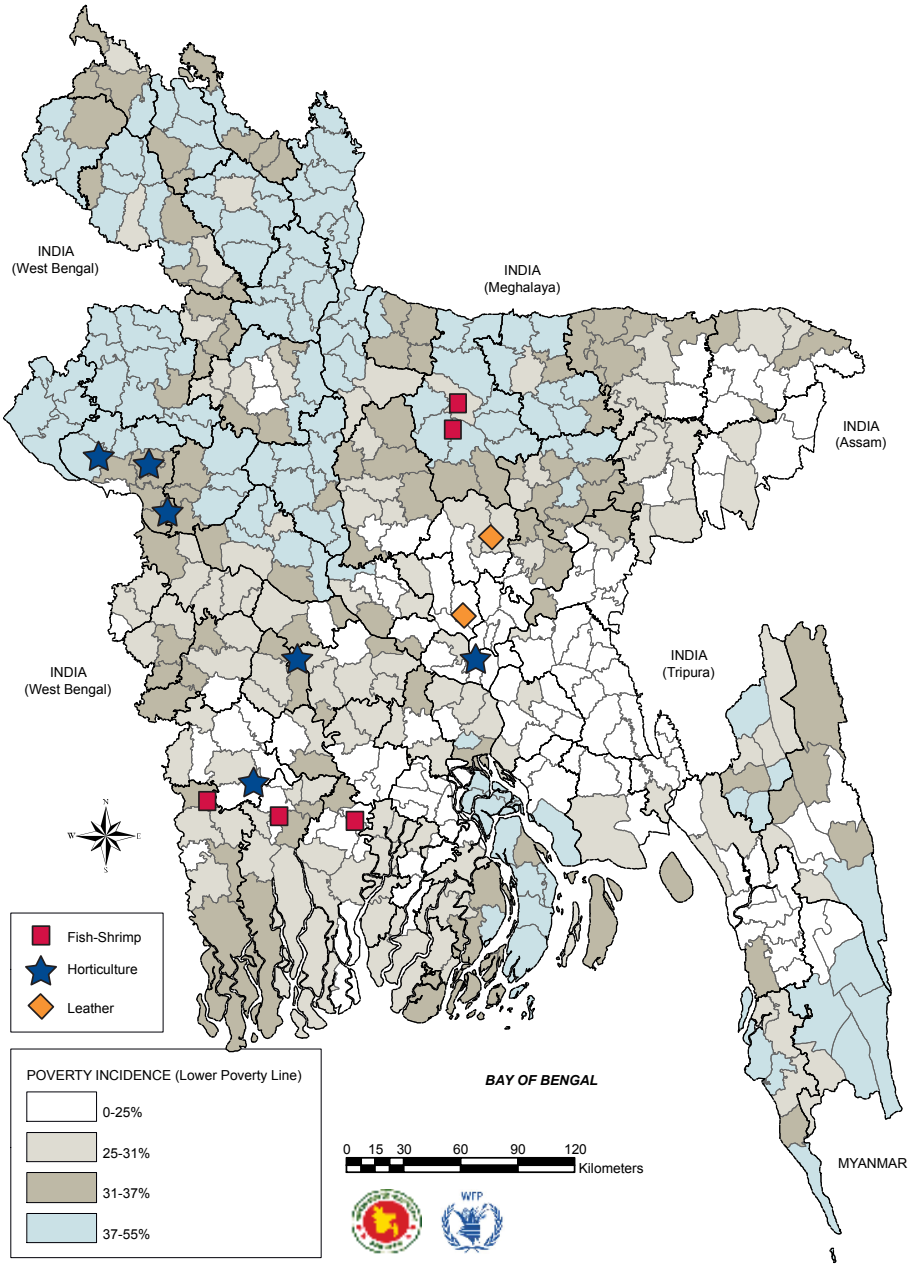


Figure 1: Horticulture, shrimp/fish, and leather sites visited by the EMP team members

5. ENVIRONMENTAL ISSUES AND CONCERNS

The fish and shrimp aquaculture industry continues to grow every year, significantly contributing to the economy of the country, generating needed employment, supporting exports, and providing hard currency earnings. The industry has become diversified as it has evolved, with shrimp producers at the heart of the industry. Shrimp export ranks second in earning foreign currency for Bangladesh. This study has identified various environmental issues that have resulted from the growth of the sector and how PRICE can address some of these through its interventions.

5.1 Fish & Shrimp Aquaculture

5.1.1 Carp

Carp fisheries comprise 85.72 percent of total culture production, 58.72 percent of which is indigenous. The rest (27 percent) are exotic carps. These fish are of high market value and production is spread across the country.

Hatchery

Hatchery is the heart of a culture system. Male and female fish are artificially crossed for breeding. Inbreeding problem is evident in most of the hatcheries in Bangladesh, resulting in small sized or deformed fish production. Due to easy handling, small sized fishes are often used for selective breeding purpose. This selective breeding cause serious problems, producing small fish with slow growth patterns.

Nursery and Culture Ponds

Nursery and culture ponds are important areas in production cycle. For elimination, unwanted or carnivore fishes are totally removed from the nursery and culture pond system. For environmentally friendly fish killing, a Derris root called rotenone is used. From the present investigation, it was evident that the efficacy of rotenone for killing carnivore fishes is ineffective, so farmers add pesticides along with rotenone. The use of pesticide in nursery and fish culture ponds and its ingress into the food chain is of great environmental and health concern.

Fish Seed/Fingerlings Traders

Fish fry and fingerling need oxygen in water to survive. Majority of the fish seed/fingerling traders/suppliers lack facilities to carry fish fries and fingerlings to distant places with oxygen. Traditionally, they do hand-clapping in the water hari or transporting pots. In a recent study, it was revealed that hand clapping could kill as much as 50 percent of the transported fish fries/fingerlings. Besides, many fish fries and fingerlings became injured due to the hand agitation. This ultimately results in large mortality in the system and cause low production and disposal problems.

Fish Farmers

Farmers lack the knowledge of ideal farming, i.e. culturing fish in an environmental friendly way. Lack of knowledge to use chemical fertilizers hampers production and accidental overdose of chemical fertilizers.

Fish Processing Depot

The price of fish depends upon the quality of fish delivered. Fish as a delicate item need to be handled gently in hygienic condition. It needs landing centre with clean water and platform. Most of the village fish depots do not have landing facilities. In addition lack of ice and ice boxes result in quick spoilage of fish. Lack of knowledge and practice of waste disposal is another arena to look into.

Local Fish Retailers

Most of the local fish retailers have the similar kinds of environmental quality maintenance problems as fish processing depots.

Other Concerns

- Pituitary gland (PG) is an important component in every hatchery. These are used for artificial insemination in fishes. This is a small scale industry developed by private entrepreneurs, where the PGs are collected from dead fish head all over the country. The legal status or policy for commercial production of PG (pituitary glands for hatchery breeding) is lacking in Bangladesh. This resulted in low feedback for seed production in the hatchery. The country has to import hormones (legally/illegally) from other countries.

- Carp can be cultured in pond by feeding natural feed in the water. To improve natural productivity fertilizer is needed. Non-availability of fertilizer during culture season could hamper the country's fish production for next year.

- The lack of facilities on disease detection is another problem in the hatcheries.

- Lack of awareness on personal hygiene in handling fish and fish products is also a problem.

5.1.2 Tilapia

Tilapia is an exotic fish, introduced in the early 1960s in the country. The major area of culture is all over the country. Accidental release or escape has allowed it to establish breeding populations in the open aquatic systems including the Sunderbans. This fish solely contributed 3.55 percent of total fish production in 2006-2007.

Hatchery

Mono sexing of tilapia is done by using male sex hormone in feed for the first 21 days to the early feeding stage larvae (see picture). The abundant use of sex hormone in hatchery for mono-sexing fish fry production may be a health hazard for the operator as he handles it with bare hands. It may become a greater concern for the sector.

Other Concerns

The recent price hike of fish feed ingredients resulted in high price of feed, which may hinder the production cycle for this low valued fish.

Above and below: Antibiotics and chemicals used in the shrimp and fish industry in Bangladesh.

5.1.3 Pangasiid

Pangasiid is an exotic fish, introduced from Thailand in the 1980s. The major culture areas are Mymensingh, Satkhira, Jessore, Bogra and many coastal areas of Bangladesh. The sole contribution of the fish was 1.13 percent of total culture production in 2006-2007.The overcrowded fish culture is alarming and low quality feed (see picture) with high nitrogen output result in water pollution, eutrophication, and diseases in culture ponds.

Other Concerns

- High price of fish feed may hinder the production cycle for this low valued fish.
- Ulcerative disease may cause reduction in the market price.

5.1.4 Bagda (Shrimp)

Shrimp culture in Bangladesh was first introduced in Sundarbans region in 1929-30. But massive shrimp culture in Bangladesh started in early-1980s in the southwest and southeast, especially in greater Khulna and Cox's Bazaar districts. Even the semi-intensive shrimp farming system particularly of Penaeus monodon in the mid-1980s at Cox's Bazaar region had gradually expanded towards south western part. Bangladesh has a large fertile tidal flooded coastal area suitable for shrimp culture. The rapid expansion of shrimp culture in the past few years is one of the most conspicuous developments in the fisheries sector. Shrimp ponds covered 1,445 ha of brackish water in early 1980s and presently shrimp farming is reported from 27 districts and it covers 217,877.1 ha of farming area. Within this area 20.68 percent is dedicated for Golda farming and the remaining 79.32 percent area for Bagda. Besides monodon, Chakka (P. indicus), Horina (Metapenaeus Monoceros) and Honni (M. brevicornis) are harvested from brackish water shrimp ghers. Chatka icha (M. malcolmsoni) is harvested from freshwater culture ponds as by product. The value chain nodes in the production system are shown in Figure 2.

Hatchery

The use of antibiotics and some chemicals like formaldehyde and bleaching (see pictures on previous page) has been an issue for the entire value chain with regard to international market access, particularly the EU. Speculation as to the origin of these toxins has frequently centered around the hatchery and fish feed industry. Illegal drug uses are now mostly under control by Fish and Livestock Feed Act 2008. Lack of knowledge for environmental issues like use of banned drugs or chemicals is evident.

Various known and unknown chemicals and drugs are in use in the hatchery. It is one of the major concerns throughout the world. As no or less control to the hatchery system by the Department of Fisheries (DoF) authority is evident, similar concern is expected for the untreated hatchery effluents in Bangladesh. The effluents may cause environmental degradation by affecting the aquatic fauna/ecosystem and food chain.

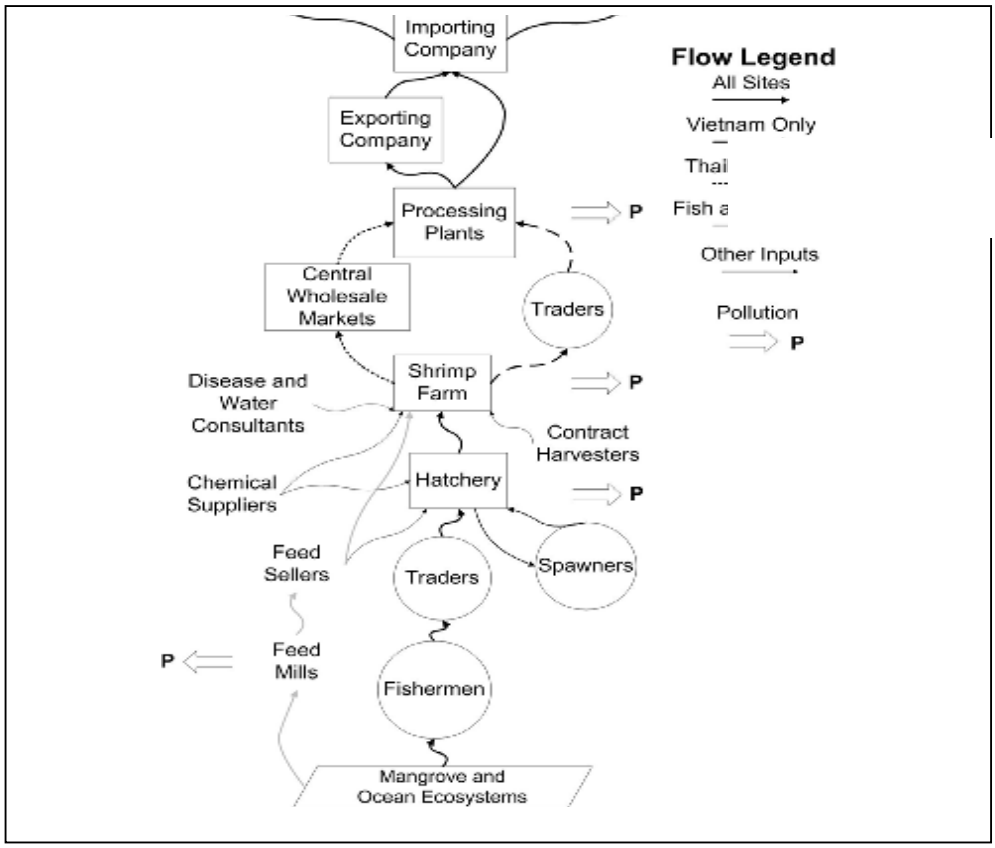


Figure 2: Value chain nodes of shrimp production and nodes identified that may cause environmental pollution.

Mother brood collection from the sea results in great biodiversity loss (in the form of by-catch) and environmental degradation (disruption of ecosystem function) for the country. As the bagda hatchery is operating year round, the broods are collected through out the year by bottom trawl or baiting. Bottom trawls cause damage to the non targeted fauna as well as the immature bagda through this activity.

Farming

Bacterial and viral disease of shrimps is caused by low quality water in ghers (ponds). There is no inspection for bacteria or viral free seed supply.

Saline water intrusion or seepage to non-saline adjacent area is of great worry. This resulted in environmental degradation of the area by hampering soil composition, biodiversity and cropping patterns.

Fish processor & exporter

Most of the export fish processors have maintained the Hazards Analysis for Critically Control Point (HACCP). No visible environmental issues were found. However for general environmental concern, mandatory wastewater treatment plants are necessary for controlling water sludge or pollution from the liquid waste outputs. In addition, the de-headed shell of prawns and shrimps and other solid wastes (mainly Styrofoam) is of great nuisance to discard safely for the industry.

Other concerns

- Most Bagda ghers (ponds) are very large. These ghers are thus unmanageable for culture practice.
- There has been less support from government and other agencies.

5.1.5 Golda (Prawn)

Golda or Giant Freshwater prawns occur naturally in the rivers, canals, beels, haors, and ponds of Bangladesh. Two species are commercially important. They are the giant freshwater prawn locally know as Golda chingri (Macrobrachium resenbergii) and Chatka icha (M. malcolmsoni), where the former is one of the major export items. They are commonly cultured in the districts of Chandpur, Khulna, Bagerhat, Satkhira, Jessore, Jhenidah, Magura, Narail, Barisal, Pirojpur, Bhola, Jhalakathi, Patuakhali, Barguna, Dhaka, Faridpur, Gopalgonj, Madaripur, Sariatpur, Rajbari, Jamalpur and Kishoreganj.

Freshwater prawns breed in early monsoon months in flooded current water or in tidal estuaries of low saline zone (salinity up to 15 ppt). The larvae and hatchings reside in estuaries for their growth and development during the rainy season. At attaining the juvenile stage they start to migrate to the freshwater areas of the country. The major spawning ground of Galda is not known. The present study revealed that several river side areas of Khulna, Satkhira, Barisal and Patuakhali region are the common brood collection sites for hatcheries.

Hatchery

Most of the hatcheries are producing low quality seed. This is due to small-sized females in the breeding cycle. The collections of brood from various river banks cause natural stock depletion.

Farming issues

- Disease caused by low quality water in ghers (ponds).
- Saline water intrusion or seepage to non saline land area.
- Illegal drug uses in some hatcheries cause ecological degradation in the gher bed by affecting the benthic fauna.
- Mother brood collection from sea cause destruction of other biodiversity (by-catch & thrash fish).

Fish processor & exporter

Most of the export fish processors have maintained the Hazards Analysis for Critically Control Point (HACCP). No visible environmental issues were found. However for general environmental concern, mandatory wastewater treatment plants are necessary for controlling water sludge or pollution from the liquid waste outputs. In addition, the de-headed shell of prawns and shrimps create solid waste from the industry.

Other Concerns

- Most of the Bagda ghers (ponds) are of very large size. These ghers are thus unmanageable for cultural practice.
- Less support from government and other agencies.

5.2 Leather Sector

The animal-to-leather supply-chain includes a variety of processes of different technological complexity, where relatively large amount of water, energy, and chemical substances are used and significant amounts of wastes and by-products are generated. This may raise serious environmental and health problems for present-day slaughter houses and tanneries, as well as cause poorly efficient resource exploitation. On the other hand, such industries are increasingly kept under pressure by stricter regulation and more and more severe limitations have led companies, especially in the tanning industry, to look for new methods for minimizing the release of waste materials and pollutants.

Leather is the fourth largest export sector in terms of earning foreign currency and third in pollution generation. The National Environmental Management Action Plan (NEMAP 1995) identified the leather industry as more harmful to the environment than the textile, medicine, fertilizer and paper industries. Every day the tanneries at Hazaribag discharge huge quantities of effluents – 200 tons of solid waste and 7.7 million liters of untreated highly toxic liquid waste from over 200 tanneries to the nature. This has been a common practice for more than four decades. The glue and paint industries, located in the same general area, together have affected water and air

quality in a large poorly drained area locked behind a nine-meter high flood control embankment constructed in 1989-90 in southwest Dhaka city. The toxic effluents and solid wastes contaminate soil, air, and water of the area as well as the water of the adjacent Buriganga River (see picture on the right).

Fish and other aquatic resources are adversely affected within a few kilometers of the river by the tannery effluents. The pollution is not limited to the surface water as it also contaminates the underground water apart from the atmospheric pollution through foul odor. Annual consumption of more than 60 different chemicals in the tannery industry include 3,500 tons of sodium sulfide, 3,400 tons of calcium oxide (lime), 6,000 tons of (basic) chromium sulfate, 723 tons of ammonium chloride, 350 tons of dye-stuff and other chemicals including fungicide, sodium chloride, etc.

The solid waste largely contains pieces of raw hides, lime fleshing and skin, trimmed finished leather, shaving dusts, and hair (see picture below). Solid waste like shaving dusts are used for making leather board, dried waste skin is mixed with fish and animal feed as a cheap protein source and also used in the production of bio-fertilizer, particularly used for vegetable farming. A significant portion is left every day on the roadside and in the nearby dustbins causing foul odor to the surrounding area. The Dhaka City Corporation's (DCC) garbage trucks partly remove the waste to the landfill sites once a week. The open drains around Hazaribag sometimes get clogged and overflow because of waste accumulation into the drains.

5.2.1 Environmental Concerns

Table 2. Environmental issues and concerns for the leather sector value chain nodes, follows.

Nodes	Environmental Issues
Slaughter of animal	Soil pollution, bad smell and nuisance
Raw hide & skin trader	Water pollution
Raw hide & skin process	Water pollution, solid waste problem, heavy metal
Acid & Sulphide chemicals	Gaseous emission
Generator, vehicle movements	Air pollution
Generator, vehicle movements	Noise pollution
Trimming, Fleshing and Cutting	Solid waste
Tannery process, tanning	Odor problem, water pollution, solid waste problem, heavy metal

5.2.2 Animal Slaughtering

Cattle slaughtering generate waste as blood, dung, bones, hooves, teeth, other fluid and solid wastes. The blood and other fluid are high in Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) content which need special attention otherwise DO is reduced from the air by microbial activity and the wastes become septic. The impact of high oxygen demand causes decomposition, producing bad odor. A portion of these wastes enter into the tanneries due to improper disposal practices.

5.2.3 Raw Hide & Skin Trader (Middle Man)

The raw hide and skin trader acts as a middleman and his intention is to transport the raw products to the wholesaler and/or processor. Delay in transportation starts decomposition and may cause damage to the hide and spread bad odor and finally putrefaction. To avoid the process of putrefaction salt is used profusely. There is no proper storage facility and the whole area is smelly with salt spread all over.

5.2.4 Raw Hide & Skin Trader (Aratdat Or Pre-Processor)

In the arat (storage area), necessary preliminary processing of hides are done. Application of additional salt, sorting, and shavings of hides are done here for preparation in suitable sizes and shapes of hides and skins. Disposal of the removed excess salt and shaving wastes are a major concern. Very often the solid wastes are not disposed properly and dumped on the road sides or other vacant land.

5.2.5 Processing/Tannery Operations

The various stages of the tanning process produce huge quantities of waste water containing dirt, hair, dung, blood, salt, toxic chemicals and solid wastes are produced and discharged into the drain without treatment which then flows into the river. The

biologically oxidizing maters present in wastes exert a deoxygenating effect in the rivers. Suspended matter ultimately forms sludge bank on the bed of river, causes odor pollution, deteriorates the water quality. Chrome tanned wastes are highly toxic to fish, aquatic and animal life. Dyeing and chrome re-tanning processes contain heavy metals which further aggravates pollution problem in the wastewater. Exposure to such toxic chemicals is also harmful for human health and particularly the workers who work there without using any protective gears (see pictures).

5.2.6 Finishing Operation

The overall objective of finishing is to enhance the appearance of the leather and to provide the appropriate performance characteristics in terms of color, gloss, and handling, among others. During finishing operation tanned waste and buffing dust are generated. Formaldehyde and organic solvent produce air pollution. Formaldehyde is known to be carcinogenic and buff dust containing chromium particles cause respiratory problems in humans.

5.3 Leather Goods & Footwear

The demand of finished leather has a higher degree of price elasticity than the demand for raw hides and skins by tanneries. Leather is principally used by footwear, leather goods, upholstery, and leather garments manufacturing industries. The primary factors that determine the use of leather in leather products are; availability of leather of sufficient quality and type; prevailing price of leather; and the traditional preferences of specific markets for the products. Typical leather products like luggage, small leather goods, briefcases, handbag, and travel goods are in many cases manufactured from non-leather materials or leather substitutes depending on market demands. In the footwear sector, many components are being produced from alternative materials. Soles and lining, for instance are made of leather, textile fabric, plastic, or other synthetic materials. Many shoes and sandals today are manufactured from synthetic materials. About 35 percent of the footwear made in developed countries is from non-leather materials, which is as high as about 85 percent in developing countries.

BBJ Leather Goods Ltd. is a 100 percent export oriented industry established in Zirabo, Ashulia, Dhaka. This is a joint venture industry with Japan. The total number of employees is 86. Out of 86 employees 26 are office level (24 male and 2 women) and 60 are workers (40 women and 20 male). During interviews with the owner of the BBJ Leather Goods Ltd., he said that water is occasionally required for processing and hence wastewater is generated in small quantity. Only solid wastes are generated from the cutting of leathers, container, and packages materials. This solid waste (cut leather) is sold to the small traders. There is no foul odor only natural leather odor is felt during preparation of leathers goods. Noises are generated from the various machines. Insignificant amount of smoke and fumes are generated during the manufacturing the footwear and leather goods.

The owner of the footwear and leather goods industry mentioned that due to lack of linkages and marketing at the international level this sector is losing foreign exchange. Lack of technical knowledge also hampers export. Improvement of the marketing side is required on an urgent basis. Another intervention area is back-up linkage which needs to be developed.

5.4 Horticulture Sector

In Bangladesh horticulture occupies only a small share of the country's agricultural land but generates about 21.84 percent of the Gross Domestic Product (GDP). Growth in fruits and vegetables production has increased respectively at the rates of 2 percent and 4 percent during the last decades. Potato production has increased with an average growth rate of about 14 percent during the period from 1995-1996 to 2005-2006. Among agricultural commodities, the fruits and vegetables sector has an enormous potential for higher income and economic growth. The range of employment includes nursery business, production activities, post-harvest operations, transportation, processing and marketing, etc. About 19.4 million homesteads cover about 0.45 million hectare and grow 60-70 different types of fruits and vegetables. The scope of women employment is comparatively higher in this agricultural sub-sector than in others.

5.4.1 Environmental Issues & Concerns

Agriculture accounts for some 18 percent of GDP in Bangladesh and more than half of total employment, so the ability of soil to sustain agricultural production is an issue of national concern. Cropping intensity in Bangladesh is the highest in South Asia, having increased from below 140 percent to more than 175 percent over the last thirty years with the introduction of short duration cereal varieties and winter irrigation facilitated double and triple cropping. Pressure on agricultural land is further intensified by urbanization and infrastructure development, as a result of which the cropped area is declining at about 1 percent annually. To support this intensity of cultivation, rates of fertilizer application are the highest in the region; nevertheless, surveys and soil tests provide evidence that agricultural inputs are imbalanced and nutrient mining is occurring. Sustainable crop protection and judicious application of chemical fertilizers and appropriate use of other agro-chemicals are a key concern of the stakeholders dealing with agriculture and consumer and environment protection. However, harm to human health and the environment as well as economic and social disadvantages are major continuing problems found the world over from pesticide usage, fertilizer and other agro-chemical applications especially in developing countries like Bangladesh.

5.4.1.1 Irrigation

With the adoption of high-yielding varieties (HYV), chemical fertilization and multiple cropping, controlled irrigation has become the chief factor in increasing productivity. Irrigation usually employs surface water, quality of which can be of major problem especially for urban or suburban areas with sewerage and industrial effluents often being discharged into rivers and streams, but the same risks can be applicable to production anywhere. Upstream discharge into rivers of sewerage or of effluent by industrial concerns can have a significant impact on water quality. The risks are compounded by irrigation practices that spray the whole plant rather than

irrigate the roots, a particular problem for products that are eaten raw (e.g. tomato, chili, etc). To meet up the irrigation purpose using of underground water is increasing simultaneously. The underground water composes of different minerals, which are directly added to the soil that create fertility of the land. It is reported that the underground water level is decreasing by over up lifting of ground water and soil fertility is declining by the application of over dose and continuous use of underground water. The iron compositions are continuously added to their land by irrigation, which make land fertility vulnerable.

5.4.1.2 Chemical Fertilizer

Chemical fertilizers are used along with better seed, natural fertilizer, and irrigation to increase the crop production. The fertilizer that is not recovered by the crop ends up, mostly gone in soil, air, and water and create adverse impact on environment. Nonstop use of chemical fertilizer cause harmful impact on environment similar to decreasing soil fertility as well as polluting surrounding water bodies. Washing and transportation by rain water/stream; it is directly added to the near water bodies. On an average, more than 50 percent of the respondents claimed that soil fertility is decreasing and that water bodies like ponds, lakes, are polluted by them. After fertilizer, pesticide is the second important chemical input that saves crops from pests.

5.4.1.3 Application of Pesticides (Including Banned Items)

Pesticides and fungicides are used to protect the crops from the attack of insects, pests,and diseases but these are important sources that badly pollute the environment. By washing and run off, it goes to near water bodies and pollute them. Fish resources of those water bodies are also affected. By using polluted water people also suffer from different diseases. Fish and other aquatic resources and biodiversity have declined significantly.

In Bangladesh, Persistent Organic Pollutant (POP) pesticides (also known as the Dirty Dozen) are completely banned for use in agriculture since 1997 but their continued use has been reported, possibly attributable to cross-border movement, continued local formulation, inadequate product labeling and farmers' lack of information. Significantly high pesticide levels have been found in the food chain.

To grow HYV requires three principal inputs: irrigation facility, chemical fertilizer,and pesticides. With the advent of industrialization and urbanization, industries dealing with the production, packaging and transport of fertilizer, petrochemical products, cement, textile, leather and mining were set up. Improper chemical use, handling, and indiscriminate disposal of chemical wastes thus became a hazard introduced to health and environment.

5.4.1.4 Other Chemicals – Coloring, Ripening Agents and Hormones

Food adulteration has emerged recently as a public health menace in the country. The fraudulent traders and produce handlers use toxic chemicals and hormones (e.g. calcium carbide, planofix, ethrel) for early ripening and increased production of fruits and poisonous colorants (e.g. those used in textile and tannery industries) to make fruits and vegetables look fresh and attractive. It is reported that fruits are given a shine by traders using petroleum jelly, which is suspected of being a carcinogen.

Furadan, an insecticide is reportedly used by vendors in India to give brinjal a glossy, deep purple color and sometimes green dyes are applied to chilli, okra, palwal and cucumber. Besides, chemicals used for surface decontamination are used too. All these can affect safety of fruits and vegetables.

Farmers usually place more emphasis on maximizing yield than on minimizing residue level. Most of the farmers are not aware of the dangers inherent in their production practices and they take their produce as food and feed plant residues to their animals while in rare cases they usually do not eat what they produce utilizing pesticides. Pesticide spillage is quite common and empty containers/packets are often not properly disposed of and become a source of contamination that harms the environment. However, countering such problems by using pesticides has major implications for food safety as well as environmental protection, particularly when they are not applied in accordance with recommendations or when banned chemicals continue to be used.

5.4.1.5 Processing Industries

Most of the agro-food processing industries in the country using fruits and vegetables, as raw materials do not apply required measures to address the environmental issues. The processing plants are running in unhygienic conditions without paying attention to sanitation and safety issues. The quality of the products is low that do not meet the environmental and health safety standard requirements. Ad-libbing demands acquisition of technology, heavy investment and training of personnel and better management from the levels of procurement of raw materials to packaging and selling.

5.4.1.6 Floriculture

To produce flowers and ornamental plants growers use chemicals (e.g. pesticides and fungicides and growth hormones) those have undoubtedly negative effects on the environment especially soil and ground water system but if used correctly their harmful effects can be minimized. Growers have to use fertilizers, insecticides or other chemicals in the right quantity and concentration and at right time to save the environment.

6. ENVIRONMENTAL MITIGATION AND MANAGEMENT MEASURES

Different approaches have been made through various agencies/organization to address the issue of environmental pollution through implementing various programs/activities. However much needs to be done at the field level in raising awareness, capacity building, and enforcement of legislations.

6.1 Fish & Shrimp Aquaculture Sector Mitigation Measures

We recommend promoting use of probiotics. Probiotics are environment friendly bacteria that are biologically engineered to destroy specific harmful bacteria within the fish or shrimp production line.

There is a need to identify and control viruses affecting the shrimp and fish products using PCR technology. This may require setting up laboratories with appropriate equipment and trained staff. Government research institutions and public universities may be a better option for such laboratories.

There is a need to Involve educational institutions, government research institutions for in-depth research in specific issues particularly for eradication of diseases so that disease-free products are marketed with value addition.

6.2 Leather Sector Mitigation Measures

6.2.1 Animal Slaughtering

The blood waste need to be properly managed through covering by soil. The raw skin and hide need to be immediately transferred to a suitable place where salt or anti-bacterial chemical can be put on to prevent further putrefaction. The other solid wastes like bone, hoof (khur), teeth, and tail can be collected and stored for use after processing.

6.2.2 Raw Hide & Skin Trader (Middle Man)

The middle man need to transfer the raw hides and skin immediately in a covered van to the wholesaler (aratdar). If time taken to transfer the raw hides and skin to the wholesaler store is more than expected then salt should be applied to prevent putrefaction.

6.2.3 Raw Hide and Skin Traders (Aratdat or Pre-Processor)

Excess salt should be removed from the hide and stored in a suitable place for further use or can be put in a dug out pit on the ground and covered.

6.2.4 Processing/Tannery Operations

Different kinds of wastes should be separated before treatment of the raw hides and skins. The liquid lime waste may be neutralized using acid. Primary treatment or simple sedimentation is required for abatement of the waste water pollution.

Dehairing and fleshing generates a lot of biological waste materials. To mitigate their effects, biological treatment of the waste water is needed, which may be done by introducing microbes or biological oxidizing agents. Wastes generated from tannery operations (de-liming, bating, pickling and tanning) may be treated for ammonia stripping to reduce the ammonia content. Chloride may be removed by separation method. Primary and secondary treatments are required before the effluent is discharged. During bating some undesirable proteins are hydrolyzed and excess lime absorbed by the skin is removed and treated with some chemicals and hot water to start the tanning process. It is during this tanning process that chromium is used. Highly contaminated water may be treated through the same process again and chromium recovered and recycled for use.

6.2.5 Post-Tanning Operations

Washing out of acids, re-tanned if necessary, dyed with water-soluble dyestuffs, fat liquored and dried. This is crust leather and traded. The liquid waste generated during dyeing and chrome re-tanning processes contain heavy metals which further aggravates pollution problem in the wastewater. Tanned water will require all treatment processes prior to discharge

6.2.6 Finishing Operations

Finishing operations generate tanned waste and buffing dust. Formaldehyde and organic solvents produce air pollution. Buffing dust can be sold to secondary users. Organic solvent can be absorbed through absorption materials media.

6.3 Horticulture Sector Mitigation Measures

Modern agricultural technique have been helping farmers meet the increasing demands of an increasing population in Bangladesh. Inputs like chemical fertilizers, plant protection chemicals, high-yielding varieties, and weedicides, if used with mechanical inputs such as tractor, thresher as well as controlled and assured irrigation, may increase productivity. Modern agricultural inputs and environmental degradation are negatively correlated and due to lack of proper using manner these inputs create severe environmental degradation.

With the advent of industrialization and urbanization, industries dealing with the production, packaging and transport of fertilizer, petrochemical products, cement, textile, leather and mining were set up. Improper chemical use, handling and indiscriminate disposal of chemical wastes thus became a hazard introduced to health and environment. The Bangladesh Health and Environment Action Plan emphasizes the need to review the present situation on chemicals, assess health risks, and promote health and safety procedures in handling and use of chemicals. The Action Plan also stresses the need to develop monitoring, prevention and treatment of poisoning and establish Poison Control Centers in the country. Improper chemical use, handling and indiscriminate disposal of chemical wastes thus became a hazard introduced to health and environment. The Bangladesh Health and Environment Action Plan emphasizes the need to review the present situation on chemicals, assess health risks, and promote health and safety procedures in handling and use of chemicals. In Bangladesh, pesticides are imported. Some agro- chemical industries formulate and re-pack pesticides. There are numerous pesticide products that are formulated by local

unauthorized companies and these are mostly adulterated with toxic pesticides like DDT. In the year 1996, Bangladesh used more than 11 thousand metric tons of pesticides and their use has been on the increase. Banned pesticides are being smuggled into the country. A study in seven agro-chemical industries showed that those who had been working for long time in the agro-chemical sector have features of toxicity. This was reflected clinically and in biochemical reports. Those workers who used personal safety devices regularly, on the other hand had better health than those who did not. The agricultural workers of Bangladesh are highly susceptible to toxic hazards of pesticides because of their involvement in spraying chemicals in the fields without using the personal protective device. Moreover, extreme climatic conditions of temperature, humidity, solar radiation coupled with malnutrition and parasitic infestation accelerate the risk of toxicity.

Different types of approaches have been made through various agencies/organization to address the issue of environmental pollution through implementing various programs/activities. The Government of Bangladesh has adopted Integrated Pest Management (IPM) policy through the Ministry of Agriculture with a view to contribute to an effective safe, sustainable, and economically sound crop protection system. Beside, the Department of Extension has launched campaigns on the use of composting through reducing the use of chemical fertilizers. But the progress of such efforts does not at all satisfactory due to lack of coordination and sincere services and often the interventions do not reach to the door of the stakeholders. This is, however, not particular to Bangladesh. Many other countries in this region also suffer from the same problem.

7, RECOMMENDATIONS FOR PRICE INTERVENTIONS

Issues relating to activities performed during production process to marketing of fish/shrimp, leather, horticultural products that have direct and indirect impact on environment are very complex and embrace not only the public health, environment safety and the safety of farmers or workers using pesticides or toxic substances but also the quality and safety of products, among other issues. This report addresses the impact on environment from supply chain for fish/shrimp, leather and horticultural and the way they operate. The following recommendations therefore address primarily these sector supply chains.

7.1 Fish & Shrimp Aquaculture Sector

Recommendations

a. Awareness development through hands-on training and local workshops on all mitigation process for illegal drug/chemical, pesticide use.

b. A few short time research surveys should be conducted for understanding the loopholes of the production system; some of the important research topics may cover the optimum seed density in transportation bags; fish and shrimp diseases; traceability of pesticide elements in shrimp and fish; hormone use impact on a mass scale in the tilapia monosexing process.

c. Practical, field based handouts or manuals should be developed for each stakeholder to enlighten them on the value chain, and his/her relationship and

importance in the value chain. In addition, the handouts will give simple scientific explanation on product quality maintenance and improvement.

d. Personal hygiene needs to be outlined for solid and liquid waste handling and management. Local advisory contacts may be developed and maintained for their own need.

e. At present it is difficult to get support for fish and shrimp disease identification in the country. Independent disease identification laboratory (equipped with polymerase chain reaction (PCR) and microbial analytical facilities) should be established for additional support for the industry. Efficient faculty from Universities (zoology, fisheries and microbiology departments) could help in supporting this matter.

f. Training for 1- Fisheries extension services, NGOs to maintain quality of fish and shrimp products, 2- Awareness in environmental issues in fishery industries and mitigations, 3- Microbial analytical methods for processing plants, 4- Environmental friendly fish/shrimp production, 5- Hatchery operational protocol, 6- Short and long distance fish and shrimp seed transportation, 7- Conservation of aquatic biodiversity for future

g. Physical infrastructure, particularly in the area of pack house, laboratory testing services and total quality management need to be put in place to respond effectively to address the environmental issues.

7.2 Leather Sector

Recommendations

a. Initial basic training for workers from animal slaughtering to finished leather products.

b. Hands on training on good house keeping and efficient use of the resources like water thus reducing quantity of wastewater.

c. Develop facilities to screen and discharge/dispose different kinds of wastes separately at source.

d. Install primary treatment plants to reduce 50 percent pollution load.

e. Intermediate training for increasing technical know how of core staff.

f. Provide soft loan to the sick industry for recovery and improvement.

g. Chrome recovery plant need to be introduced for reuse in the process.

h. A lagoon constructed for secondary treatment will reduce major pollution load.

i. Develop industrial auditing system to improve the industry and to introduce cleaner production technology in medium and large industries.

j. A complete CETP is required for long term intervention.

k. Separate drainage for rain water and wastewater for proper management.

l. Enhancement of reuse of solid wastes in a) Glue manufacturing; b) Making weaving mats/cheap carpets; c) Biogas; d) Fertilizer; e) Poultry feed; f) Handmade leather products, etc..

m. Introduce training for the workers addressing health, safety and other environmental awareness issues.

n. Facilitate backward linkages for the SMEs.

7.3 Horticulture Sector

Recommendations

a. At the national level there is a clear need for improved coordination between the different government agencies involved in this sector. Government should consider the need to develop comprehensive policy on the subject.

b. Efforts should be made to increase the involvement of local communities and farmers on the provision of education and training.

c. Take initiatives to improve the market management skills for effective and efficient wholesale and retail marketing and also make efforts on upgrading market facilities to facilitate the supply of higher quality produces/products.

d. Wholesale markets should investigate the feasibility of developing separate sections to handle horticultural crops that meet defined safety and quality standards.

e. Develop standards/guidelines for good practices at all stages of the supply chain and circulate among the stakeholders.

f. Attempts should be made to consider promotion of Good Agriculture Practice (GAP) and Good Manufacturing Practice (GMP) in the supply chain of horticultural produces.

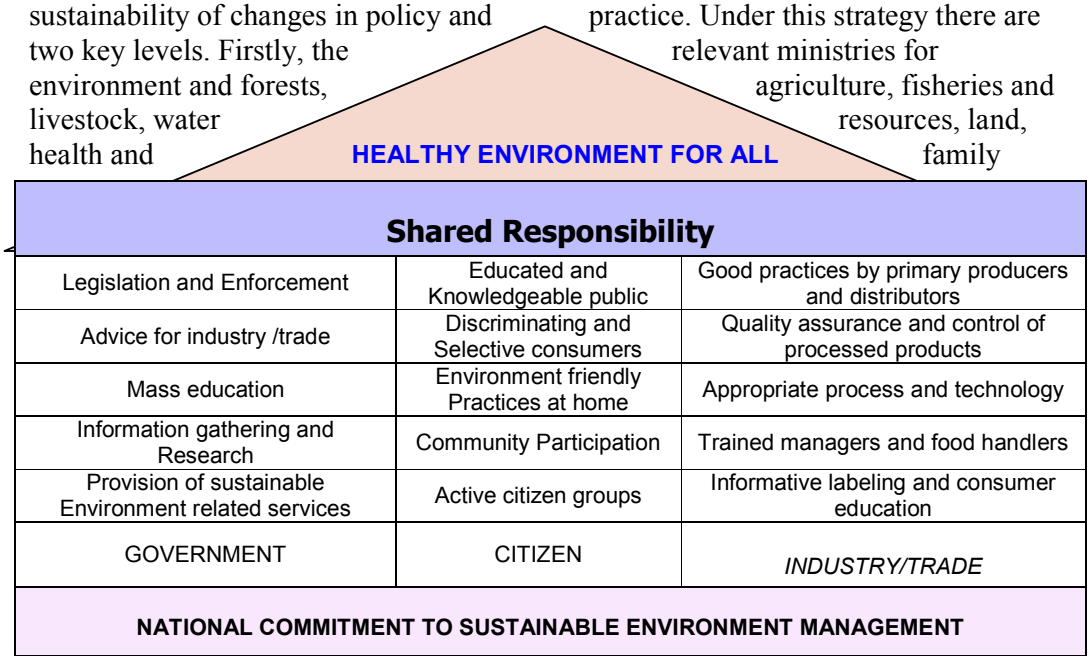
g. Introduce Integrated Crop Management (ICM) approach in the horticultural supply chain.

h. The use of crop specific awareness materials like leaflets with advice on the cultivation, handling and marketing of various crops following ICM techniques will give benefit to the stakeholders.

i. Physical infrastructure, particularly in the area of pack house, laboratory testing services and total quality management need to be put in place to respond effectively to address the environmental issue.

8.0 KEY/POTENTIAL PROJECT PARTNERS

Implementation of the mitigation strategy will rely on partnership and this will be based on clear set of principles. The partnership will address gaps and complement other partners whether providing fund or transferring technology to other stakeholders to address environmental degradation. Government agencies are vital for the sustainability of changes in policy and practice. Under this strategy there are two key levels. Firstly, the relevant ministries for environment and forests, agriculture, fisheries and livestock, water resources, land, health and family welfare along with mechanisms that would improve their coordination - including both the Planning Commission and Cabinet Division. Secondly the relevant line agencies in these sectors (environment, forests, agriculture, fisheries and livestock, water), etc. The Department of Environment under the Ministry of Environment & Forest should act as lead agency and collaborate with other partners. Healthy environment for all would be a shared responsibility for all partners.



Partnership could be built up among the following agencies/organizations:

- Public organizations (Ministries of Environment and Forest (MoEF), Land, Water Resources, Agriculture, Energy, Planning, Departments of Environment, Fisheries, Forest, Agricultural Extension, etc)
- Development partners (Support from GEF and Montreal Protocol Multilateral Fund, DFID, UNDP Regional Centers, NEP & IUCN, FAO, SDC and USAID.)
- WARPO; Research Institutions: BIDS, BMDA, Universities, CPD and NGOs
- Private sectors organizations and associations
- Civil society, and
- Local communities.

The criteria used for identifying some of the key project partners during this study include government and public institutions and private sectors players; including NGOs those who have some impact on the business enterprises. Other criteria may be used and all important partners may have not been mentioned but may be included later on. However, some of the potential key partners are listed under each sector head.

8.1 Fish & Shrimp Aquaculture Sector

- Department of Fisheries, GOB
- Department of Fisheries, Bangladesh Agricultural University
- Department of Zoology, University of Dhaka
- Department of Microbiology, University of Dhaka
- Department of Fisheries & Aquaculture, University of Dhaka
- Bangladesh Fisheries Research Institute, Mymensingh
- Fish Inspection & Quality Control (FIQC), Department of Fisheries, Khulna
- Department of Environment, Ministry of Environment & Forest
- Bangladesh Coast Guard
- Bangladesh Export Promotion Bureau
- Marine Academy, Chittagong
- Bangladesh Frozen Food Association (BFFA)
- BRAC
- Proshika

8.2 Leather Sector

- Tannery Association
- Worker Association
- Department of Environment
- Export Promotion Bureau
- Dhaka City Corporation (DCC)
- Dhaka WASA
- NGOs
- Back up and linkage businessmen and enterprises

8.3 Horticulture Sector

- Ministry of Agriculture

- Ministry of Environment & Forest
- Department of Agriculture Extension
- BARC
- Department of Forest
- Department of Environment
- Regional Horticulture Research Centers
- Academic institutions (BAU, DU, RU, etc)
- Fertilizer, pesticide, insecticide business associations
- Fertilizer, pesticide, insecticide producers/industries (Syngenta, Eskayef, CIBA-GIEGY, etc)
- Hortex Foundation
- BRAC
- PRAN-RFL Group

9. CONCLUSIONS

There are many ways in which environment is negatively affected during supply and production process of fish and shrimp aquaculture; leather; and horticultural products and the marketing chain. In all the three sectors, one who dares to keep the environment healthy has to be very careful and vigilant to ensure that the produces he/she is buying as raw materials for his/her products has been produced in an environmentally friendly way and that he/she follows appropriate protocols at the production centers and also take responsibility for proper disposal or recycling.

However, some of the practices deserve to be mentioned for all these three sectors. In the horticultural sector harvested produce may contain heavy metal through irrigation water or by washing using polluted water. Use of untreated manure can spread pathogens while imbalanced use of chemical fertilizers may degrade soils and pollute the water. Harvesting practices can have a major impact on both quality and safety if the produce harvested at immature stage or taken immediately after pesticide application. The indiscriminate and over use of pesticides and banned chemicals and their residual effects may have bad impact on human health, ecology and environment. Use of fertilizers in soils without testing the nutrient status and applying them without following the recommendations properly in horticultural crops is degrading the soil fertility alarmingly. Use of toxic chemicals/adulterants that contain poisons or deleterious substances in horticultural supply chain is unsafe and injurious to human health, biodiversity and environment.

Poor packaging materials and dirty vehicles can introduce physical and microbial contamination as can washing during marketing or the watering of leafy and other fruits and vegetables using dirty water. Marketing infrastructure is inadequate and unhygienic. Traders are constrained by poor market infrastructure, poor storage facilities, an inability to control the quality of transport and handling, and a lack of knowledge of post-harvest techniques. The challenges facing food chain are very complex and have expanded in recent times and many countries are struggling to effectively manage it. Managing the production process and the food chain so that the public has access to a safe produce and healthy environment requires an effective environment management system (EMS). This will set strategic direction for food control activities in the whole supply chain. The goal of this EMS is to safeguard the

quality and safety of the total food supply chain, leading to reduction in the incidence of food borne illness and quality of life and sustainable environment.

Changing practices to introduce environment friendly production system (like GAP) will require recognition that, firstly, farmers and traders need to be motivated to make change. That motivation will come primarily from increased incentives and reduced risk. Secondly, the availability of information and resources to enable those involved to make those changes is essential. Establishing regulations and then sitting back and waiting for them to be implemented can achieve little. Unless those involved see personal benefit in following rules and regulations they are likely to ignore them. Adoption of good agricultural practices and promotion of food safety as well as quality needs to consider the entire supply chain from producer to consumer. A supply chain approach thus involves detailed analysis of the factors affecting produce quality and the environment throughout the chain as has been briefly described in this paper with indication of improvement that could be implemented. Such improvements may involve training and awareness creation in addition to regulation. Donors could assist with pilot scale activities to demonstrate new approaches.

Similarly, there appears to be growing concern regarding the impact of leather on the environment and the health of consumers. The general public and the authorities are paying increasing attention to these areas, and additional regulations are being developed accordingly. All aspects from origination right through to disposal have to be taken into account to investigate the ecological and toxicological impact of processes and products.

There has been a continuous shift of leather, footwear and leather goods production from developed to developing countries mainly caused by price competitiveness. Bangladesh has not yet been able to make a significant breakthrough in its leather sector through diversification and improvement of the quality of leather products. Bangladesh needs to improve the quality of leather products for better market access and economic benefits from the international export market.

Given the highly polluting nature of the leather industries, the dependence on foreign market and the realization (albeit gradual) that environmental issues are growing in importance, the time is ripe to initiate a multi-stakeholder dialogue between the private sector industry owners, local citizens affected, environmental regulators, health professionals, government export promotion officials, NGOs and media within Bangladesh. Such a dialogue would aim to develop ways to solve the pollution problem in a manner acceptable to all, including the industry owners, local people and environmental regulators. The inclusion of the importers into such a multi-stakeholder dialogue would enhance its effectiveness.

Future market access will increasingly depend on the product quality as well as compliance with international social and environmental standards. This will need treatment of waste and adoption of cleaner production technologies. Compliance with the international social acceptability standards like SA 8000 will also be required. The compliance will however require capacity building of the Standard Institutions in the Government as well as the private sector.

The new export policy of Bangladesh and the Country's Fifth Five Year Plan (FFYP 1997-2002) have identified leather and leather products industry as one of the thrust

sectors to receive priority. While quality improvement, up gradation of technologies, incentives for investment in the leather sector are emphasized in the development plan and export policies, the issues of pollution control and labor standard have been largely overlooked. The tannery owners, who reap the lion share of the benefits, are not much concerned about the problem.

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