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CIRDAP

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ASIA-PACIFIC JOURNAL OF RURAL DEVELOPMENT

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Extensive Shrimp Aquaculture in Coastal Areas of Bangladesh: Socioeconomic and Environmental Perspective

Md. Arif Chowdhury*, Yahya Khairun** and Ganesh P. Shivakoti***

Abstract

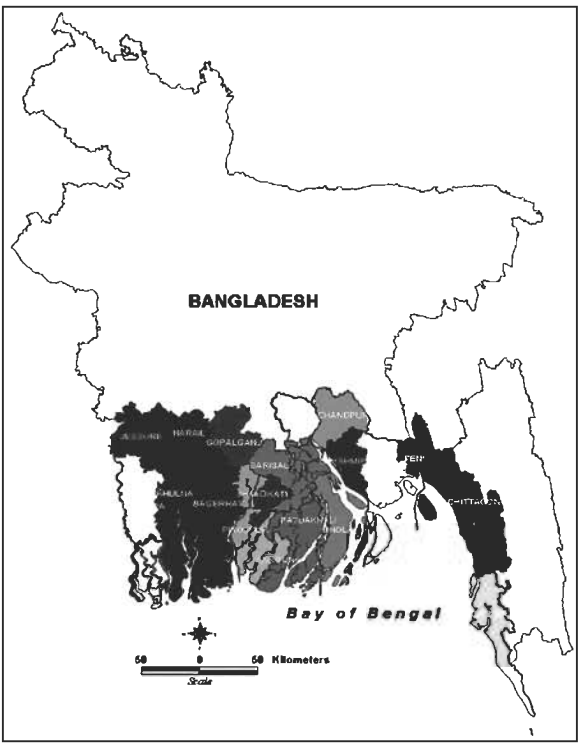
The study makes an assessment of present status of shrimp farming and its environmental and socioeconomic impacts in coastal region of Bangladesh by using data available in journals, reports and conference proceedings. The FAO statistical database software 'Fishstat Plus-2010' was used to analyse the shrimp production trend of Bangladesh in comparison with world production. Shrimp farming is an important economic activity with significant contribution to the foreign exchange earnings, employment generation and proper utilisation of local resources. The total area of shrimp farming was 246,198 ha which constituted a total production of 67,197 metric tons in 2008 standing eighth highest shrimp producer in the world. It contributes 8 per cent of country's total export earnings. Farmers follow traditional extensive method, and, thus, generally do not follow recommended management practices such as proper pond preparation, predator control and usage of artificial feeding. The rapid horizontal expansion of this sector during last few decades have, however, contributed to negative socioeconomic and environmental impacts such as soil salinisation, biodiversity loss, water pollution, occurrence of shrimp disease, loss of grazing lands, reducing agricultural lands, displacement of labour employed by rice sector and social conflicts. Consequently the shrimp farming has fallen under threat of sustainability together with the shrimp industry itself as well as coastal sustainable development. Though shrimp farming is the best option in coastal salty land, proper planning of land usage including minimisation of conflicts over land tenure and identifying proper strategy for vertical expansion in terms of increased shrimp production as per unit area for better employment and foreign exchange earnings can be recommended in achieving sustainable shrimp aquaculture development in coastal areas of Bangladesh.

1.0 Introduction

Coastal aquaculture of Bangladesh mainly composed of shrimp and fin-fish farming is an important economic activity with significant contribution to foreign exchange earnings, employment generation and proper utilisation of local resources (Alam et al. 2007; Chowdhury et al. 2006; Wahab 2003). Recent practice of shrimp culture inside the embankments, despite its adverse environmental effects and serious social problems, has been boosting the national economy. Major shrimp culture activities are centred on Sathkhira, Khulna and Bagerhat districts in the south-western region and Cox's Bazar District in the south-eastern region. Integrated shrimp, finfish and paddy cultivation are very common in south-western coastal districts (Azad et al. 2007). Alternate shrimp and salt production are primarily located in the Cox's Bazar District (Hossain 2001).

* Lecturer, Centre for Marine and Coastal Studies, Universiti Sains Malaysia (USM), Malaysia. E-mail: arifait@yahoo.com
** Director, CEMACS & School of Biological Science, USM, Malaysia.
*** Professor, Natural Resources Management, Asian Institute of Technology (AIT), Thailand.

Figure 1: Coastal Zone in Bangladesh



Source: ITCZM Bangladesh 2003

3.0 Historical Development of Shrimp Farming in Bangladesh

Shrimp culture involving stocking of wild fry in ponds is probably centuries old in Bangladesh. It is believed that traditionally shrimp farming had started after 1900 in the Sundarban (the world largest mangrove) area of Bangladesh in limited scale (Paul 1995). In the brackish water shrimp-farming sector, the target species for culture is Penaeus monodon locally known as Bagda and English name is black tiger shrimp.

Shrimp aquaculture has developed rapidly in recent years in many countries in the world including Bangladesh. Many factors are responsible for rapid expansion of shrimp aquaculture mainly high profits, high demand in international market, foreign currency earning and employment of poor coastal people having significant positive aspects, but it has created many problems including environmental degradation and social conflicts. According to Ahmed et al. (2002), traditional coastal shrimp farming locally called gher farming has century old history, with trapping shrimp fry within paddy fields during January to July for raising the shrimp and after that used to go for paddy cultivation in very low salinity. Further initiatives were taken during 1970s in response to extended global demand for high quality sea food. A historical development of shrimp farming is presented in Table 1.

Figure 1: Coastal Zone in Bangladesh

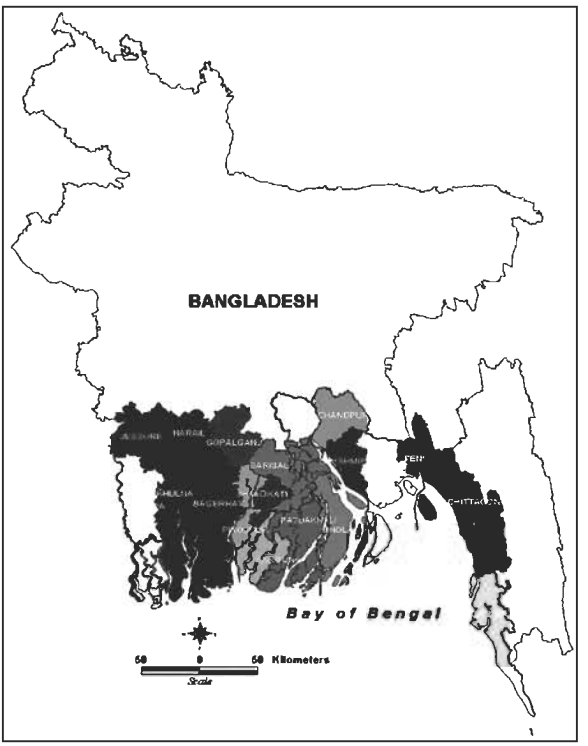


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Table 1: Milestone in the History of Shrimp Aquaculture Industry in Bangladesh

1950-60[1]	Shrimp farming originated in tradition gher method, about 100 paddy-cum-shrimp farms were in operation in Shatkhira District in 1950. Production was very low, harvested both for domestic consumption or sell at local market
1970[2]	Shrimp farming was initiated as an economic activities in coastal region
1980[3]	Shrimp culture in extensive method was expanded dramatically in unplanned manner
1990[4]	Semi-intensive shrimp farming was initiated in south-eastern region and shrimp hatchery established, this was quickly supplementing the shrimp seed from natural sources
1994[4]	Semi-intensive shrimp farms did not sustain due to outbreak of viral disease. Farmers imported shrimp fry from Thailand and Taiwan.
1995[3]	Shrimp farming area has been expanded from less than 20,000 ha in 1980 to about 140,000 ha in 1995
1996[5]	Extensive shrimp farms in south-western part of Bangladesh, where almost 75 per cent are located, were affected by disease
1997-98	The total shrimp production dropped mainly due to disease, and semi-intensive shrimp farms stopped their production
2000[4]	Wild seed collection was banned by adopting a government regulation, but lack of proper guidelines and lack of manpower it was poorly implemented
2000-	to date Try to find out new improved closed culture system to reduce the disease risk, especially poly culture of shrimp with finfish

Source: [1]Nuruzzaman (1993); [2]Chowdhury and Muniruzzaman (2003); [3]Wahab (2003); [4]Mazid (2003); [5]Hossain (1997)

4.0 Culture Techniques

Different types of culture systems are practised for shrimp farming in Bangladesh. Most of the farmers follow traditional method and generally do not practise well-defined pond preparation, liming, fertilisation, predator control or artificial feeding. Water exchange is irregular, water management is poor, and production is very low. Different authors quoted different production rates as 146.39 kg ha-1 yr-1 in different categories of farming systems by Alam et al. (2007); 155 kg ha-1yr-1 by Chowdhury (2006); 70-250 kg ha-1 yr-1 by Karim (2003); 97-226 kg ha-1 yr-1 by Hoq et al. (1995) and 62-206 kg ha-1yr-1 by Rahman et al. (1994). One key management feature of aquaculture system is the intensity of the production. The term intensity refers to a combination of two variables: the amount of biomass harvested from a specific area and the degree of management to enhance production. All aquaculture system can be defined with regard to intensity and placed on a continuum from extensive to super-intensive (Pillay 1990). According to this definition, Bangladesh shrimp farming is extensive to improve extensive.

In most areas, marine shrimp aquaculture is practised in low-lying tidal flats within polders constructed by Bangladesh Water Development Board (BWDB). These polders are designed and constructed for reclamation of coastal land for agricultural purposes. However, many polders now find dual uses for agricultural farming and shrimp farming

generally in rotation. In the high saline areas in Cox's Bazar District (south-eastern part of Bangladesh), marine shrimp culture is rotated with salt production. According to copping pattern Bangladesh, shrimp farming is categorised as follows:

4.1 Alternate Shrimp-Paddy Farming

The shrimp-paddy farming system is an integrated process of shrimp farming, coexisting with salt tolerant rice cultivation, thereby maximising the benefits of the same land area. This system is very common and popular in south-western Bangladesh (Azad et al. 2009). In the traditional system, paddy fields are enclosed by embankments with narrow inlet and outlet channels, controlled by sluice gates or wooden plates. At the beginning of the rainy season, farmers rely on the heavy monsoon rains to flush the salts out from the system before planting the wet season rice crop. Fish excreta increase the availability of many nutrients in the field and directly contribute to increased production. Sometimes trenches and dykes are constructed in paddy fields to shelter the shrimps from shallow waters. Rice is transplanted to grow between September to December, which can coincide with shrimp cultivation or after shrimp cultivation.

4.2 Alternate Shrimp-Salt Farming

In south-eastern region, both shrimp-rice and shrimp-salt are being practised. The salt beds are encircled with low-earthen dykes, and saline water is brought into the farm, preserved and evaporated during dry season between December and April. Because of rainfall, the farmers cannot produce salt during May to early November, and then the farmers usually go for shrimp farming.

4.3 Year-round Shrimp-only Farming

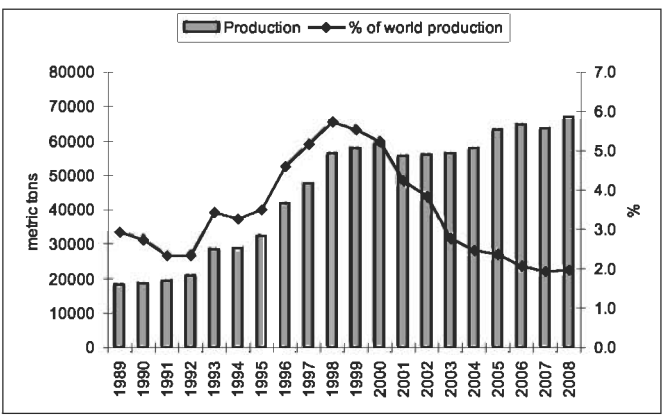
This type of culture pattern takes place where the salinity of 3-15 ppt exists year-round in nearby rivers, a common method of farming in the extreme south-western zone and areas closer to the Sunderbans. In this method, the shrimps are cultured for 9-10 months starting from January or February to the end of October. Multiple stocking and harvesting are done during this period. Most farms employ improved extensive management with a negligible number practising semi-intensive culture methods.

5.0 Bangladesh Shrimp Production and World Perspective

According to FAO (2010), Bangladesh shrimp production has increased significantly since 1989 with 18,235 metric tons and reached to 67,197 metric tons in 2008 including few worst years during 2001 to 2004, due to international market fall and disease problem. Several primary forces have driven the rapid expansion of shrimp aquaculture; they include potentially high profits, world demand for high-value seafood products, increasing demand for farmed shrimp due to limitations and fluctuations in supplies from capture fisheries and foreign exchange and employment in poor coastal areas. In last 20 years world brackish water shrimp aquaculture production has increased by 5.47 times in weight and 3.6 times in value, increasing the world production from 620,739 tons in 1989 to 3,396,010 tons in 2008 with estimated value of US$3.94 billion and US$14.29 billion, respectively. Bangladesh shrimp industry could not achieve the same fashion of production increment. Bangladesh production in Figure 2 shows that the percentage of contribution to the world production is decreasing. Farmed shrimp now contributes more than 50 per cent to the world total supply of shrimp, and this share is growing up. Capture shrimp production was 3,120,691 tons in

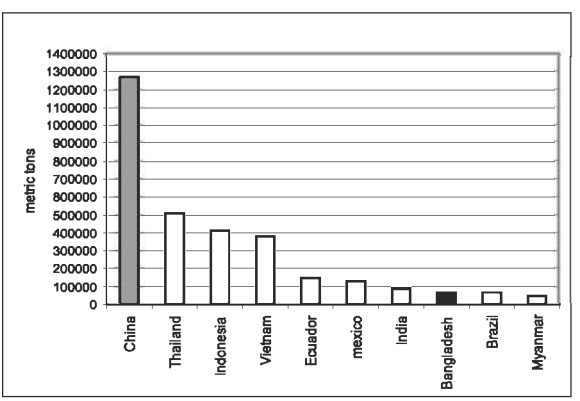
2008, steady in last few production years. More than 69 countries in the world are involved in shrimp aquaculture production though ten producers contribute more than 92 per cent of the world production (Figure 3). The world top ten shrimp producers in 2008 were China (37.3%), followed by Thailand (14.9%), Indonesia (12.0%), Vietnam (11.2%), Ecuador (4.4%), Mexico (3.8%), India (2.6%), Bangladesh (2.0%), Brazil (1.9%), and Myanmar (1.4%). The major shrimp-producing countries including China, Thailand, Indonesia have gone through the 'Boom and Bust Cycle' of shrimp production with struggling process due to viral disease and international market price fluctuations. Medium shrimp producing countries like Bangladesh, Myanmar and India are involved with less intensive culture methods and stable production having minimum environmental impact. The main farmed species are whiteleg shrimp (Penaeus vannamei), black tiger shrimp (P. monodon), and banana shrimp (P. merguiensis and P. indicus). Due to disease problem in tiger shrimp production farmers have shifted culture species into whiteleg shrimp after 2001, presently more than 80 per cent of world farmed shrimp production comes from whiteleg shrimp Bangladesh shrimp production is mostly based on black tiger shrimp.

Figure 2: Bangladesh Coastal Shrimp Aquaculture Production during the Year of 1989-2008



Source: FAO 2010

Figure 3: Top Ten Shrimp Producing Countries in the Production Year 2008



Source: FAO 2010

Bangladesh shrimp farming production is very low and sometimes unstable. After few initiative of semi-intensive culture system until 1994, there has been rapid fall after devastating viral disease spread out into all semi-intensive culture system. For this reason all semi-intensive farms have stopped their production. These all semi-intensive farms either have been kept fallow or are producing other fin fishes (Chowdhury and Muniruzzaman 2003).

6.0 Environmental Impacts of Shrimp Farming

6.1 Habitat Destruction

Shrimp culture has been expanded rapidly since 1980s and led to environmental degradation such as destruction of mangroves, pollution of tidal rivers and inshore waters, salinisation of soils, loss of grazing grounds for livestock and loss of freshwater sources for drinking water. Vast areas of low-lying floodplain have been converted into shrimp farms, and there is concern that adverse environmental effects on wetland systems are making it unsustainable. Unplanned shrimp-farming expansion has reduced the natural wetlands and blocked fish migration routes and affected biodiversity (Williams and Khan 2002). Once excavated and converted the coastal habitat into shrimp ponds are not easily restored to their natural state or function because continued storage of salt water in shrimp ponds alters the chemical properties of the pond soil, making it unsuitable for crop production in the future (Salequzzaman 2001). Accordingly the water parameters like BOD, hardness and some other factors increased in every steps of development of the shrimp aquaculture practice, besides, soil Fe is continuously increasing with every improvement of shrimp aquaculture systems increasing pollution to the coastal shrimp farm and its surrounding environment.

6.2 Mangrove Destruction

Mangrove forest is an important part of the tropical coastline and essential for healthy coastal ecosystems. It is important in nutrient cycling and supporting large biodiversity such as providing habitat and highly productive breeding and nursery grounds for many species of shrimps, crabs, finfish and mollusc (Boyd et al. 1998; Hossain 2001). Mangroves are now well-documented for various products and amenities which include products for fuel construction, fishing, agriculture, tanning, food, drugs and beverage, paper production, and coastal tourism (Primavera 1994a). The destruction of mangrove forest has implications on sustainability of many coastal activities including aquaculture and other human activities through coastal water quality regulation and shoreline protection from erosion and cyclone (Phillips 1998). Reduction of mangrove forest in the coastal area can greatly affect the ecosystem of the region. It is now realised that aquaculture development should not proceed indiscriminately in mangrove areas. There is an example that one hectare of mangrove can yield yearly 767 kg of wild fish products, compared to the lower production range of 100-500 kg ha-1 yr-1 by extensive culture system (Macintosh and Phillips 1992). Conversion of mangrove areas into shrimp ponds and other forms of land uses have resulted in economic benefit to some people, but at the same time created irreversible long-term impacts to the coastal environment.

Bangladesh shrimp farming has been credited for protection of mangrove forests. This study also identified that mangrove forest in coastal Bangladesh were not encroached by shrimp farmers since its rapid expansion in last decades. The remote sensing investigation by Shahid and Islam (2003) using remote sensing data reveals that the Sunderbans mangrove forest remained unchanged from 1975 to 2001.

6.3 Wild Fry Collection and Biodiversity Loss

Natural shrimp post larvae (PL) collection is a big concern of biodiversity loss when farmers use these natural collected PL for their pond stocking. Although hatcheries fries are available and supply are sufficient, but wild fry is still being used. It is presumed by farmers that natural collected PL are more disease resistance and fast growing compared to hatchery produced PL (Chowdhury 2006), but no research has so far been made in this regard. Every single species of harvested P. monodon fry from natural sources is responsible for the destruction of more than 100 numbers of other species of shrimp, zooplankton and fishes (Deb et al. 1994). By-catch of shrimp PL has been estimated by Primavera (1998) in different countries (Table 2). Azad et al. (2007) has reported that 15 per cent by-catch is destructed by dragnet operated fry collectors. According to Rashid (2000) around 99 finfish and other shrimp larvae are discarded for collecting a single shrimp PL in Bangladesh.

Table 2: By-Catch of Shrimp Post-Larvae in Different Countries

P. monodon: By-catch	*Habitat and country*
1:66-157 crustacean + fish fry	Littoral waters, Bangladesh
1:475 juvenile shrimp	Mangrove inlets, Malaysia
1:15-330 penaeid juveniles	Mangrove water ways, Philippines
	Shore waters, Philippines
1:24 penaeid post larvae	Coastline, India
1:47-999 prawn+fish fry	River and estuary, W. Bengal, India
1:15-22 shrimp+21-32 fish + 34- 46	Sunderbans, W. Bengal, India
zooplankton 1:10 fish + shrimp larvae (biomass	

Source: Primavera (1998)

Despite the growth of hatcheries in Bangladesh, the demand for natural fries is still high. Though in 2002 the government introduced a ban on the harvest of PL from natural sources to conserve biodiversity, it has not yet been effected to be implemented (Williams and Khan 2002). In the South-west, many women and children that use push nets are discarding by-catches on the ground. As it is one of the income sources of rural landless in coastal region, about 0.42 million people are involved in shrimp PL collection along the estuaries and coastline of the Bay of Bengal (Azad et al. 2007). Currently hatchery produces 1.08 billion shrimp PL yearly from more than 70 hatcheries (DoF 2011) which are situated in the south-eastern part of Bangladesh. According to DoF (2011), one billion shrimp PL are being collected from natural source which is 50 per cent of total demand of PL.

Due to lack of law enforcing manpower and alternative livelihood of fry collectors, the Government of Bangladesh cannot enforce to stop natural PL collection. Government can train the fry collectors on biodiversity conservation to minimise the biodiversity loss. In many places fry collectors do attempt to return by-catches to the water, which is the result of awareness campaigns of some NGOs working for environmental conservation in the coastal area of Bangladesh.

6.4 Salinisation

Increase in soil salinity by shrimp farming is an issue in coastal zone of Bangladesh (Azad et al. 2009). Factors related to salinity intrusion in coastal lands are mainly due to direct inundation of saline water, tidal flooding, and upward movement of saline water in dry season. Shrimp farms retain saline water for prolonged period which enhance seepage from shrimp farms to adjacent ponds, paddy plots and other water bodies. For example, seepage contributed 38 per cent of salt losses while 33 per cent by discharge water, 6 per cent by sediment and 23 per cent remained at pond harvest could have been recycled (Braaten and Flaherty 2001). The construction of shrimp farms and channel system can lead to changes in local hydrology which increases salinity in surrounding areas through inflow of saline water and discharges of saline effluents or diversion of fresh water flows.

This salinisation has degraded potable and agricultural water, which has created conflicts with other land users and residents (Phillips et al. 1993). Salinisation of groundwater also are reported in many countries, due to pumping of large volume of underground water which leads to lowering the groundwater levels and penetrates salt and increases salinity (Primavera 2006). These effects are reported in a number of countries and regions, including Taiwan, Republic of China, Thailand, Indonesia, Bangladesh, the Philippines and Ecuador (Primavera 1994b; Dierberg and Kiattisimkul 1996). Over 30 per cent of total cultivable land of Bangladesh is located in coastal zone, but all are not being used for crop production due to soil salinity (Wahab 2003). The salt water intrusion has caused many problems in coastal region of Bangladesh like loss of crop production, reduced availability of fodder for livestock, fresh water for drinking and bathing etc. Long-time inundation of land by salt water prevents free nitrogen fixation and thus mineralisation is halted and land fertility reduced rapidly within 1-2 years (Ham and Nandy 1990). Saline soil does not support plant growth, primarily for excessive salt in the soil solution as it prevents absorption of moisture and nutrients in adequate amounts due to 'higher osmotic pressure'. As a result, crop yields are shrinking, reducing the size of freshwater bodies, decreasing the grazing fields, and stunting the growth of trees (Salequzzaman 2001).

6.5 Disease

Recently viral and bacterial diseases hit shrimp farms in different countries causing devastating losses of millions of dollar. It has caused high mortalities and severe damage to the shrimp culture industry. Guzman et al. (2000) have listed different types of common shrimp diseases (Table 3).

Table 3: Most Common Shrimp Diseases

i) Bacterial disease	Vivriosis, Filamentaous bacterial disease, Necrotizing hapatopancreatitis (NHP), Chitinolytic bacterial shell disease, Red disease, Mycobacteriosis and Rickettsial infection
ii) Viral disease	Monodon baculovirus disease (MBV), Baculovirus penaeid vieus (BP type), White Spot Disease (WSD), Taura syndrome virus disease (TSVD), Shrimp iridovirus disease (IRDO), Yellow head virus disease (YHV), Ravdovirus disease of shrimp ((RPS) hepatopancreatic parvovirus, and Infectious hypodermal and haematopoietic necrosis virus (IHHNV)
iii) Fungus disease	Larval mycosis, and Fusarium sp
iv) Protozoa disease	Ciliate disease, Gregarina, Microsporidia, and Haplosporidian
v) Other common shrimp disease	Algal overgrowth in shrimp body, Black dead, Black spermatophore disease, and Nematomorph parasitism

Source: Guzman et al. 2000

Hill (2002) reported that at least 22 countries are now affected by White Spot Disease (WSD) which are: Bangladesh, China, Colombia, Costa Rica, Ecuador, Guatemala, Honduras, India, Indonesia, Japan, Korea, Malaysia, Mexico, Nicaragua, Panama, Peru, Philippines, Sri Lanka, Taiwan, Thailand, USA, and Vietnam. The WSD first emerged in 1991 or early 1992 in Taiwan and rapidly spread out in mainland in China in 1992; in 1993 it was observed in India and in 1994, the disease spread out in Thailand and subsequently spread to all shrimp producing countries (Hill 2002). The common syndrome of WSD is reported to show a rapid reduction in food consumption, becomes lethargic in normal movement and is having loose cuticle with white spots (Sangamaheswaran and Jeyaseelan 2001). The disease outbreaks have caused mass mortalities of cultured penaeid shrimp worldwide (Sangamaheswaran and Jeyaseelan 2001; Otta and Karunasagar 2003). Black tiger shrimp farming in Taiwan grew rapidly at 80,000 metric tons in 1987 and then collapsed in 1988, production dropped to less than 20,000 metric tons, due to disease caused by Monodon baculovirus (MBV) (Lin 1989). Presently MBV is not considered major problem to shrimp grow out ponds, but WSD is now major threat for shrimp aquaculture in Asia (Otta and Karunasagar 2003).

In Bangladesh shrimp disease first occurred in semi-intensive shrimp farms in Cox's Bazar region in 1994; disruption of production continued until following years and in 1996 disease transmitted to Khulna region and about 90 per cent of the farms were affected severely (Chowdhury and Muniruzzaman 2003). In 1997-98 the total shrimp production dropped mainly due to disease and semi-intensive shrimp farms stopped their production. In 2001, disease again broke out with a reduction of 20 per cent of shrimp production in high farms intensity Khulna, Shatkhira and Bagerhat districts of Bangladesh (Chowdhury and Muniruzzaman 2003). Due to rapid expansion of unplanned shrimp farms, disease has now become a serious threat to the coastal shrimp farming in Bangladesh. It severely affects the shrimp production. Research on shrimp disease in Bangladesh has limited scope due to low facilities of laboratory, equipments and enough funds.

Viral and bacterial diseases of shrimp now dramatically affect production and thus profitability problem makes shrimp farming unsustainable (Chowdhury 2006). For sustainability of shrimp farming, the industry should aim to undertaking ecologically sound and management practices following the principles of 'precautions is better than cure'. More research is needed for ecological sound management system to overcome disease problem.

7.0 Social Impacts of Shrimp Farming

7.1 Positive Impacts

Shrimp farming is the best option for development in poor coastal areas with saline soils and has the potential for smallholder income or provides well paid employment. Shrimp farming creates relatively high-level of employment per unit area in comparison to other alternatives. Though shrimp farming itself is less labour intensive than that of rice farming but overall labour requirement of shrimp industry when considered supply chain is much higher than that of rice production, because, the shrimp industry consists of four distinct sub-sectors comprising shrimp farms, shrimp hatcheries, feed mills, and processing plants (Islam 2003). All these sub-sectors are linked together to constitute vertical integration of activities where the ultimate goals is to export shrimp products. Shrimp farms are primary sub-sectors of this industry and others depend largely on the growth and sustainable production of shrimp farms. Shrimp farming has created a new job in many shrimp-producing countries. About 1.15 million shrimp farmers and 0.42 million fry collectors in Bangladesh are directly involved in this sector for their livelihoods (Azad et al. 2007; Mazid 2003).

Shrimp culture has also opened new arena of employment pattern for rural women in Bangladesh. Women in rural area had no income-generating activities before rapid expansion of shrimp farming in coastal zone; the rural women used to prefer household-based activities such as threshing, drying crops, grading and processing agricultural crops, feeding and rearing of livestock and poultry, in addition to the cooking family meals, cleaning utensils and looking after children. Shrimp fry collection is also an important source of employment for rural women and children (Azad et al. 2007).

7.2 Negative Impacts

The shrimp aquaculture does not impact only those who are directly involved with this, but also others those who live and work in the shrimp-farming area. There are several social impacts associated with unregulated shrimp farming. These are mainly: loss of goods and services, food insecurity, land conversion and loss of livelihoods, social conflicts and violence

7.2.1 Loss of goods and services

Coastal resources have provided various products and services for coastal communities (Primavera 1994a). But it might be threatened when it is over-exploited. Recent development of shrimp farming in mangrove area has created negative impacts on coastal community, despite the direct benefits of mangroves for fuel wood, woods for fishing

boat, housing construction materials and medicine. More than 90 per cent local community is affected by deforestation of Chokoria-Sundarban in Bangladesh (Hossain et al. 2001). The nature protection and protecting the lives and properties by mangroves during cyclone and storms are still underestimated.

7.2.2 Food insecurity

The shrimp aquaculture has negative impact on food security for coastal population because cultured shrimps are luxury foods and exported into industrialised countries, not available in local market due to high market price. Moreover, shrimp farms use high amount of fishmeal which use fish, by-catch, trash fish which were used for human consumption by poor people in many countries. Naylor et al. (2000) has estimated the ratio of wild fish with fed farmed fish, some 2.81 kg of wild fish are being used to produce required amount of fishmeal for 1 kg of farmed shrimp production. In many countries, small-scale artisanal fisheries were main income and protein sources for coastal people. Increasing demand of fishmeal may result over fishing and make unsustainable of natural fishery resulting in food insecurity. Another reason of food insecurity is depletion of natural fish due to extensive natural fry collection. Though hatchery fry are available in many countries but in Bangladesh, shrimp farmers are still using wild fry as farmer's belief that wild fry is fast growing than hatchery fry. But excessive pressure on natural fry can endanger capture fishery, which further creates protein insecurity of local poor community, but it's yet to be quantified.

Unplanned development of shrimp farming in Bangladesh has affected the production of rice, vegetables, fruits, trees, poultry and livestock in the coastal region (Islam 2003). Farmers who converted good rice fields into shrimp ponds are reported that they felt greater food insecurity due to lower rice production (Ahmed et al. 2010). Decline in the number of livestock due to decreasing of grazing lands by shrimp farming in the Khulna region of Bangladesh makes protein deficiency. Rapid expansion of shrimp-farming hampers not only valuable protein source for local people, but also other agricultural production due to conversion of crop production into exportable shrimp making food-insecurity for coastal people in many countries. The exact figures of losses are not well-documented.

7.2.3 Land conversion and loss of livelihoods

Coastal zone in Bangladesh like other countries, residential and agricultural lands are being converted into shrimp farms. Many common pool resources like mangrove forests and wetlands are also converted into shrimp ponds in recent years. As a result many of the poor people who depend on common pool resources for their livelihoods are eventually displaced. Many shrimp farmers are rich and come from cities, even big companies; they hire skilled labour from outside and take lease of public land for shrimp farming which previously were used as a common resources for the livelihoods of poor people (Chowdhury 2006).

In Bangladesh coastal lands including paddy lands, grazing lands and mangroves are being used for shrimp farming (Islam 2003). Extensive shrimp farming provides limited

employment opportunities for coastal residents. A study on shrimp farming in Bangladesh shows that cultivating 100 acres land for growing rice employs 50 workers, but cultivating shrimp in extensive culture on the same land employs only 5 workers, consequently it displaces 40 per cent area and some 300,000 inhabitants of south-western Khulna region into the overcrowded cities of the country (Greenpaece 1995). A recent study also estimated that 122 person-days ha-1yr-1 and 116 person-days ha-1yr-1 are employed by traditional (extensive method) shrimp-rice and shrimp-only farming system, respectively, and it cannot absorb available large volume of local labour force (Chowdhury 2006). Employment can be increased 2 to 3 times more through converting shrimp farms into semi-intensive/intensive culture in sustainable way.

7.2.4 Social conflicts and inequity

The outsiders including rich investors, multinational companies, and national and local elites control the shrimp industry. In this context local people in coastal areas in most of the countries are disadvantaged. The unplanned shrimp culture expansion has led to social conflicts over land tenure and user rights, leading to marginalisation of small rice farmers, who have been forced to lease their lands to large shrimp farmers (Islam 2003). Many poor paddy farmers are forced to either sell or lease out their lands for shrimp culture by influential person. A recent study in south-western coastal Bangladesh shows that around 60 per cent of local people (including shrimp farmers) do not support shrimp aquaculture as they think their land fertility is decreasing due to intrusion of salinity (Chowdhury and Shivakoti 2005).

The coastal belt of Bangladesh is always the subject of debates on law and order situations. There are many incidents of violence in connection with shrimp farming especially on land use. In most cases, outsiders always try to acquire land and this process also results in increased corruption among the members of law enforcement agencies (Chowdhury 2006). In many times outsider do not repay lease money properly. Control of large shrimp farms by outsiders is the prime cause for social conflicts and deteriorating law and order situation in rural coastal areas. The reason might be limited access of law-enforcing agencies as the rules and laws in shrimp aquaculture strategies are not straightforward. The impacts of shrimp farming mentioned above have been reported, but few are well-documented. In many cases it is unclear whether shrimp farming is the major cause of social impacts in coastal region. However, these are very serious issues for sustainable development of shrimp farming and need further research.

8.0 Conclusion

All the diversified issues discussed in this article for shrimp aquaculture development in Bangladesh have posed challenges for effective and sustainable development of the industry. In view of the increasing need and pressure for environmental conservation and social equity, emphasis is now laid on developing socially oriented and environment-friendly aquaculture. Currently the shrimp industry suffers from significant production inefficiencies and is exposed to important social and environmental risks. There are frequent conflicts on the coastal lands for paddy, shrimp, salt, mangrove plantation, cattle

grazing, freshwater supply for agriculture etc. A clear cut land use policy based on topography, tidal inundation, water salinity and soil quality is lacking. No area has been specifically assigned for shrimp culture, and there is no effort in assessing appropriateness of an area for one or other type of farming practice. Many of the conflicts that occur in the shrimp polders are related to land tenure. Coastal zoning would improve land-use planning, minimise conflicts over land tenure and identify appropriate areas for shrimp farming and areas that need to be protected. In addition, the industry urgently needs a long-term strategy in order to respond to emerging trends in the competitive global market place and reduce its exposure to the inherent risks currently facing the shrimp sector. The development strategy should also incorporate the need for food security in the coastal zone, equitable rural development, disease control, bio-diversity and sustainable use of resources and make provision for input from all stakeholder groups. Vertical expansion of shrimp culture in terms of increased production as per unit area rather than expanding horizontally can improve land-use efficiency. This expansion can be done in scientific, well-planned, well-managed and sustainable way. More research is needed to develop an improved model which is environmentally sound, economically viable and socially acceptable.

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Challenges and Opportunities for Agrarian Transformation and Development of Agribusinesses in Fiji

Sunil Kumar* and Jagdish Prasad Bhati*a

Abstract

More than 45 per cent of Fiji's population lives in the rural areas and a significantly large proportion lives on meagre income. There have been many efforts in the past to improve the rural economy but only limited success has been achieved. There are many constraints that hinder sustainable development of this sector. A wide range of well-designed policies are needed to increase primary production and simultaneously develop sustainable agribusiness enterprises to add value and generate more rural income. This paper analyses these issues and delves on policy prescriptions to create the right macroeconomic environment to encourage agri-entrepreneurship to boost farm production through commercialisation. It further argues that strengthening agribusiness linkages with small-scale farmers would provide both the basis and means of rural economy contributing to poverty reduction and sustainable development.

I.0 Introduction

There is probably no greater challenge facing development planners in small island countries such as Fiji than the problem of agricultural development. Fiji is an island country located at the centre of the Pacific Ocean where the bulk of the population earns its living from employment in agriculture either directly or indirectly. A majority of these people are also poor-living on the bare edge of subsistence. A productive rural sector in Fiji would not only help alleviate rural poverty, it would also broaden the domestic market to absorb the output of a growing manufacturing sector in the country. In other words, strengthening of agricultural development programmes in Fiji islands would provide both the basis and the means for a broader and more rapid growth of the economy. But, the progress of agricultural transformation is very much dependent on the policies that the government implements to change the social and economic context within which agricultural production, marketing and consumption are being taken place.

Understanding challenges and opportunities of agricultural development in small island countries of the South Pacific region is important for several reasons. Firstly, it is now well-known that rural economic growth is important for poverty reduction, which has significant implications for progress towards the Millennium Development Goals (MDGs). Secondly, there are significant gaps in understanding the role of agricultural

* School of Economics, Faculty of Business & Economics, University of the South Pacific, Suva, Fiji Islands.
a Corresponding author. E-mail: bhati_j@usp.ac.fj

policy to stimulate growth in small island countries, in particular the linkages that determine the outcomes across the economy. In essence, there are basic ingredients that constitute a successful growth strategy, which are broadly understood but there is a need to deepen the understanding of this phenomenon. The policymakers need to understand how to apply appropriate development strategies in the economic and political context of the countries. Thirdly, greater efforts are needed to ensure that the correct development policies are applied with clear objective and outcomes.

This paper has two main objectives: (i) to highlight the major problems and challenges faced by agro-entrepreneurs in Fiji; and (ii) to identify the need-based agricultural development policies that essentially provide the framework that allows farmers to shift from traditional farming methods to more productive methods appropriate for the adoption of commercial farming systems on a sustainable basis. The paper would be of interest to agricultural policymakers, extension officers, and others who have interest in the development of rural sector economy, especially in small island countries like Fiji.

The paper is organised in five parts. The next part provides an overview of the agricultural sector in Fiji. The third part describes the factors hindering domestic production of agricultural commodities. The fourth part outlines a policy framework essential to overcome the constraints faced by farmers to boost agro-entrepreneurship. In this part, strategies for agricultural development and diversification are discussed which are essential to provide a socio-economic framework that would motivate farmers to shift from traditional farming systems towards a more productive commercial mode of production. The final part of the paper summarises the analysis and draws some concluding remarks for policymakers.

2.0 Overview of the Agricultural Sector in Fiji

To formulate development strategies for enhancing rural incomes and employment for a country, it is essential first to examine the rural scenario and understand the economic condition. In this section of the paper, a brief discussion is provided on: i) land and the people; ii) agricultural sector growth; and iii) Fiji's food import and exports balances.

2.1 Land and the People

Data about the basic features of Fiji's economy are presented in Table 1. As already pointed out, Fiji is an island nation located at the centre of the Pacific Ocean. The archipelago has about 330 small islands with a total land area of 18,333 km^2. Its two largest islands Viti Levu and Vanua Levu make up 88 per cent of the total land area. Fiji is a multiethnic country with a total population of 837,271 as of 2007 Census. Almost half the population lives in rural areas and earns its livelihood from agriculture. The population comprises of 56.8 per cent indigenous community, 37.5 per cent Indo-Fijians and 5.7 per cent other mixed communities, mainly people of Chinese and European descent. The density of population is about 46 persons per square kilometre. But most areas of the country are hilly and mountainous terrains with 30 per cent land area suitable for agriculture. Although overall average size of farms is 6.2 hectares, majority (56.2%) of total land holdings is comprised of small farms of size less than 2 hectares.

Contributions of different sectors of the economy to the gross domestic product of Fiji are also shown in Table 1. It is clear from the table that manufacturing and services sector are dominant but agricultural sector is also a major contributor to the economy. Agriculture (inclusive of fisheries and forestry) contributes around 13 per cent to the GDP.

Table 1 : Basic Features of Fiji's Economy

Particulars	*Amount*
Total population (2007 census)	837,271
- Native Fijians (%)	56.8
- Indo-Fijians (%)	37.5
- Others (%)	5.7
Rural population (%)	49.3
Total land area (km^2)	18,271
Agricultural land area (km^2)	5,480
Arable permanent crops area (km^2)	2,850
Average farm holding size (Ha)	6.2
Percent of total holdings below 2 hectares (%)	56.2
Land area by tenure system:	
- Land under communal tenure (%)	87
- State or public land (%)	6
- Freehold land (%)	7
Gross National Income per person (2007) (USD)	3,750
Structure of the economy:	
- Share of Agricultural sector in the Gross Domestic Product (%)	13.1
- Share of Industrial sector in the Gross Domestic Product (%)	21.1
- Share of Services in the Gross Domestic Product (%)	65.8

Source: Fiji Key Statistics, Fiji Islands Bureau of Statistics (FIBS), Suva, 2009

Roughly 87 per cent of total land holdings in Fiji are communal. The communal owners are the indigenous Fijians, who own the land collectively under the traditional Fijian clan system. The law and traditional conventions governing the collective ownership of land are quite complicated for an outsider (France 1969). The protocol governing the distribution of proceeds is also quite complex and sometimes controversial. The government owns 6 per cent of the land and the remaining 7 per cent is regarded as

freehold that can be bought and sold by individuals, where certain restrictions exist depending on the size of the land involved in sales. The land ownership pattern is frozen by law and native land sales are prohibited. The Indo-Fijians, who are the descendants of the indentured labourers brought from India by the British make up around 38 per cent of the population. Historically, Indo-Fijians dominate the agricultural sector since they were brought to Fiji to work in the sugar plantation of the Colonial Sugar Refinery Company (CSR) in 1879 (Kingi and Kompas 2010). About 90 per cent of the sugarcane crop (which is the main export crop of Fiji) is produced by Indo-Fijians who must lease the land from the Fijian communal system, where the option of buying such land does ot exist. Due to this ethnic divide, the land tenure issue has been a contentious one for a long time.

The land owned by native Fijians under the communal tenure is under the jurisdiction of the Native Land Trust Board (NLTB), a statutory authority created in 1940 under the Native Lands Trust Ordinance, now known as the Native Land Trust Act (NLTA). NLTB controls and administers lease dealings in native land. Such dealings, however, are regulated by the provisions of the Agricultural Landlord and Tenants Act (ALTA) of 1976, which is a successor of the Agricultural Landlord and Tenant Ordinance of 1966. The ALTA legislation aimed at providing a legal framework for leasing the native holdings for agricultural use.

2.2 Slow Growth of Agricultural Sector

Primary production includes agriculture (crops and livestock) production and forestry and fishery sub-sectors. Crops and livestock sub-sectors account for 77 per cent of primary sector while fishing activity and forestry account for 14.3 per cent and 8.7 per cent respectively. Within agricultural production, the main activity is crop production while contribution of livestock production is a minor component.

Further break-up of the primary sector to its components is shown in Table 2. The overall growth rate of the Fijian economy since early last decade has been 1.45 per cent on an average. Small island nations like Fiji have plenty of ocean resources which have a huge potential for growth. But the growth rate of fishing sector has only been 1.8 per cent on an average for the last 8 years. As regards to agriculture, the annual growth rate has remained low at around 0.6 per cent in the period shown. Annual growth rate of production of other crops has been positive and impressive at around 6.8 per cent. Similarly livestock production is also progressing well with a growth rate of 6.8 per cent, which shows that livestock production has good scope in Fiji.

Sugarcane is Fiji's main crop but farmers also grow other crops including staple food crops such as rice and root crops. Sugarcane alone accounts for more than fifty per cent of the total crop production. Interestingly, in Fiji sugarcane is mainly produced by Indo-Fijians and other crops (cassava, taro, sweet potato, coconut etc.) are mainly produced by the indigenous Fijians. Annual growth rate of sugarcane production had a negative growth in recent years (minus 3.45 per annum). Hence, the main cause of dismal performance of agricultural sector as a whole in Fiji was the negative growth rate of sugarcane

production. The main reason for which is the decline in sugarcane production at the primary level. The expiry of land leases and uncertainty about the renewal of leases in the future have been the main causes of this. On the whole, the land tenure problems since mid-1990s, declining milling efficiency and declining price of sugar recently due to the withdrawal of preferential prices have been the key reasons for the downward trend.

Table 2: Share of Different Sub-sectors in Agricultural Sector Production in Fiji (Gross domestic product at Factor Cost 1995 Prices)

Sub-sectors of agriculture	2003		2007		Average annual growth rate (2003-2007)%
	FJD 000	% share in total agriculture	FJD 000	% share in total agriculture	
1. Agriculture	334,620	77.00	342,372	77.44	0.58
Total crops	187,257	43.90	188,460	42.63	0.16
Sugarcane	121,070	27.86	104,340	23.60	(-)3.45
Other Crops	66,187	15.23	84,121	19.03	6.77
Livestock	19,019	4.38	24,213	5.48	6.83
Subsistence	120,528	27.73	122,756	27.76	0.46
Public Sector	7,815	1.80	6,943	1.57	(-)2.79
2. Fishing Sector	61,959	14.26	66,310	15.00	1.76
Fishing	33,465	7.70	37,270	8.43	2.84
Subsistence	27,552	6.34	28,061	6.35	0.46
Public Sector	942	0.22	979	0.22	0.98
3. Forestry sector	37,997	8.74	33,429	7.56	(-)3.00
Forestry	20,736	4.77	15,945	3.61	(-)5.78
Subsistence	16,626	3.83	16,934	3.83	0.46
4. Public Sector	635	0.15	550	0.12	(-)3.35
Total Agriculture	434,576	100.00	442,110	100.00	0.43
GDP	2,784,385		2,946,284	1.45	

Source: FIBOS (2010) Key Statistics (P. 25)

Furthermore, the interest among young people to engage in farming is declining. The hope to revive the agricultural sector gets dimmer as the Fiji Sugar Corporation (FSC) which supports sugarcane farming faces financial and other problems (Prasad 2010). Thus, the challenge facing development planners in Fiji to strengthen and diversify the rural economy of this island country is enormous. It entails the task of establishing sound agricultural economy that involves people at various levels and where many creative policies are applied and the markets are surveyed periodically for new measures (EU 2009).

Crop production and livestock production have symbiotic relationship which needs to be exploited in Fiji. Livestock farming for milk and meat production is an important activity of the farmers throughout the world. But unlike other tropical areas of the world, animal husbandry has only become established recently in the Pacific island countries (PICs).

In Fiji, cattle are reared mainly on Indo-Fijians farms that use milk and employ bullock as draft power and where sugarcane top is available in plenty to provide fodder resources. Recently other farmers in Fiji have also stated rearing of cattle but mainly for meat purpose. Fiji is not self-sufficient in milk and meat production and a considerable amount of foreign exchange is spent on imports. Livestock farming would provide a regular cash flow for poorly resourced farmers by converting low value forages and crop residues, and using family labour, into a valued market commodity. There is a need to fully understand the importance of livestock production not only as a medium for rural development and import substitution but also from the nutrition point of view.

2.3 Rising Food Imports

Data on Fiji's exports and imports of agricultural products are presented in Table 3. In Fiji, the main agricultural exports are sugar, root crops (dalo, cassava), spices (chilies) and processed wheat and cereals. The major imported crop products are wheat, rice, vegetables, fruit and nuts. The imports include livestock products such as meat and milk products.

Data reveal that Fiji's import bill of agricultural products has a rising trend because domestic production of food products is not keeping pace with the rising domestic demand, and thus the quantities of imported food items have been increasing (Table 3). The food import trend is expected to worsen as the rural to urban mobility of the population continues into the next two decades due to the natural migration process that entails economic growth and development, including the push factors such as the expiry of land eases of tenant farmers.

Table 3: Fiji's Imports and Exports of Agri-products, 2002-2005 (USD '000)

Product (1)	*Exports (2)*	*Imports (3)*	*Balance (2-3)*
Wheat & cereals*	12,755	24,904	(-) 12,145
Rice	304	11,074	(-) 10,770
Roots, other produts	13,543	--	(+) 13,543
Vegetables	--	19,680	(-) 19,680
Fruits and nuts	7244,	119	(-) 3,395
Sugar	120,745	3,075	(+) 117,670
Spices	3,966	1,279	(+) 2,687
Total crop products	152,037	64,131	(+) 87,906
Live animals	54	569	(-) 515
Meat of bovine	9	3,256	(-) 3,247
Other meat	4,329	20,230	(-) 15,901
Eggs and birds	72	1,383	(-) 1,311
Milk and milk products	866	18,800	(-) 17,934
Total livestock products	5,330	44,238	(-) 38,908

Note: *Wheat and Cereals are re-exported from Fiji after processing whole wheat from Australia.

Source: International Trade Statistics, ITC, UNCTAD/WTO, 2002-2005

Moreover, in recent years, the movement toward greater free trade and the 'globalisation' of economic activity also plays an important role in imports. Globalisation and the lowering of barriers to international trade and investment allowed international corporations to roam around the world seeking more profitable business opportunities. In the case of Fiji, key domestic sectors such as rice, milk and meat have been subjected to global competition.

Data in Table 3 show that Fiji is heavily deficient in production of vegetables, rice, and milk and meat products. However, this should not have been the case for Fiji to be importing such agricultural products as it has sufficient agricultural resources like land, labour, conducive climate as well as human resources (Prasad 2010).

This domestic supply-demand mismatch of food products is often more common in countries where storage facilities are not available and/or government intervention policies are non-existent. Farmers normally attempt to produce and sell commodities that cover the cost of production and marketing, including at least a small net return, or profit, for their effort. While the idea of profit maximisation is there, the choice of how much to produce at any one time is limited by the response delay. In other situations farmers are not able to match the demand for agricultural commodities in the short run with a supply response to avoid shortages in the market. This condition is prevalent in the vegetable market of perishable commodities such as greens leafy vegetables and fresh beans. Such shortages cause alarm among urban-dwellers who constantly depend upon local supply of such food commodities. Prolonged shortages and the inability of farmers to respond quickly to variations in the food demand are normally construed as food security issue. Such issues are not well understood in Fiji or other Pacific Island countries and government facilities for storage and preservation are basically non-existent. Although Fiji does not normally face prolonged extreme whether conditions, farmers frequently face serious problems responding to the market demand on a continuous basis.

In view of this agricultural situation, the dependence on traditional farming methods in Fiji needs change towards more productive methods with application of appropriate scientific technology and knowledge about crops, soil, and the environment. This process however is not easy. A long-term development strategy needs to be established. The current policy documents of the Ministry of Agriculture and the information made available on the public domain seem to reflect this quite well (see for instance MPI 2010b). However, the process of agricultural transformation is severely constrained by various factors. Firstly, by the land tenure issues constrained by the current land legislation, and secondly, the lack of confidence amongst investors due to political instability (frequent coups), which hinders long-term strategies. This partly explains why Fiji imports so much food, which could easily be produced in the country. To formulate an effective action plan for boosting production of farm products to meet the local demand as well as for export, it is essential to understand the problems faced by the farmers in Fiji.

The long-term agricultural strategy would entail more productive agricultural sector with multilayered stakeholder interests. The unfortunate aspect of this strategy is that it requires enormous amounts of resources to be mobilised simultaneously, which Fiji

simply does not have at its disposal. However, such approach can be implemented in a much smaller way with certain focus. To start with, the required resources could be pooled and staggered over time to cover multiple crops. This would include the whole spectrum of activities from crop husbandry to agribusiness and export initiatives to expand and diversify the rural economy. This approach would be a long-term one that will broaden not only the supply side but also the demand and domestic market as a whole (ADB 2010; Naude 2010; Oxfam 2010; Prasad 2010; Qamar 2005 for some suggestions).

Strengthening the rural sector and establishing new agribusinesses enterprises would provide a sound basis for the growth of the Fijian economy. The most recent national budget document (Ministry of Finance 2010), emphatically argues that agriculture has the potential in Fiji that can be pursued through appropriate policies. However, this process of economic transformation and expansion is likely to be severely hampered by various inherent constraints such as land tenure, lack of investments and many other challenges faced by the agricultural sector (Prasad and Kumar 2000; Barbour and McGregor 1998; Ward and Proctor 1980). The economic contex within which farm production and agribusiness occur currently needs to undergo sea change in perception and approach. It needs a psychological turnaround from negative to positive that establishes a new euphoria to boost entrepreneurial confidence among the rural-dwellers. Some form of reverse mobilisation of entrepreneurship may be essential at this stage so that urban entrepreneurs can participate in the new economy. This shift in thinking would encourage farmers to engage in a more commercial approach to farming.

3.0 Factors Affecting Supply of Domestic Agricultural Products

The assessment of needs and priorities of farmers provides the development planners with a broad framework for understanding the range of issues involved in bringing about substantial changes to the farming systems that could improve the farmers' supply responsiveness to the market prices and market stimulus. Adopting this approach to agricultural development with well-designed programmes would reduce the current problems of demand and supply mismatch and substantially address the problems of price instability in the domestic market. In the following sub-sections, the challenges and constraints of farmers in production and marketing of agricultural products are identified. The data summarised in Table 4 are based on various field surveys conducted in Fiji. Since problems for farmers differ according to the type of agricultural production, the following discussion is organised roughly according to those sub-sectors.

3.1 Problems of Sugarcane Farmers

In Fiji, during the last two decades, sugarcane farmers lacked appropriate support from the government. Lal (2009) reports that combined with lack of land tenure security and the absence of good extension services, farmers have lost interest in sugar cane production. Furthermore, cost of cane production is increasing due to rising price of fertiliser, misapplication of fertiliser, cost of cartage, cost of harvesting and labour cost combined with declining price of sugar due to eroding preferential markets (Lal 2008).

Prasad (2008) also found that major causes for the declining trend in cane production in Fiji are: (i) lack of land tenure security, (ii) lack of credit availability to farmers, and (iii) lack of extension services. The overall decline of infrastructure, falling mill efficiency and now the declining price of sugar have resulted in the decline in sugarcane production (Island Business 2010).

Table 4: Production and Marketing Problems of Farmers in Fiji

Types of problems	*Problems faced by farmers producing:*			
	Sugarcane	*Dalo & Cassava*	*Vege tables*	*Livestock*
1. Insecure land tenure	✓	✓	✓	✓
2. Lack of irrigation facilities	✓		✓	
3. Lack of credit facilities	✓	✓	✓	✓
4. High cost of inputs—fertiliser, feed, etc	✓		✓	✓
5. Lack of skills for modern Farm Practices	✓		✓	✓
6. Lack of road networks in rural areas	✓	✓	✓	✓
7. Lack of transportation facilities		✓	✓	✓
8. Lack of marketing yards/centers		✓	✓	
9. Lack of agro-processing facilities		✓	✓	✓
10. Unscrupulous behavior of marketing agents		✓	✓	
11. High cost of marketing		✓	✓	✓
12. Lack of storage facilities		✓	✓	
13. Lack of marketing information		✓	✓	

Sources: Areghcore et al. (2001); Areghcore et al. (2008); Bolatsul (2008); Nacoke (2007); Prasad (2008); Remudu (2006); and Vereleva & Bhati (2006)

3.2 Problems of Root Crops Producers

Major problems faced by the producers of root crops such as Dalo, Cassava and Kava are listed as pointed out by Nacoke (2007) are:

- Poor road conditions affect most farmers who live in areas far away from the main roads in rural areas. Poor road condition gives rise to the following problems: (i) limited access of farm produce to the market; (ii) delays delivery causing damage to the products and lowers the quality of the products; (iii) long cartage period on poor roads increases damage and thus the marketing costs;
- Marketing agent collecting farm products from farmers does not have organised plans for uplifting the produce from villages which adversely affects farmers in two main ways: (i) waste of perishable products harvested for supply on a particular day which were not lifted by the agent, and (ii) loss of weight and quality of fresh produce during waiting time;
- Lack of storage facilities result in theft, damage or waste of products at the collection centre;
- Lack of marketing information to farmers about the market situation and prevailing prices in major markets affects the whole agricultural system;
- Insufficient knowledge of farmers about the post-harvest management also affects the marketing process and the quality of the product;
- Lack of knowledge on quality and handling requirement for export products results in waste and losses;

- Lack of provision of collection centre/market yards in their neighbourhood affects many farmers of remote areas as it results in high transport costs and the wastage of farm produce;
- Lack of transport facilities for interior farmers and riverside dwellers that need varied transport systems like boats and small utility vans.

3.3 Problems of Vegetable Growers

Farmers producing vegetable crops in Fiji also face numerous problems (Remudu 2006). Important among them are as explained below:

- Insecure land tenure (contributing to lack of improvements or investments in land for drainage, etc.;
- Lack of institutional credit facilities to farmers;
- Lack of skills of scientific methods of vegetable production;
- Poor marketing facilities. There is price dictatorship by iterant merchants and inconsistent purchasing;
- Lack of storage and preservation facilities for vegetables and fruits causing gluts and shortages in supply and undue price fluctuations;
- Lack of processing facility and thus spoilages during glut periods;
- Lack of irrigation facilities (manual irrigation is time consuming and now costly due to rising labour cost);
- High costs of fertiliser and other agro-inputs required for vegetable production.

3.4 Problems of Cattle Famers

Livestock farming provides regular cash flow for many poor farmers. A lot of these livestock farming occurs in sugar growing areas where farmers are poorly resourced to rear animals, but the existence of cane-top feed helps greatly. These farmers convert low value forages and crop residues into animal feed. In most cases, farmers use family labour to sustain these small-scale livestock farms, which supplement their family income. Unlike other tropical areas in the world, animal husbandry has only become established recently in the Pacific island countries. In Fiji there are very few large commercial scale farms and most animal husbandry is done at subsistence level. Even though in some areas a lot of fodder resources and grassland exists in Fiji, animal husbandry is not so common, particularly on commercial basis for which reason Fiji is not self-sufficient in meat and milk production.

Due to various problems faced by cattle farmers, livestock production is not progressing in Fiji (Aregheore et al. 2008; Bolasui 2008; Vorelevu & Bhati 2006; Aregheore et al. 2001). The major problems pointed out by cattle farmers are summerised below:

- Lack of veterinary facilities in most farming regions (resulting in farmers not confident about rearing exotic breeds of cattle whose productivity could be much higher);

- Disease susceptibility of highly value exotic breeds;
- Artificial Insemination (A.I.) facilities for cross-breeding and genetic improvement of local cattle population are lacking in most farming areas;
- Lack of training and education for farmers (as a result there is lack of modern methods of animal rearing and pasture management);
- Short-term and customary land-tenure systems under which many cattle farmers operate hinders farmers from long-term capital investment required in cattle farming;
- Lack of institutional credit facility for investment in cattle farming or pasture improvement due to lack of property rights on lands;
- Lack of property rights also result in weak or no incentive for the development of the pastureland (this has led to huge decline in productivity of most pastures in Fiji since the mid-1990s);
- Poor road condition and lack of transportation facilities due to which cost of marketing of livestock products is higher;
- High cost and irregular and inadequate supply of inputs (especially of concentrated livestock feeds and medicines).

3.5 Policy Implications of the Problems identified

The above discussion highlights various problems faced by livestock farmers in Fiji and provides the basis for more concerted agriculture development policies and support schemes. These concerns point out about the urgent need for establishing information, training and infrastructure system for development of agriculture and agribusinesses enterprises in Fiji. Establishment of well-structured and efficiently managed agribusiness supply chains linking farmers with consumers is also needed. This is particularly important due to increasing urbanisation of the population and thus the need to move more food from rural to urban areas to meet the increasing demand of primary agricultural products in urban areas. There are unreliable and inadequate agricultural marketing services in the country at the moment (McGregor 1999). Under such a situation, production and supply of perishable agricultural products such as meat, milk, vegetables and fruits are badly affected and so the country's dependence on imported food increases substantially (Table 5 for absorption of imported food commodities in Fiji).

Table 5: Absorption of Imported Food Products in Fiji (FJD '000)

Broad Category of Food	2004	2005	2006	2007	2008	2009
Primary Food Product	57,387	55,711	63,219	69,493	85,350	73,287
Processed Food	205,558	206,709	202,775	199,578	260,095	300,394
Total Absorption	262,945	262,420	265,994	269,071	345,445	373,681

Source: Fiji Key Statistics, Fiji Islands Bureau of Statistics, Suva, 2010

Farmers generally do not respond to the increased urban demand if the price signals do not reach them and current marketing channels are not adequately linked to them. Since supplies of farmers in Fiji are not adequately and efficiently linked with the urban demands, the excess demand in the domestic market is met by the food products imported from Australia, New Zealand and other countries. In the absence of robust domestic agro-supply chains, the wholesalers and retailers in Fiji find it much easier and reliable to import from faraway places rather than meeting their orders of farm products from the domestic producers. Supply chains from foreign suppliers are well-managed and properly linked with local wholesalers and retailers while those connecting local farmers are poor, inadequate and unreliable to meet the demanded quantity and quality on timely and sustainable basis. Hence, it is a big challenge before the policy planners and development agencies to harness this opportunity of increased urban demand in Fiji by expanding and strengthening the local agro-food supply chains linking farmers and urban consumers within the country.

This challenge is huge since agricultural production differs significantly from the manufacturing sector in one important respect that production lag in the Agricultural sector is significantly larger. Thus the market seldom resolves the demand-supply mismatch adequately within a short-term period. The suppliers do not have the mechanisms to adjust or respond to the market conditions immediately to avoid wastages. Farmers often face the prospect of glut in the market when the season sets in since supply side information is often not available and even if they are, it is often too late to make any adjustments. Such commodity gluts in the market cause prices of agricultural commodities to spiral down causing significantly revenue loss to farmers.

Some reasons are forwarded here about why the domestic farm production in Fiji fails to respond to demand of food commodities. The key problem in Fiji is the lack of information about the demand side of the market, to which farmers could match their supply through appropriate storage and preservation mechanisms. The government, however, has recently launched a web based market watch publication which is meant to provide market information to the farmers (MPI 2010b & 2010c). But most of the farmers in Fiji are not computer literate and lack access to internet facilities.

4.0 Policies for Strengthening Production and Agribusiness Supply Chains

The process of transforming agricultural production depends largely on the government policies that are put in place in the current period. In addition to this, the transformation process will depend significantly on the creation of new mechanisms for value addition such as processing, packaging, transportation and marketing. These mechanisms would also dependent on the nature of the government policies put in place for development. The policies would change the social and economic context of the farm production and its transportation mechanism. The effectiveness of the policies would also depend on the nature of policies implemented by the government. The appropriate nature of these policies for the development of the agriculture in Fiji is discussed in this section. The development of agro-entrepreneurship issues are also discussed here.

The concerns and problems pointed out by the farmers in fact stem out from their unfulfilled needs for a long time. The neglect of this sector is marked by numerous cases of fraud and mismanagement by government officials since early 1990s, in fact, since the 1970s when new policies were implemented by the first post-independence government. Policy failure is therefore the basic reason for the current scenario where production is hardly sufficient to meet the domestic demand.

To boost the production to meet local demand and to increase production for exports to address the trade imbalances, well-planned and structured government policies are needed. Some good policies are currently being facilitated, but the actual outcomes are not showing yet (see for instance MPI 2010a, 2010b & 2010c for some of the newer government policies to increase production). Such policies would help fulfil the much needed aspirations of the farmers and possibly resolve a number of their business constraints, but there are many obvious deficiencies in these policies. In many instances the implementation of policies is based on long-term sustainability. A lot of the policies have been politically driven and lack market rationale. However, these policies do have basic productive rationale and can be implemented in an optimal manner for better outcomes.

Some of the issues that need government attention are described in the following sub-sections.

4.1 Marketing Mechanisms and Networks for Farm Products

Vegetables, fruits, meat and milk are highly perishable products. Expanding production of these sectors needs various concurrent measures. On the whole, an efficient and dependable market chain system needs to exist to link the farmers with consumers in the domestic as well as the external markets. Such a functioning system will induce and sustain a consistent and dependable market system for agricultural products. There must be village level supply mechanism that is linked with a competitive market system which fetches the farmers the best price for their products. The current system is neither functional nor competitive or efficient. The suppliers of products such as meat and dairy products are too few and the intermediation is mostly weak or in some cases non-existent. The economies of scale are not there to facilitate a dependable market system. There are a number of identifiable problems. Foremost, the government to facilitate and support of the market is non-existent. Secondly, the transport linkages to the rural sectors where such products could be produced are not sufficient or reliable. Thirdly, the farmers that exist do not have enough security or support, which has led to losses due to theft or wastages. The much-needed confidence among farmers is grossly lacking in the current period due to numerous problems including land tenure insecurity and conflicts that have existed historically. In addition to this, the government's extension services have been in ruins since early 1990s due to institutional neglect. Farmers generally lack knowledge and are almost totally unaware of new ideas and technologies.

Fixing these problems crucially depends on multi-dimensional approaches. The development of more effective transportation and storage system through government initiative could be a key strategy. The market mechanism could be facilitated this way

more effectively. It is a well-known fact that the existence of agricultural market structures is the most important condition for enhancement of output and efficiency (FAO 2008). For instance, in the case of supply of vegetables, local storage and processing facilities would widen the supply side of the market, particularly when there are many smallholders supplying such perishable products as vegetables, fruits and meat products.

The absence of storage and transport infrastructure in Fiji is an insurmountable constraint for smallholder farmers, who can only ill-afford such facilities to preserve their produce. If efficient marketing systems are established, solving the problems would be much easier. The economies arising from scale would in itself solve a number of these binding constraints. The economies of scale in these sectors basically through facilitation of markets could lead to better transportation and storage infrastructure, which would lessen the production side constraints that exist currently.

4.2 Training of Farmers in Modern Methods of Crop and Livestock Production

Cattle farmers and growers of fruit and vegetables need immediate up-gradation of their skills for mass (or large quantity) production of agriculture commodities on commercial scale. There is a huge skill deficit among the younger generation that needs attention of the policymakers. This new generation that is computer savvy and has English language skills far superior to the previous generation, needs to be motivated towards agriculture by exposure to scientific and modern methods of agriculture. Appropriate training and empowerment of young agriculture entrepreneurs is essential. This would be possible if agriculture is portrayed to the younger generation as scientific, modern and a high income earner.

Instituting farmers training programmes would lead to substantial gain in enhancing the supply of these products and fulfil the supply-demand gaps that exist at the moment. To some extent. the training and extension process is already underway at the Ministry of Primary Industries (MPI), but sufficient information is still not flowing out to the farmers. Some programmes need to start from scratch, for example, training the sugarcane farmers to produce alternative crops is long overdue. However, such proposed programmes may not take long or arduous effort to start since reasonable infrastructure already exists in those farming areas.

Currently, there is a shortage of agricultural extension officers in Fiji and those that are there are not active. Therefore, training new and motivated extension officers is urgently needed. This would help the Ministry of Primary Industries personnel to reach out to the farmers who are the real actors in the business of agriculture (MPI 2010d).

4.3 Local Supplies of Farm Inputs and Equipment

Many of the suggestions stated here may entail new farming methods and thus, may need special equipments, material inputs and seeds etc. Such facilities need to be made available locally at cheaper prices. For instance, disease control medicines for goat, sheep and cattle or improved seeds and animal breeds, fertilisers and feed stock can be made available from local sources as least cost options. The MPI in Fiji is making a reasonable effort towards these goals, but facilitation of private sector involvement would be the most viable and obvious option. This unfortunately is not the case at the Ministry of

Primary industries (MPI) in Fiji. There are many sectional political objectives at play in efforts to develop the agricultural sector. These sectional political objectives hinder the commercialisation process quite significantly. For instance, the government officials at the MPI select pilot projects on ethnic or provincial basis rather then merits of farmers.

Despite these problems, some hopes exist since a start has been made on such projects. Tangible results are achieved quite easily if the necessary equipment and materials are delivered to the agents in the agriculture sector with appropriate motivations that need to be built. It is expected that production of meat, milk and fruits can be significantly enhanced in a short time if effort is made to reach out to the farmers with the much needed assistance.

4.4 Transportation and Storage Facilities

Since most farms are small and widely dispersed throughout the countryside, a correspondingly widespread transportation network is required to channel supplies to the market centres in the urban areas. Easily available and efficient transport mechanisms to move farm products such as milk, cattle, vegetables, fruits and root crops to the market areas are essential for the system to work. It would work as a significant incentive to farmers if inexpensive transportation with improved infrastructure is made available to them. Bulky and highly perishable commodities such as meat and green vegetable often require special care during transportation, which is non-existent in Fiji, except for some provision of refrigeration facilities in Sigatoka valley where private initiatives have worked well.

The essential transportation and storage facilities mentioned here should be provided and supported actively by the government with ongoing promotion of private initiatives.

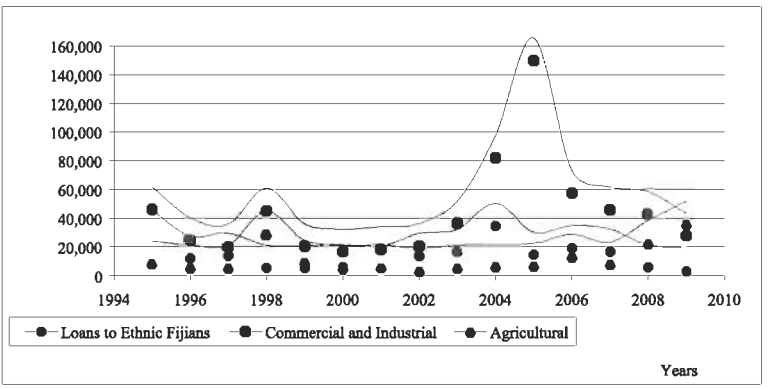
4.5 Credit Facilities for Farm Investment

Credit facilities for the agricultural sector have been low since early 1990s and declining due to a number of reasons. Firstly, the uncertainty about the land tenure since early 1990s was the main cause of this decline in loans to farmers. As a result of looming expiry of land leases since 1997, the investment confidence of the farmers declined and banks have refused to issue loans to farmers. Native Land with improvements could not be considered as collaterals for loan due to their declining demand associated with their downside risks. Secondly, the government development policies since early 1990s up until recently remained inherently passive and biased against agriculture due to more generous allocation towards tourism and support of manufacturing. The data in Figure 1 show very low levels of credits for agriculture. However, there seems to be a significant increase in the agricultural loans recently as a sign of change in the government policy towards this sector of economy. Apart from the Fiji Development Bank, which is government-owned entity, a lot of commercial bank activities have been encouraged by the government recently. This is very encouraging for the smallholder farmers who were unable to borrow and expand their farm activities due to lack of credit.

The increased supply of credit needs to be matched with demand for agricultural credit. Apart from access issues for the farmers, success also depends on reasonable cost of

credit. Therefore, the rate of interest needs to be maintained at reasonable levels and also to provide enough time for the farmers to meet repayment. Such measures are important if farmers are to succeed in competitive markets domestically or globally.

Figure 1: Fiji Development Bank Loans



4.6 Cooperative Societies for Smallholder Farmers

Some agricultural products are highly perishable and need special transportation facilities. Milk and meat products are the most important commodities that need such facilities even for short duration of a few hours. Vegetables (particularly green leafy products) need such facilities but the cooling process may be less intense. Because these products are bulky and highly perishable, their transport system needs to be fast and cost-effective, which could make small-scale production profitable. This is where local cooperative systems would become useful for farmers.

The constraints of farmers would at least be partially addressed if farmers have some control over the prices they get for their produce. The small-scale producers are often in a weaker and vulnerable position in the market place. Hence, farmers form cooperative societies to take joint action to tackle many market-related problems including joint production to create economies of scale. This kind of voluntary group action by farmers in the form of cooperative is important for enhancing agricultural development within local communities. Such strategies are well-documented in countries as India, Bangladesh and Philippines where results have been positive, particularly due to continued government support. There are numerous examples of such systems globally where cooperatives are formed to take the responsibility of transporting and marketing farm products. The supply of farm inputs can also be organised in this way much more cheaply. However, the establishment of such cooperatives and their successes depend largely on considerable government involvement.

4.7 Expansion of Area under Agriculture and Long-term Land Tenure

Only one-third proportion of land in Fiji is under cultivation, and there is a scope for bringing substantial new land under cultivation (Table 1). Furthermore, the problem of

insecure land tenure has daunted the farmers for long without any clear solution in sight. This has been the most troubling concern of most farmers in Fiji. On the one hand the demand for food products is increasing in Fiji while, on the other, outward movement of human resources from agriculture and rural areas are taking place at an alarming rate. Farmers are migrating out of areas where land leases are held by them from the native owners. As a result of this substantially fertile areas of land are lying unused. Also, marginal and wastelands which are also currently unused may require development strategies to spin off some form of production such as pastureland for livestock or production of fruit and other tree crops.

Such development may not be easy since the land tenure issues remain unresolved and for such development long-term leases are necessary to encourage farmers to invest.

4.8 Land Tenure Issues

Agricultural productivity and land tenure systems are intricately linked and are crucial for economic progress in many Pacific island countries (Acqaye and Crocombe 1984). In Fiji, Agricultural Landlord and Tenant Act (ALTA) provides for a minimum of 30-year agricultural leases, with no reference to any renewal of leases. A large number of leases on ALTA began expiring in 1997. With the impending expiry of the first batch of ALTA leases, emerged the debate on whether ALTA was a suitable legislation for leasing land in Fiji. There have been two strong views in this debate: one is referred to as the tenants' view; and the other as the native landowners' view. The two positions precipitated into immense political fallout in the year 2000. Many Indo-Fijians argue that these terms of tenancy do not provide them with adequate security and have pressed for renewable 30-year leases, while many ethnic Fijians fear such lease holdings by Indo-Fijians would erode their control over the land. Indigenous Fijian communities very closely identify themselves with their land. The problem emerges from the fear psychosis that land resources could possibly be taken over by the migrant ethnic group, namely Indo-Fijians. The land tenure system in Fiji has been under debate for long and continues today.

There have been two strong views in this debate: 1) referred to as the tenants' view; and 2) native landowners' view. The shorter and insecure land tenure system that ALTS provides under the current circumstances hinders long-term investment prospects towards increasing productivity. Issues such as land levelling, terracing, drainage and irrigation system development do not find much attention of the leaseholder farmers.

5.0 Conclusions and Suggestions

In this paper some important agricultural development policies have been highlighted to this point. Prospects for higher earnings of farmers and other rural-dwellers due to better market networks, agro-processing activities and more efficient distribution system could lead to better opportunities for all economic agents in the countries. The paper highlights the need for increase in agricultural production to improve food security and reduction of dependence on imports. It is argued that agriculture-based entrepreneurship in Fiji is necessary to keep pace with global economic trends. It is believed that the task of sustainable development in the rural sector requires sound economic approach with the

aim of creating more agriculture based entrepreneurship. Such deepening of investments in agriculture is necessary to create new economy. But it is essential to identify major skill gaps and production constraints that need rectification for long-term success. The need-based eight-point agricultural development strategy has been outlined in this paper which may be useful for policymakers. It is expected that a simultaneous change both in the skills of farmers and the availability of new technologies and allied inputs would effectively change the farm production methods and the management of food supply chains.

From the foregoing discussion, it is felt that a more productive form of agriculture is necessary in Fiji, which can be achieved through motivation of new actors in this sector of the economy. Rejuvenating the interests and expanding income prospects for all stakeholders should be the primary objective of the government policymakers. The introduction of post-harvest technology for crop processing and value adding in agricultural production may be a good way of creating new agribusinesses avenues of income for the landless farmers and people in rural areas. Strengthening market linkages and motivating farmers to produce more with higher efficiency should pave the way for economic success in agriculture. Having a more productive and price responsive agriculture and interlinked agri-businesses in rural areas would not only generate higher income and help diversify rural economy but would also weaken the stream of rural-to-urban migration of people. Increasing incomes and employment in rural sector would in turn lead to higher rates of absorption of domestic manufactured products and increase of income in other sectors of the economy.

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Non-Farm Economic Activities in Rural Bangladesh: The Case of the Bamboo Craftsmanship

Khondoker Abdul Mottaleb*

Abstract

The role of rural non-farm economic activities in generating employment and income opportunities for the rural poor in Bangladesh has increasingly been recognised. About 40 per cent of employed labour force in the rural area of Bangladesh is engaged in the non-farm economic sector, and the sector contributed 36 per cent to the country's total GDP. Despite its enormous contribution to employment creation and income generation, very little is known about the rural craftsmen who are engaged with the rural non-farm economic sector. This paper explores the characteristics of the rural craftsmen using primary data collected from 201 bamboo craftsmen from four districts in Bangladesh as a case. Bamboo craftsmanship is one of the oldest non-farm economic activities in rural Bangladesh. It has created enormous employment opportunity for the rural poor and distress women. It is found that most of the bamboo craftsmen produce simply traditional household items using age old technology. As most of the craftsmen are less educated and delinked from modern training and latest marketing information, product quality upgrading seldom takes place. New entry by new craftsmen also seldom takes place. High raw bamboo price has been creating great problems to the craftsmen. Based on the research findings, the paper suggests introducing proper training for the bamboo craftsmen on production and marketing. It also suggests disseminating the latest knowledge on planting and nourishing bamboo bushes and preserving and processing raw bamboo. Finally, the paper suggests public-private partnership for the growth of the bamboo craftsmanship in Bangladesh.

1.0 Introduction

It is widely recognised that rural non-farm economic activities play important roles in creating employment opportunities, promoting sustainable growth of the rural economy and reducing rural-urban gap and poverty in the rural areas in developing countries (e.g., Child and Kaneda 1975; Islam 1984; Ranis and Stewart 1993; Reardon 1997; Weijland 1999; Hayami and Kikuchi 2000; Lanjouw 1999, 2001; Haggbladde, Hazell and Brown 1989). The rural non-farm economy comprises 30 per cent to 45 per cent of rural incomes all over the developing countries (Haggblade, Hazell and Reardon, 2002). In Bangladesh, which is predominantly an agriculture-based developing country in South Asia, rural non-farm economic activities has been playing important role in creating employment and income opportunity for the rural poor (e.g., Hossain 2004; Bakht 1996; Islam 1984).

The statistics available from the 1981 population census and the 2005-06 labour force survey in Bangladesh show that the economy of country is rapidly transforming from mainly an agro-based economy to a mixed one with the rural non-farm economic sector

* Post-Doctoral Research Fellow, GRIPS, Tokyo, Japan and Senior Research Officer, Bangladesh Public Administration Training Centre, Savar, Dhaka, Bangladesh. E-mail: kmottaleb@gmail.com

providing for an increasing portion of income and employment (BBS 1990, 2008). In Bangladesh, about 40 per cent of employed labour force in the rural area is engaged in the non-farm economic sector, and the sector grew at 5 per cent per annum between the late 80s and the mid 90s and in 1995/96, and the sector contributed 36 per cent to the country's total GDP compared to about 31 per cent by agriculture (Hossain 2002). Thus, the rural non-farm economic sector has been playing an important role in the economy of Bangladesh.

Despite its enormous contribution to employment creation and income generation, detailed information on the rural non-farm economic sector in Bangladesh is still scanty (Bakht 1996). Particularly, studies and statistics often overlook important questions, such as who the craftsmen in the rural non-farm economic sector are, and what the problems and prospects of the rural non-farm sector in Bangladesh are. To formulate effective policy to facilitate further development of the rural non-farm economic sector in Bangladesh, these questions should be addressed carefully using cases and primary data.

In this paper, attempts have been made to explore the characteristics of the craftsmen who are engaged with the rural non-farm economic sector and identify problems and prospects of the sector using primary data collected from 201 bamboo craftsmen from four districts in Bangladesh as a case. Bamboo craftsmanship is one of the oldest non-farm economic activities in rural Bangladesh. Using family members, particularly women, bamboo craftsmen produce numerous essential commodities, such as stools, mats, baskets, fishing traps and cages, poultry cages, ladder, as well as decorative items using locally available bamboo. An empirical study using information from the bamboo craftsmen might provide valuable insights into the non-farm economic activities in rural Bangladesh.

2.0 Literature Review

Altenburg and Meyer-Stamer's (1999) conjecture is that in most cases the evolution of a non-farm economic activity in the rural areas of a developing country can be tracked back to a master craftsman who learned the technique elsewhere and starts production and trains family members, neighbours and employees. Later, family members, employees and neighbours start the same activities once they gather relevant techniques and starting capital. As technology is usually simple to imitate, requires low capital to start a business, the non-farm economic activity spreads in the locality quickly through massive entrants by the new craftsmen.

Due to high population growth followed by rapid increase in the work age population and less employment opportunity in the formal sector, rural people in developing countries with surplus family labour are forced to join in the non-farm economic activities (Hossain 2004). In general, the non-farm economic activities in the rural areas of developing countries are mostly run by less educated craftsmen who are also tend to be de-linked from the formal training opportunities and modern market information (Altenburg and Meyer-Stamer 1999). Low level of formal education hinders craftsmen ability to create and adopt modern production techniques to produce high quality diversified products (e.g., Sonobe and Otsuka 2006; Mottaleb 2007). Thus, rural craftsmen in the developing

countries tend to produce low quality products using traditional technology with seldom upgrading in the product quality. As a result, over the time, non-farm economic activities in the rural areas of developing countries expand simply due to increase in the number of craftsmen with no or minor product diversification and upgrading in the product quality (e.g., Altenburg and Meyer-Stamer's 1999).

Although both urban and rural households in Bangladesh are unthinkable without bamboo utensils, such as kula (winnowing fan) and jhuri (basket), most of the craftsmen inherit the production techniques by generation without no or minor change in technology, products and marketing strategy. Banu (2008) asserts that much of the technology used in bamboo industry is primitive and has remained unchanged for more than thousand years. Thus, it might be interesting to assess the level of formal education of the bamboo craftsmen and how their level of formal education affects production and price of raw materials and final products.

3.0 Objectives of the Study

The following objectives have been put forward to explain the bamboo craftsmanship as rural non-farm economic activity in Bangladesh:

i. To evaluate the level of human capital of the traditional bamboo craftsmen.

ii. To assess the level of human capital that affects the production, employment and marketing of the product of the craftsmen.

iii. To identify the problems of bamboo craftsmanship and suggests solutions.

4.0 Materials and Methods

4.1 Data Sources

Data for the study were collected both from secondary and primary sources. Various journals, reports and government documents were consulted for recording secondary data for the study. Data collected from primary sources were made by the participants of 40th Foundation Training Course organised by Bangladesh Public Administration Training Centre (BPATC) as part of their village study assignments from four districts i.e., Rajbari, Bagerhat, Chittagong and Joypurhat. As many of 201 bamboo craftsmen distributed over four districts were interviewed (Table 1).

Table 1: Distribution of the Sample Craftsmen by Location and Gender in 2007

Gender	*District-wise Location*				
	Bagerhat	*Rajbari*	*Chittagong*	*Joypurhat*	*Total*
Male	39	38	25	54	156
Female	0	11	34	0	45
Total	39	49	59	54	201

Source: Survey, January 2008

Table 1 shows that out of 201 sample bamboo craftsmen, 39 are located in Bagerhat District, 49 are located in Rajbari District, 59 are located in Chittagong District, and 54 are located in Joypurhat District. Among the sample craftsmen, a total of 45 are female and the rests are the male craftsmen. Craftsmen in all four districts produce kula (winnowing fan), jhuri (basket), chalani (sieve), dala (tray), poultry and fish cage, fishing trap, cradle (baby bed) etc. Unfortunately, there is no clear information on how many craftsmen are engaged in bamboo industry in the sample areas. Craftsmen were selected randomly. Data were collected on craftsmen's age, experience, prior occupations, education, total workers and product-marketing channels. An effort was also made to collect price of raw bamboo, final products and yearly total production (piece). Most of the bamboo craftsmen do not maintain written records, and also most of the craftsmen produce a variety of bamboo products and sell at different prices. Nonetheless, it was managed to obtain reasonably accurate data on annual total sales revenues and behavioural pattern of the respondents.

5.0 Results and Discussions

5.1 Contribution of Bamboo Craftsmanship to Non-Farm Employment Generation and the Characteristics of Sample Craftsmen

Agricultural employment in Bangladesh is seasonal in nature and in the long lean season, rural wage class and families with surplus labour desperately search for alternative income opportunities to fulfil basic needs (Haque and Hussain 1984). As one of the most common rural non-farm economic activities in Bangladesh, traditional bamboo craftsmanship has created alternative income opportunities for the rural poor especially for the women. Table 2 presents total number of workers engaged in the sample 201 bamboo production units and the percentage of female workers. It is found that more than 670 workers working in 201 bamboo production units, of which nearly 50 per cent are female workers. On an average, more than three persons are employed in per production unit. It is important to mention here that all of the workers are the family members of the craftsmen and none of them are salaried worker.

Table 2: Workers Composition by District in 2007

District	*Total worker*	*Percentage of female worker*
Bagerhat	169	35.5
Chittagong	212	42.5
Rajbari	133	78.2
Joypurhat	159	49.1
Total	673	49.3

Source: Survey, January 2008

Like Myanmar and China, Bangladesh could earn a lot of foreign currency by upgrading the quality of the bamboo products and exporting the fancy bamboo products, such as ladies bag, toy and show piece and decorative items. It is, however, found that bamboo

craftsmen in Bangladesh produce simply low quality household items using age old technology. Thus, the traditional bamboo sector, which has created enormous employment opportunities for the rural poor, has been shot to verge of extinction.

The first important problem as depicted in Table 3 is that new entry in the bamboo sector by new craftsmen is seldom taking place. Table 3 presents the location of the sample craftsmen and their business starting years. It shows that almost all of the sample craftsman have started their business before 2000. Only less than seven per cent of the sample craftsmen have started their business in 2000 or later. On an average a sample craftsman has operated his business for 25 years. Thus, new entry in the bamboo sector is not active. It means, in the long run, further development of the bamboo sector might stagnate due less entry by the new craftsmen. Although it is not clear, but it might be the case that probably the market saturation of the traditional low quality bamboo products and/or new employment opportunities in other formal sectors and/or the scarcity of raw bamboo have significantly discouraged new entrants to the bamboo sector.

Table 3: Distribution of Sample Respondents by Years of Starting of the Business and by Districts

Starting year	*Bagerhat*	*Rajbari*	*Chittagong*	*Joypurhat*	*Total*
Before 1975	11	14	9	16	50 (24.9)
Between 1975 to 1984	22	15	15	14	66 (32.8)
Between 1985 to 1999	6	13	30	22	71 (35.3)
In 2000 or later	0	7	5	2	14 (6.9)
	39 (19.4)	49 (23.4)	59 (29.4)	54 (26.9)	201 (100)

Note: Figures in the parentheses indicate percentage.

Source: Survey, January 2008

Table 4 presents the price trends of per piece raw bamboo in the four sample districts in 2005 and 2007 and also presents the percentage change in price in 2007 compared to 2005. Scarcity of raw bamboo is recently very severe in the industry. Almost all of the sample craftsmen mentioned that the supply of quality raw bamboo is increasingly reducing. As a result, the unit price of raw bamboo is increasing dramatically over the years. Table 4 shows that price of raw bamboo has been increasing over the years in all four sample districts. For example, in Bagerhat, on an average, the cost of a piece of raw bamboo in 2005 was less than Tk.68 whereas in 2007 it has increased to nearly Tk.100. The similar pattern in raw bamboo price can also be observed in other three sample districts. The last row of Table 4 shows that on an average, price of a piece of raw

bamboo in all four sample districts was Tk.47.7, in 2005. In 2007 it has increased to Tk.72. Thus, the price has increased by 34 per cent in 2007 compared to 2005. During the survey almost all of the craftsmen were requested to take actions ensuring the availability of raw bamboo at low price. They suggested that government might help craftsmen to grow their own bamboo bushes by leasing government's land. The scarcity of raw bamboo has created enormous problem to the bamboo craftsmen. Probably, scarcity of raw bamboo is one of the major reasons for less new entry in the industry.

Table 4: Raw Bamboo Price per Piece and its Change over the Years

Study Area	*Year*		*% Change in Price of Raw*
	2005	2007	Bamboo
Bagerhat	67.6	97.8	+ 30.9
Rajbari	50.8	82.3	+ 38.3
Chittagong	23.7	33.9	+ 30.1
Joypurhat	56.4	89.3	+ 36.8
Overall	47.7	72.9	+ 34.6

Source: Survey, January 2008

Table 5, which presents the age structure of the bamboo craftsmen, supports the finding based on Table 3. That is new entry is not very active in the industry. Table 5 shows that nearly 70 per cent of the sample craftsmen belong to age group 40 years and above. It reflects that bamboo craftsmanship has failed to attract new generation craftsmen.

Table 5: Age Structure of the Sample Bamboo Craftsmen by District in 2007

Age structure	*District*				*Total and percentage*
	Bagerhat	*Rajbari*	*Chittagong*	*Joypurhat*	
Less than 30	0	8	3	10	21 (10.4)
30 to 39	8	10	10	14	42 (20.9)
40 to 49	17	13	21	13	64 (31.8)
50 to 59	14	13	12	12	51 (25.4)
60 and above	0	5	13	5	23 (11.4)

Note: Figures in the parentheses indicate percentage.

Source: Survey, January 2008

The traditional bamboo craftsmen are not only aged but also they are mostly uneducated. Educational attainment of the sample craftsmen is presented in Table 6. The Table shows that nearly 60 per cent of the sample craftsmen do not have any formal education. Only 30 per cent of the craftsmen have five or equivalent years of schooling and the rests

(11%) have six to ten years of schooling. Such low level of educational attainment of the sample craftsmen might have significantly reduced the opportunities to create and adopt new technology to produce more value added products. In an empirical model it is tried to quantify the role of education of the craftsmen on their size of operation, sales revenue and proportion of sales to traders.

Table 6: Educational Qualification of the Sample Craftsmen in 2007

Education Level	*District*				*Total and percentage*
	Bagerhat	*Rajbari*	*Chittagong*	*Joypurhat*	
No formal education	19	33	38	25	115 (57.2)
Up to class V	14	13	16	19	62 (30.8)
Class VI to X	6	2	5	9	22 (10.9)
SSC	0	1	0	1	2 (1.0)

Note: Figures in the parentheses indicate percentage.
Source: Survey, January 2008

Table 7 presents information on prior occupation of the sample craftsmen. The table shows that nearly 90 per cent of the sample craftsmen have learnt the craftsmanship from their families. Importantly, a total of 90 per cent of the sample producers face the problem of shortages of working capital and thus suggest introducing loan facilities for them and also protecting them from local money lenders (Mohajon), because local money lenders are notorious for their very high interest rate. Probably, the craftsmen, as they are less educated and produce simple low-quality product, and probably the bamboo sector seems almost stagnant, formal money lenders, such as NGOs, seldom show their interest in providing loan to the bamboo craftsmen.

Table 7: Information on Prior Occupations of the Sample Craftsmen by District in 2007

Prior occupation	*District*				*Total*
	Bagerhat	*Chittagong*	*Rajbari*	*Joypurhat*	
Associated with bamboo	37	44	44	53	178
industry through family	(94.9)	(74.6)	(89.8)	(98.2)	(88.6)
Agriculture/day labour	2	5	4	1	12
	(5.1)	(8.5)	(8.2)	(1.8)	(5.9)
Others (students, housewives)	0	10	1		11
		(16.9)	(2.0)	0	(5.5)
Total	39	59	49	54	201
	(100.0)	(100.0)	(100.0)	(100.0)	(100)

Note: Figures in the parentheses indicate percentage.
Source: Survey, January 2008

Finally, it is found that out of 201 sample bamboo craftsmen, 15 are homeless. It means craftsmen in rural Bangladesh who are involved in the bamboo sector belong to the poorer class in the society.

5.2 Effects of Age, Years of Operation and Education of the Craftsmen on Sales Revenue, Raw Bamboo Price, Final Product Price and on Proportion of Sales to Traders

Discussions based on Tables 5, 6 and 7 reveal that most of the bamboo craftsmen are aged, not formally educated and most of them simply inherited the production techniques from their families without further upgrading. It is examined how age, sex, education and years of operation of the craftsmen affect sales revenue, raw bamboo price, final product price and proportion of sales to traders of the craftsmen.

Figure 1 illustrates how age of the craftsmen affects his sales revenue, raw bamboo price, price of final products and proportion of sales to traders. The figure shows that in general, after 40 to 49 years of his age, a craftsman earns lower amount of sales revenue, gets low final product price, collects raw bamboo at low price, and increases proportion of sales through traders. Thus, sales revenue, raw bamboo price and final product price are negatively correlated with age. As collection of raw bamboo, production and sell requires physical energy, it might be the case that older craftsmen (with less physical energy) collect low quality raw bamboo, produce less in number and sell mostly to the traders (middle men) at a low price.

Figure 1: Yearly Sales Revenue, Bamboo Price, Product Price and Proportion of Sales to Traders by Age Structure of Craftsmen in 2007

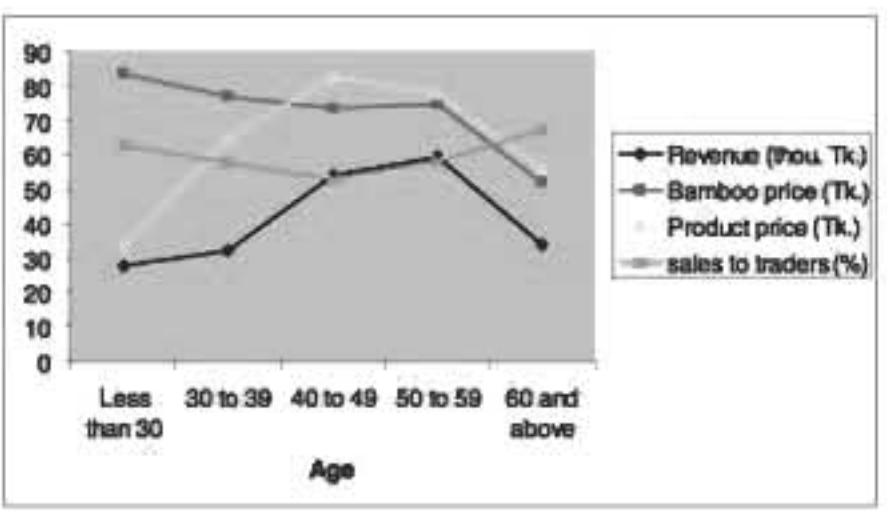
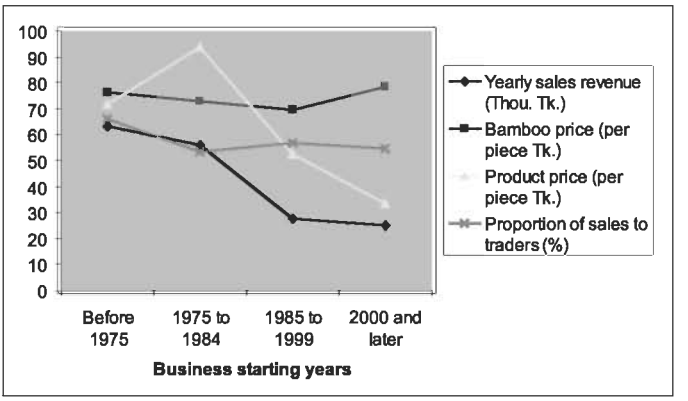


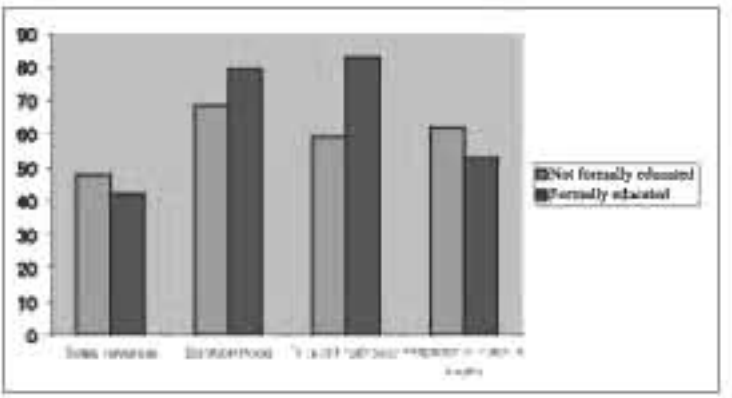
Figure 2: Yearly Sales Revenue, Bamboo Price, Product Price and Proportion of Sales to Traders by Business Starting Years



It is mentioned earlier that on an average, a sample bamboo craftsman has been operating his business for 25 years. Figure 2 illustrates the relationship between business starting years and sales revenue, price of raw bamboo, price of final products and the proportion of sales revenue to traders. The figure illustrates that the craftsmen who have started their business earlier, tend to earn higher sales revenue, collect high priced raw bamboos, sell products with higher price and more likely to sell products through traders. On the other hand, new craftsmen tend to have lower sales revenue, receive low product price, use low priced raw bamboo, and mostly sell products on their own. It is plausible, because craftsmen who are operating for long years tend to have more capital, and less likely to face the problem of capital constraint compared to new craftsmen. It is found that none of the sample craftsmen have received any loan facilities from any formal lending institutions, such as bank. As formal loan facilities are not available to the craftsmen and as reinvestment of earnings is the major way to expand the size of operation, craftsmen who have started earlier tend to be bigger compared to others.

Table 6 shows that nearly 60 per cent of the sample craftsmen do not have any formal education. Figure 3 illustrates the effect of formal education of the craftsmen on sales revenue, raw bamboo price, final product price and proportion of sales to traders. In Figure 3, based on years of schooling, sample craftsmen are divided into two groups and then sales revenue, per piece raw bamboo and final product price and the proportion of sales to traders are compared between formally educated and uneducated craftsmen. The figure shows that formally educated craftsmen receive higher product price, buy high priced raw bamboo though they receive less revenue and sell less to the traders compared to uneducated craftsmen. Although it is difficult to explain why formally educated craftsmen earn less sales revenue compared to the uneducated craftsmen, however, it might be the case that educated craftsmen are the part timer in the business and they are engaged in other activities, such as agriculture and other small business. As a result, although formally educated craftsmen receive higher product price and use high priced raw bamboo, they tend to keep their operation size smaller (low sales revenue).

Figure 3: Sale Revenue (Thousand Tk.) of Raw Bamboo Price, Price of Final Product and Proportion of Sales to Traders by Educational Status of the Producers in 2007



5.3 Model Specification

It is intended to examine empirically the role of age, education and years of operation of the craftsmen on their operation size, per piece raw bamboo and final product price and the proportion of sales to traders. It can be examined by estimating following the function:

$$Y_{jt} = \theta_0 + \theta_1 \{Age\}_{jt} + \theta_2\{Square\ of\ Age\}_{jt} + \{Years\ of\ Schooling\ Dummies\}_j\ \lambda_1 + \theta_3 \{Male\ dummy\}_j + \theta_4 \{Business\ starting\ year\}_j + \theta_5 \{Dummy\ for\ prior\ affiliation\ with\ the\ Business\}_j + \varphi_{jt} + \zeta_{jt}$$

where Y_j is a vector of dependent variables, which includes natural log of yearly sales revenue, natural log of price of per piece of raw bamboo, natural log of the price of per piece of final product and the proportion of sales to traders. Variable φ is the individual level random effect and ζ is the error term with white-noise properties. θ is the scalar parameter and λ is the vector of parameter. Finally j and t stand for individual craftsman and year respectively. Based on their level of education, craftsmen were divided into four groups. The base line group consists of the craftsmen with no schooling. The second group consists of the craftsmen with years of schooling equal to or below five years. The third group consists of the craftsmen with years of schooling in between six to nine years. The fourth group consists of the craftsmen with years of schooling ten years and above.

It was applied random effect GLS estimation process to estimate functions explaining yearly sales revenue, per piece raw bamboo and final product price. The only reason behind this is that if it was used fixed effect estimation process, four of the time invariant variables that are sex, years of schooling dummies, business starting year and dummy for prior affiliation with the industry will be eliminated. For this reason, it was applied random effect GLS estimation process to estimate sales revenue, raw material and final product price functions. It was also used two limits Tobit to estimate the function that

explains proportion of sales to traders, because the variable (proportion of sales to traders) ranges 0 at the minimum and 100 at the maximum. In the case of two limits Tobit estimation process, the dependent variable, which is proportion of sales to traders, is censored 0 at the minimum and 100 at the maximum.

Table 8: Estimated Functions Explaining the Yearly Sales Revenue Price of Raw Bamboo (per piece), Price of Final Product (per piece) and Percentage Sales to Traders

Dependent variables	*ln (Yearly sales revenue)*	*Ln(Per piece raw bamboo price)*	*ln (Per piece final product price)*	*Percentage sales to traders*
Estimation method		*Random effect GLS regression*		*Two-limit Tobit*
Age (year)	0.07**	0.04*	0.08***	-4.98***
	(2.30)	(1.67)	(3.48)	(-2.48)
Age square	-0.001*	-0.001	-0.001**	0.05**
	(1.68)	(-1.54)	(-2.47)	(2.44)
Dummy for years of schooling five years or below (yes=1)	-0.06	0.11	0.17	-13.4*
	(-0.38)	(0.82)	(1.29)	(-1.71)
Dummy for years of schooling six to nine years (yes=1)	-0.13	0.15	0.53***	-8.6
	(-0.40)	(0.71)	(2.48)	(-0.73)
Dummy for years of schooling up to ten years (yes=1)	-0.05	-0.16	-0.26	-58.7
	(-0.14)	(-0.28)	(-1.08)	(-1.63)
Male dummy (yes=1)	0.40**	0.50***	0.09	1.31
	(2.32)	(3.46)	(0.67)	(0.15)
Business starting year	0.01	0.01	0.01	-1.13**
	(0.76)	(1.40)	(1.18)	(-2.28)
Affiliation dummy (if previously worked in the industry before starting own business=1)	0.30	0.26	0.11	2.88
	(1.45)	(1.38)	(0.66)	(0.24)
Constant	-7.52	-17.5	-14.9	2420.8**
	(-0.37)	(-1.23)	(-1.08)	(2.39)
Sample size	348	404	404	404
No. of left and right censored Observations				Left: 91 Right: 96

Note: z and t values are in the parentheses. ***, ** and * denotes significance level 1 per cent, 5 per cent and 10 per cent level respectively.

Table 8 presents the estimated functions explaining natural log of yearly sales revenue, natural log of per piece raw bamboo price, per piece final product price and percentage sales to traders. The table shows that in the estimated sales revenue function only age and sex of the craftsmen are significant. Importantly, the sign of coefficients of age and

square of age reveal that initially sales revenue increases with the increase age, however after a certain level age sales revenue starts to decline. Probably, after a certain level age older craftsmen turns too old to manage things efficiently and thus sales revenue starts to decline after a certain level age. Thus the relationship between age and sales revenue is non-linear, in which the sales revenue increase with the increase in age of the craftsmen and later sales revenue declines. Similar to the estimated sales revenue function, the age variable is also significant in the estimated functions explaining raw per piece raw bamboo price, per piece final product price and holds the relationship in the same way.

Dummy for years of schooling is only positive and significant in the function explaining natural log of per piece price of final product. According to the estimated function, sample craftsmen, who have completed six to nine years of schooling, receive more than 50 per cent higher price for per piece final product compared to others.

The coefficient of male dummy is positive and significant in the estimated functions explaining natural log of yearly sales revenue and natural log of per piece raw bamboo price. According to the estimated function explaining sales revenue of the craftsmen, on average male craftsmen receive 40 per cent higher sales revenue, and use 50 per cent more costly raw bamboo compared to female craftsman. The reason might be that in a male dominated society probably access to high quality raw bamboo and facilities to sell products at a higher price by peddling bamboo products from door to door are easier for a male craftsman compared to a female craftsman. Thus, female craftsmen tend to operate small plants compared to male craftsmen.

In case of estimated function explaining percentage sales to traders', the age variable is negative and significant and square of age is positive and significant. Thus, young craftsmen tend to sell less to traders', however, older craftsmen are more likely to sell to traders. This is probably because; if a craftsman does not sell his products to traders then only option is left for him is to sell products directly to the consumers by peddling from door to door. Compared to an older craftsman, it is easier for a young craftsman to peddle products from door to door. As selling directly to the consumer ensures higher price, young and energetic craftsmen tend to sell less to the traders. In the estimated function explaining proportion of sales to traders, dummies for education appear negative. The possible reason might be that as educated craftsmen tend to operate small business, they are more likely to sell directly to the consumers in the locality rather than selling to traders.

6.0 Major Findings and Policy Recommendations

It is depicted in the paper that the traditional bamboo craftsmanship has created ample employment opportunity for the rural poor. Most of the bamboo craftsmen are, however, less educated and have inherited the technology from their parents. New entry in the bamboo sector is seldom taking place. Almost all of craftsmen produce similar products, such as stools, mats, baskets, fishing traps and cages, poultry cages and ladder.

Majority of craftsmen belong to age group 40 years and above. Probably, low level of human capital of the bamboo craftsmen hinders the progress of the industry. It is found that age and starting year of the craftsmen significantly influence raw bamboo price, final product price, sales revenue and percentage sell to traders.

Based on the findings of research, the paper suggests following recommendations for further development of the bamboo industry in Bangladesh:

i. The level of human capital of the sample bamboo craftsmen is alarmingly low. As the level of human capital determines craftsmen's' ability to create and adopt modern technology, and thus affect the dynamic growth pattern of an industry, massive formal education and training must be introduced in rural Bangladesh for further development of the rural non-farm economic activities. Government as well as NGOs and other donor agencies, such as JICA and DFID, can take initiative to impart training to the rural craftsmen in Bangladesh.

ii. The provision of microcredit facilities with zero or low interest rate might be introduced for the rural craftsmen. Donor agencies, government and NGOs might work together in providing microcredit to the rural craftsmen.

iii. Homeless rural craftsmen should be given priority in distributing khas land (government owned land) and might be given priority in government's homeless rehabilitation programme (e.g., Ashrayan project).

iv. Provision of training relating to planting and nourishing bamboo bushes should be introduced and strengthen further in the rural areas of Bangladesh. Bangladesh Forest Research Institute (BFRI) in collaboration with other similar organisations and NGOs should disseminate the latest knowledge and technology relating to planting and nourishing bamboo bushes and preserving and processing raw bamboo.

v. To facilitate product marketing, attractive bamboo products, show pieces and decorative items might be displayed in different trade fairs and exhibitions both in home and abroad. Public private partnership can be initiated in marketing the products of the rural craftsmen in Bangladesh.

7.0 Conclusion

Bamboo craftsmanship is one of the oldest non-farm economic activities in rural Bangladesh. This paper tries to characterise the bamboo craftsmen and examines employment pattern, production and marketing channels of the bamboo craftsmen. It is found that bamboo craftsmen are mostly less educated. Low level of human capital, lack of training, and finally scarcity of raw bamboo have been threatening the survival of the bamboo craftsmanship in Bangladesh. Based on the findings, the paper emphasises that to facilitate the growth of the bamboo craftsmanship in Bangladesh government, donor agencies and NGOs should inject the latest knowledge and training to the craftsmen. Moreover, interest free loan and assistance to product marketing should be ensured for further development of the bamboo craftsmanship in rural Bangladesh.

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Socioeconomic Impact of SHGs on the Beneficiaries in Kathua District, India

Sushil Kumar Mehta[*a], Hari Govind Mishra[*] and Amrinder Singh[**]

Abstract

The present paper is the outcome of an ex-post evaluation study of the SHGs promoted by Gramudyog Hastakala Kendra, an NGO working for promotion of SHGs in Kathua District of Jammu region. A sample of 10 SHGs consisting of 162 members have been taken to study the various aspects of the SHGs viz. educational profile, economic status and occupational pattern etc. pre- and post-SHG formation. It is found that most of the members of SHGs are economically weak. The overall findings of the study suggest that SHG - Bank Linkage Programme has considerable positive impact on the social conditions. It has also empowered women members substantially and has contributed to increased self-confidence and positive behavioural changes in the post-SHG period as compared to the pre-SHG period.

1.0 Introduction

Finance is one of the most crucial inputs for economic activity, growth and development. If finance through own accumulated resource or equity is neither available nor sufficient, debt assumes a major significance. The structure of rural financial market in India is dualistic: both formal and informal financial intermediaries operate. The rural borrower has been depending upon institutional sources for production/investment credit requirement. But, for consumption credit needs, he/she is forced to go to non-institutional sources. However, credit provided by non-institutional/informal lenders has been exploitative and expensive for the rural poor.

In rural areas women living below the poverty line are unable to realise their potential. Microfinance programmes are currently being promoted as a key strategy for simultaneously addressing both poverty alleviation and women's empowerment. Microfinance is only a means and not an end. The ultimate goal is to reduce poverty. The self-help groups (SHGs) of women as sources of microfinance have helped them to take part in development activities. The participation of women in SHGs made a significant impact on their empowerment both in social and economic aspects.

The post-nationalisation period in the banking sector in India, circa 1969, witnessed a substantial amount of resources being allocated towards meeting the credit needs of the poor. There were various objectives for the bank nationalisation strategy including increasing the outreach of financial services to neglected sectors (Singh 2005).

* Asstt. Professor, School of Business, Shri Mata Vaishno Devi University, Katra, J&K, India.

** Research Scholar, School of Business, Shri Mata Vaishno Devi University, Katra, J&K, India.

a Corresponding author. E-mail: sushilkumarmehta@gmail.com

As a result of this strategy, the banking network experienced an expansion phase without comparables in the world. Credit came to be recognised as a remedy for many of the ills of the poverty. There spawned several pro-poor financial services, supported by both the State and Central governments, which included credit packages and programmes customised to the perceived needs of the poor. While the objectives were commendable and sizeable progress was achieved, credit flow to the poor, and particularly to poor women, remained low. This led to initiatives which were institution driven that attempted to congregate the existing strengths of rural-banking infrastructure and control this to better serve the poor. The revolutionary efforts at this were made by National Bank for Agriculture and Rural Development (NABARD), which was given the tasks of framing suitable policy for rural credit, provision of technical assistance backed liquidity support to banks, regulation of rural credit institutions and other development initiatives.

In the early 1980s, the Government of India (GoI) launched the Integrated Rural Development programme (IRDP), a large poverty alleviation credit programme, which provided government-subsidised credit through banks to the poor. It was aimed that the poor would be able to use the inexpensive credit to finance themselves over the poverty line. Also during this time, NABARD carried out a series of research studies independently as well as in association with Mysore Resettlement and Development Agency (MYRADA), a leading non-governmental organisation (NGO) from Southern India, which revealed that in spite of having a vast network of rural bank branches servicing the rural poor, a very large number of the abysmally poor continued to remain outside the fold of the formal banking system.

In 1999, the GoI amalgamated various credit programmes together, polished them and launched a new programme called Swaranjayanti Gram Swarozgar Yojana (SGSY). The mandate of SGSY is to persist to provide subsidised credit to the poor through the banking sector to create self-employment through a self-help group approach, and the programme has grown to mammoth size. MFIs have also become popular throughout India as one form of financial intermediary to the poor. MFIs exist in many forms including co-operatives, Grameen-like initiatives and private sector MFIs. Thrift co-operatives have formed organically and have also been promoted by regional state organisations like the Cooperative Development Foundation (CDF) in Andhra Pradesh.

In 2005, the GoI introduced significant measures in the annual budget affecting MFIs. Specifically, it mentioned that MFIs would be eligible for external commercial borrowings which would allow MFIs and private banks to do business thereby increasing the capacity of MFIs. Also, the budget talked about plans to introduce a microfinance act that would provide some regulations on the sector. It is clear from the previous discussion that the objectives of the bank sector nationalisation strategy have resulted into several offshoots, some of which have succeeded and some have failed. Today, Self-Help Groups and MFIs are the two dominant constituents of microfinance in India.

According to NABARD, a SHG consists of an 'average size' of 15 people from a homogeneous social or economic class, all of whom come together for addressing their common problems. The SHGs meet regularly and save small sums of money. The groups

are promoted either by banks or non-governmental organisations (NGOs) and are credit-linked through various models developed by banks. In India, the SBLP has now been in operation for well over a decade. The NABARD report (2005-06) suggests that the cumulative number of SHGs financed by banks till March 2006 was approximately 2.3 million across the country with a membership of 32.98 million persons. Regarding the regional distribution of SHGs, the report suggests that more than half the SHGs (12.1 lakh up to March 2006) are operating in south India, followed by 3.9 lakh in the east and 2.7 lakh in the central region. However, the north-east has only about 60,000 SHGs. The existing literature on SHG- bank linkage programme reveals an overall picture of great promise on the socioeconomic well-being of the members' households. Much has happened in this sector during the past decade, and a number of studies have already evaluated the outreach and the coverage of SHG programmes, some of which have been reviewed in the following section.

In the State of Jammu and Kashmir, the SHG movement has been mainly driven by the NGOs. Majority of the groups formed in the state are formed by the NGOs. The District Rural Development Agency (DRDA), Government of Jammu and Kashmir, has also been promoting SHGs under SGSY. The DRDA takes help of NGOs for formation of groups. The banks, especially Commercial banks have promoted some groups. The performance of the SHGs in Kathua District compares favourably with that at the state level - both in terms of physical coverage and financial performance. Impact assessment relates whether a programme is fulfilling its stated objectives. In the light of the importance of microfinance in pushing back rural poverty, through the formation of SHGs, this study has been undertaken in Kathua District of Jammu and Kashmir, India.

2.0 Review of Literature

In India, the first survey on SHGs was undertaken by NABARD, along with other Indian members of the Asian and Pacific Regional Agricultural Credit Association (APRACA). They conducted an action and research on linking SHGs with the concept of savings and credit in 1987 and published the outcome of the research in the form of a survey report in 1989. The survey was carried out in the form of case studies of 46 SHGs spread over 11 states and associated with 20 SHPIs. Of all the SHGs sampled, 17 had savings collection and credit provision as a major activity. Another 13 were engaged in farming or farm-based activities, five were into social forestry and afforestation, eight were engaged in non-farm activities, and three were occupied in diverse occupations.

Puhazhendi and Satyasai (NABARD) (2000) conducted a study for NABARD on SHG-bank linkage programme. The study assessed the impact of microfinance on socioeconomic conditions of 560 household members from 223 SHGs located in 11 states of India. The study found homogeneity in terms of group members living in the same village or having uniform socioeconomic status. With regard to social aspects, the study found that becoming members of SHGs and associating in its activities had significantly contributed to improving the self-confidence of the participating women.

Puhazhendhi amd Satyasai (2002) conducted a study on Empowerment of rural women through self-helps groups - An Indian experience. For the study the data were collected with the help of a structured questionnaire. The sample for the study was 223 SHGs functioning in 11 states representing four different regions across the country. For assessing the impact of the programme, pre-SHG and post-SHG situations were compared. The reference year of the study was 1999-2000. Data in various economic and social aspects such as asset structures, income, social empowerment, behavioural changes etc. were collected and analysed to assess the impact. It was concluded in the study that SHG as institutional arrangement could positively contribute to the economic and social empowerment of the rural poor.

National Bank for Agriculture and Rural Development (2002) conducted another ex-post evaluation study of self-help groups in Karnal, Gurgaon & Bhiwani districts of Haryana.. It was found in this study that in the pre-SHG situation 55.6 per cent of the members talked freely without any inhibition, and in the post-SHG period, 77.8 per cent of the members talked freely. The percentage of members who hesitated to talk reduced from 22.2 per cent to 5.6 per cent in the post-SHG period. The improvement in the communication was due to increase in awareness and frequent interaction with NGO and bankers. The financial independence of most of the members also helped in achieving their freedom of expression. After joining SHG, the members improved their status in the family, became helpful in family finance and sometimes helped others too. The overall improvement in all these confidence-building factors was about 43 per cent. Involvement with SHG reduced the family violence in 16 per cent cases, especially due to reduced economic difficulties.

Puhazhendi and Badatya (2002) conducted impact study on SHG-Bank Linkage Programme in India. The study assessed the impact on SHG members in three eastern states. The study was based on primary data collected from a sample of 115 members of 60 SHGs. The overall findings of the study suggest that the SHG- bank linkage programme had made a significant contribution to social and economic improvement of SHG members. There was also a remarkable improvement in the social empowerment of SHG members in terms of self-confidence, as reflected in their decision-making abilities and communication skills. Sustainability of SHGs was well-established in terms of increased value of assets and savings rate, better access to institutional loans, higher rate of repayment of loans, elimination of informal sources and impressive social empowerment.

MYRADA (2002) conducted study on women's empowerment of SHG members for the southern region's states in India. In all, 13 SHGs were surveyed, and it covered four professionally managed NGOs (DHAN, RASS, CHASS and MYRADA), one from each state. SHG members were divided into two groups- one that was under 1 year old and the other that was over 3 years old, so that comparisons could be made and conclusions drawn on the influence of group processes. The study found that most of the SHG members were young (26-35 years of age) married women in both groups of SHGs. An important aspect of group formation is stability. Because of migration, particularly of unmarried women who move after marriage to another village, it was suggested that

group leaders should focus only on married women for group formation. Apart from stability, the group leaders reported that SHG groups need the goodwill of the villagers, control & discipline and financial stability.

Nair (2005) examined the potential of SHG federations in providing sustainability to SHGs through financial and organisational support. In terms of services provided by SHG federations and thrift cooperation to SHGs, the study found that the most common service is savings and loan facilities.

Ghate (2006) highlighted the findings of recent studies on the SBLP-microfinance institutions model in India and in other countries. It reviewed the findings of three important recent studies, Parkas and others (2005), APMAS (2005) and EDA Rural System and APMAS (2006). All these studies revealed that SBLP is growing at a higher rate ahead of the capacity of SHPIs to ensure equity. The study notes that groups formed by government agencies tend to be the weakest, and their share is reducing relative to those promoted by NGOs.

Moyle, Dollard and Biswas (2006) assessed the economic and personal empowerment of 100 women aged from 16 to 65 years, participating in SHGs from two villages in Rajasthan in India. Based on qualitative data, the study found that after joining SHGs, the members achieved both economic and personal empowerment in terms of collective efficiency, pro-active attitudes, self-esteem and self-efficacy.

EDA Rural Systems and APMAS (2006) conducted a study on the SHG-Bank-linkage programme in India. The study was based on a primary survey of 214 SHGs in 108 villages in 9 districts of four states. Overall, the data reflect relatively low standard deviation around the mean for the number of loans and amount borrowed by members. The study evaluated the repayment of loans by members to SHGs on monthly basis. It was found that 24 per cent of borrowers were more than three months behind schedule on repayments. Data on portfolio at risk (PAR) for 155 SHGs show that 45 per cent of such groups had defaulted for more than a year, amounting to 17 per cent of the portfolio.

Meissner (2006) conducted a study for the NABARD-GTZ Rural Finance programme examining the viability of SHG lending in a regional rural bank branch, the Alwar Bharatpur Anchalik Gramin Bank (ABAGB), in India. Overall, the study found that the SHG-lending operations of the branch were viable and sustainable. The importance for the viability of SHG lending operations lies in the low-risk costs of SHG lending in comparison to normal transactions.

Ramakrishna (2006) assessed the SHG bank-linkage programme from the primary data collected from 27 public sector banks, 192 regional rural banks and 114 cooperative credit institutions in India. The analysis of the study was based on information from the banks as on 31 March 2005. The study reported that commercial banks had a major share of the market at 61 per cent of total number of active SHG members and 68 per cent of the total number of loans outstanding to these SHGs. As compared to 61 per cent market share of commercial banks, the RRBs had 30 per cent and cooperative banks had only 9 per cent of the share of the total number of active SHG members.

3.0 Knowledge Gap and Significance of the Study

The state of Jammu and Kashmir has its own economic and cultural ethos. Geographically as well as culturally, the state can be divided into three main regions. The Jammu Region being culturally adjacent to Punjab is dominated by Punjabi culture, Kashmir Region dominated by Muslim population and Ladakh region has mainly Buddhists. The microfinance programme began in the state as early as it took in other states, but the progress in SHG formation and linkages is far behind other states, which could be mainly due to very low level of poverty of nearly 3.5 per cent of total population of the state. The state has also faced unrest due to militancy during last decade, as a result of which the overall economic growth got slowed down. Another reason could be poor publicity of the programme and low understanding of the concept. There could be some other factors-reasons for poor progress of SHG-Bank Linkage Programme. The outreach of formal credit delivery system to the rural poor is still in the nascent stage in the state.

A number of studies [NABARD (1995), SANGWAN (1997), NABARD (1997), DATTA and RAMAN (2001)] have documented the achievement and impact of SHGs in Karnataka, UP, Tamil Naidu and Andhra Pradesh, respectively. A comprehensive study by NABARD (2002) in 22 districts of 11 states from a sample of 560 members of about 220 SHGs has revealed, interalia, increase in income of households involved with SHGs. Involvement of the members in group activities significantly contributed to improving their self-confidence and communication skills. A number of studies were conducted internally by NABARD as well as with the help of outside agencies to evaluate the impact of SHG in various other states, but no study has been conducted in the state of Jammu and Kashmir so far. Therefore to address the knowledge gap, the present paper tries to assess the socio-economic impact of SHG in Kathua District of Jammu & Kashmir.

3.1 Objectives

The Broad objective of the study is to analyse the impact of SHGs on beneficiaries. In specific terms, the objectives of the study are as follows:

i. To study the socio-economic profile of SHGs in the study area.
ii. To explore the social impact of SHG-Bank linkage programme during Pre-and Post-SHG period.
iii. To assess the empowerment of members of SHGs during Pre- and Post-SHG period.
iv. To study the policy implications arising out of the study.

4.0 Research Methodology

The SHG movement in the State of Jammu and Kashmir has been mainly driven by the NGOs. Majority of the groups formed in the state are formed by the NGOs. In total there are 19 NGOs working for microfinance in the whole state. Gramudyog Hastakala Kendra (GHK) is the oldest NGO woking since 1998 in Kathua District, and it is the one who had initiated the concept of microfinance in the state. The present paper is an ex-post

evaluation study of the SHGs promoted by GHK, an NGO working for promotion of SHGs in Kathua District of Jammu region. GHK has promoted 400 SHGs in total in the whole Kathua District, which is highest than any other NGO in the state and for assessing impact of microfinance, it is necessary to take the older and stable groups. The SHGs have been selected by using convenience sampling technique. A sample of only 10 SHGs consisting of 162 members from seven different villages has been taken for the present study because the SHGs formed by GHK are quite scattered and transport and even road facilities are not there in those villages. The primary data have been collected through a structured questionnaire, and the survey has been carried out during July-August 2010.

4.1 The Garrett Ranking Technique

Ranking is an expression of the respondent's priority about their thoughts and feelings. Garret and woodworth (1971) and Ray and Mondal (2004) have enunciated a scoring procedure suggested by Garrett in 1969 for converting the ranks into scores when the number of items ranked differed from respondent to respondent. The conversion method used was as follows:

As a first step, the per cent position of each rank was found out by the following formula:

Per cent position = $100(R_{ij} - 0.5) / N_j$ where,

R_{ij} = Rank given for i^{th} items by the j^{th} individual

N_j = Number of items ranked by j^{th} individual

The per cent position of each rank, thus obtained was then converted into scores by referring to the table given by Garrett in 1969. The respondents were requested to rank the opinions/reasons relevant to them according to the degree of importance. The ranks given by each of the respondents was converted into scores. Then for each opinion/reason, the scores of individual respondents were added together and divided by the total number of respondents. These mean scores for all the reasons were arranged in the descending order and ranks were given. By this method, the accuracy in determining the preference was obtained.

In the present study, the Garrett ranking technique has been used to study the overall opinion of the SHG members regarding the utility of SHGs.

4.2 McNemar Test

In statistics, McNemar's test is a non-parametric method used on nominal data. It is applied to 2 × 2 contingency tables with a dichotomous trait, with matched pairs of subjects, to determine whether the row and column marginal frequencies are equal (marginal homogeneity). It is named after Quinn McNemar, who introduced it in 1947. An application of the test in genetics is the transmission disequilibrium test for detecting genetic linkage.

The test is applied to a 2 × 2 contingency table, which tabulates the outcomes of two tests on a sample of n subjects, as follows;

	Test 2 positive	*Test 2 negative*	*Row total*
Test 1 positive	a	b	a+b
Test 1 negative	c	d	c+d
Column total	a+c	b+d	n

The null hypothesis of marginal homogeneity states that the two marginal probabilities for each outcome are the same, i.e. $p_a + p_b = p_a + p_c$ and $p_c + p_d = p_b + p_d$.

Thus the null hypothesis is $p_b = p_c$.

Here p_a, etc., denotes the theoretical probability of occurrences in cells with the corresponding label.

The McNemar test statistic with Yates's correction for continuity is given by:

An alternative correction of 1 instead of 0.5 is attributed to Edwards by Fleiss, resulting in a similar equation:

$$\chi^2 = \frac{(|b-c|-1)^2}{b+c}.$$

Under the null hypothesis, with a sufficiently large number of discordants (cells b and c), X^2 has a chi-squared distribution with 1 degree of freedom. If either b or c is small (b+c<25) then X^2 is not well-approximated by the chi-squared distribution. The binomial distribution can be used to obtain the exact distribution for an equivalent to the uncorrected form of McNemar's test statistic. In this formulation, b is compared to a binomial distribution with size parameter equal to b + c and 'probability of success ' = ½, which is essentially the same as the binomial sign test. For b + c < 25, the binomial calculation should be performed, and indeed, most software packages simply perform the binomial calculation in all cases, since the result then is an exact test in all cases. When comparing the resulting X^2 statistic to the right tail of the chi-squared distribution, the p-value that is found is two-sided, whereas to achieve a two-sided p-value in the case of the exact binomial test, the p-value of the extreme tail should be multiplied by 2.

If the X^2 result is significant, this provides sufficient evidence to reject the null hypothesis, in favour of the alternative hypothesis that $p_b \neq p_c$, which would mean that the marginal proportions are significantly different from each other.

McNemar test has been applied to study the impact of SHG on the access to various amenities and also on the self-confidence of the SHG members.

4.3 Sign Test

In statistics, the sign test can be used to test the hypothesis that there is 'no difference in medians' between the continuous distributions of two random variables X and Y, in the situation when paired samples can be drawn from X and Y. It is a non-parametric test which makes very few assumptions about the nature of the distributions under test - this means that it has very general applicability but may lack the statistical power of other tests such as the paired-samples t-test.

It is for use with 2 repeated (or correlated) measures, and measurement is assumed to be at least ordinal. For each subject, subtract the 2nd score from the 1st, and write down the sign of the difference. (That is write '-' if the difference score is negative, and '+' if it is positive.) The usual null hypothesis for this test is that there is no difference between the two treatments. If this is so, then the number of '+' signs (or '-' signs, for that matter) should have a binomial distribution with p = 0.5, and N = the number of subjects. In other words, the sign test is just a binomial test with '+' and '-' in place of Head and Tail (or Success and Failure).

Sign test has been applied to study the impact of SHG on the communication level and frequency of interaction with officials.

5.0 Analysis

This part of the paper deals with the analysis and interpretation of the primary data with respect to general profile of SHGs, social impact and empowerment of SHG members.

5.1 General Profile of the Sample SHGs

Table 1: General Profile of the Sample SHGs

Sl. no.	Name of SHG	Members	Date of formation	Age of SHG	Thrift amount per group per month	Village
1.	Mahila Sangathan	10	12-Jan-08	2 years & 7 months	Rs. 300 (Rs. 30/- member)	Chandra Chakk
2.	Kamal	10	1-Jun-08	1 year & 8 months	Rs. 300 (Rs. 30/- member)	Chandra Chakk
3.	Lotus	20	10-Aug-07	3 years	Rs. 600 (Rs. 30/- member)	Phale Pur
4.	Komal	20	5-May-06	4 years & 3 months	Rs. 600 (Rs. 30/- member)	Phale Pur
5.	Nari Sangathan	14 (Three left)	2-Sep-05	4 years & 11 months	Rs. 700 (Rs. 50/- member)	Hira Nagar
6.	Radha	13 (Two left)	5-Aug-01	9 years	Rs. 1300 (Rs. 100/- member)	Banyadi
7.	Shobha	17(Added three)	16-Aug-02	8 years	Rs. 1700 (Rs. 100/-member)	Banyadi
8.	Ganga	19	1-Aug-06	4 years	Rs. 950 (Rs. 50/- member)	Kootah More
9.	Hari Om	20	1-Dec-07	2 years & 10 months	Rs. 1000 (Rs. 50/- member)	Guru Baloo
10.	Karan	19 (One left)	1-Aug-06	4 years	Rs. 570 (Rs. 30/- member)	Mugloore

Table 1 depicts the general information regarding the sample members of SHGs. All the SHGs selected for the survey are women SHGs and are conducting monthly meetings at the members' residence by rotation. In the sample SHGs; the oldest group is 9 years and 8 years old as on August 2010 and the youngest group is 1 year and 8 months old as on August 2010 with an average age of 4 years and 5 months. It can also be seen from the table that largest group has 20 members while the smallest group has ten members. Thrift amount per member per month is fixed, which is Rs.30 in majority of the cases while for 3 SHGs it is Rs.50 and for 2 SHGs it is Rs.100/-. No late fee is being charged by any group in case of non-payment of monthly thrift on time. Twenty-Four per cent is the annual interest rate charged to the members of SHGs for taking loan from the corpus. Majority of the SHGs have never raised or reduced the monthly savings amount except one SHG who had raised it from Rs.50 to Rs.100 per member. From the above table, it can be concluded that microfinance movement is moderately old in the state and is picking up.

5.2 Basis of Forming Groups

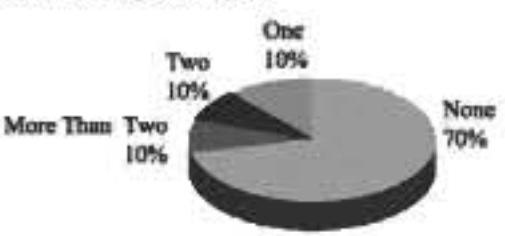
As depicted in Figure 1 about the basis of forming the groups, it can be observed that 45 per cent of SHG members have formed group on the basis of same caste, 40 per cent on the basis of saving, ten per cent because of common activity and only five per cent on the basis of same street.

Figure 1: Basis of Forming Groups

5.3 Attrition Rate of Members of SHGs

Figure 2 presents the response of the members regarding attrition in the SHGs. It can be seen that 70 per cent of SHGs have responded that no member had left their groups, while ten per cent SHGs reporting one member, another ten per cent of SHGs reporting two members and remaining ten per cent of SHGs reporting more than two members of their SHGs had left the group since inception. Therefore, it can be concluded that the attrition rate of the SHG members is quite low.

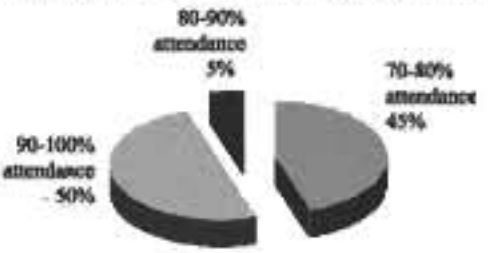
Figure 2: Attrition Rate of Members of SHGs



5.4 Average Attendance in Last Five Meetings of SHG Members

Figure 3 portrays the response of the members regarding average attendance during last five meetings. It can be seen that the average attendance in the last five meetings of 50 per cent of SHG members comes out to be between 90-100 per cent, for 45 per cent members between 80-90 per cent and for remaining five per cent members between 70-80 per cent. All the groups maintain an attendance register. Average attendance of all the sample SHG members is more than 70 per cent.

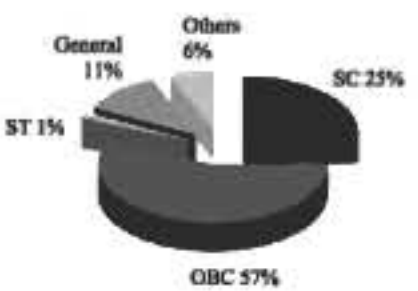
Figure 3: Average Attendance in Last Five Meetings of SHG Members



5.5 Community-wise Distribution of Sample Members

Figure 4 depicts the distribution of the sample SHG members on the basis of Community. It can be observed that 25 per cent of SHG members are from Schedule Caste (SC), 57 per cent members from Other Backward Class (OBC), only one per cent from Schedule Tribe (ST), 11 per cent from general category and remaining six per cent from others category which consists of minorities (Sikhs and Muslims). So OBCs constitute the major chunk of sample SHG members.

Figure 4: Community-wise Distribution of Sample Members



5.6 Age of SHG Members

Figure 5: Age of SHG Members

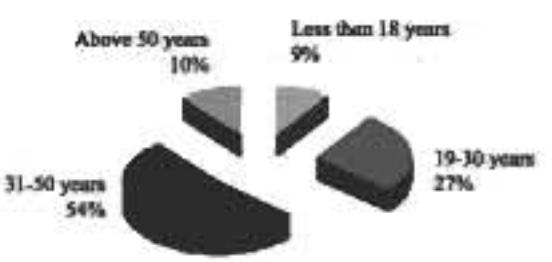


Figure 5 shows the distribution of the members on the basis of age of the SHG members. It can be seen that 9 per cent of SHG members are below 18 years of age, 27 per cent are between 19-30 years of age, 54 per cent between 31-50 years of age and remaining ten per cent above 50 years of age. Therefore, it can be concluded that majority of the members are above 30 years of age.

5.7 Occupational Pattern of SHG Members

Figure 6 presents the distribution of the sample SHG members on the basis of occupational pattern. It is found that 15 per cent of SHG members deal in farm activities, 23 per cent are Agricultural labourers, 35 per cent are housewives, 15 per cent deal in services which include anganwadi helper, school peon, etc. and remaining 12 per cent of sample SHG members deal in other activities which is mainly shawls manufacturing. So housewives form the largest proportion followed by agricultural labourers.

Figure 6: Occupational Pattern of SHG Members

5.8 Housing Position of SHG Members

Figure 7 portrays the response of the members into two categories on the basis of owning Kuchcha house (Mud house) or Pucca house (Cemented house). It can be seen that 54 per cent of the members are having Pucca house while remaining 46 per cent are having Kuchcha house.

Figure 7: Housing Position of SHG members

5.9 Educational Status of SHG Members

Figure 8: Educational Status of SHG members

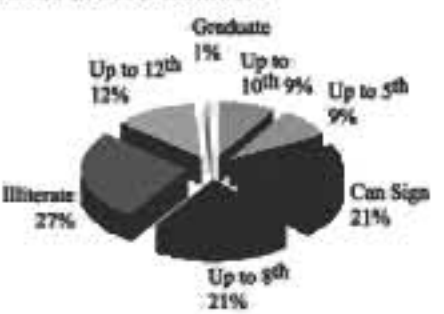
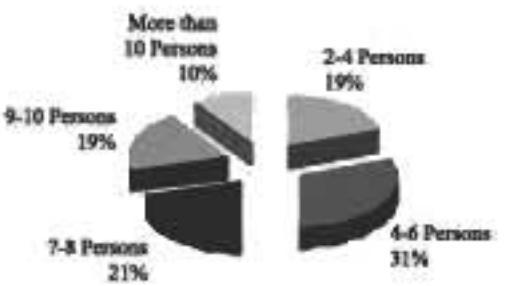


Figure 8 shows the distribution of the members on the basis of their Educational status. It can be seen that 27 per cent of SHG members are illiterate, 21 per cent can sign, nine per cent have studied up to 5th standard, 21 per cent up to 8th standard, nine per cent up to 10th standard, 12 per cent up to 12th standard and remaining one per cent are graduate. Therefore, it can be concluded that majority of the members can at least sign.

5.10 Family-size of SHG Members

Figure 9 depicts the distribution of the sample SHG members on the basis of their family size. It can be observed that 19 per cent of SHG members have two to four persons in their family, 31 per cent have five to six persons in their family, 21 per cent have seven to eight persons in their family, 19 per cent have nine to ten persons in their family and remaining ten per cent have more than ten persons in their family. Therefore, it can be concluded that majority of the members are having more than five members in their respective families.

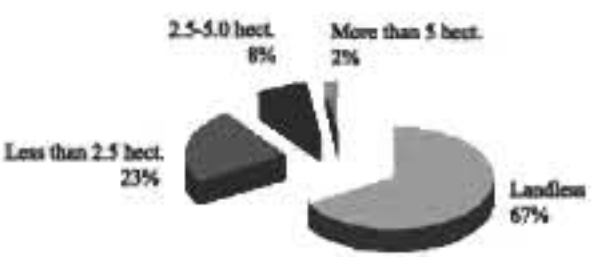
Figure 9: Family-size of SHG Members



5.11 Land Holding by SHG Members

Figure 10 presents the distribution of the sample SHG members on the basis of their land holding. It can be clearly seen that 67 per cent of SHG members are landless, 23 per cent are having land less than 2.5 hectares, 8 per cent are having land between 2.5 and 5 hectares, and only two per cent are having land more than 5 hectares. So it can be concluded that the majority of sample SHG members are landless.

Figure 10: Land Holding by SHG Members



5.12 Economic Status of SHG Members

Figure 11 portrays the response of the members on the basis of economic status. It is clearly discernible that 38 per cent of SHG members fall in Above Poverty Line (APL) category while 62 per cent members in Below Poverty Line (BPL) category. Therefore majority of the sample SHG members are low economically.

Figure 11: Economic Status of SHG Members

6.0 Social Impact and Empowerment of Members

Vast sections of the rural poor are even now deprived of the basic amenities, opportunities and oppressed by social customs and practices. Several programmes were implemented by various governments and non-governmental organisations to uplift them both economically and socially. SHG programme is one such attempt but with a difference as it follows group approach. It has been an accepted premise that women were not given enough opportunities to involve themselves in the decision-making process of the family as well as in the society. Hence, women were the main target groups under SHG programme. When infused with confidence and sense of belonging to the group, it has been found that women often would show better results than men.

The SHG programme provides adequate scope for the rural households, especially women, to help in developing self-worth and social behaviour through a series of trainings and group meetings organised by the NGOs and banks. An assessment of the impact of SHGs on social life of the members by comparing the pre- and post-SHG situations was carried out. The overall social impact has been summarised in Table 8, and it has been further seen in detail as under:

6.1 Degree of Communication of Members

Table 2: Distribution of Members according to the nature of communication in the meeting

Features	*Pre-SHG*		*Post-SHG*	
	Number	*Percentage*	*Number*	*Percentage*
Free talks	38	24	116	72
Sometimes talks	62	38	34	21
Hesitates to talk	62	38	12	7
Total	162	100	162	100

Table 2 presents the changes that occurred in the nature of communication of the members in the meetings during pre-and post-SHG period. It is found that there has been 48 per cent increase in number of SHG members, who can now freely talk in the meetings while there has been a decrease of 17 per cent and 31 per cent members, who sometimes talks or hesitates to talk. Thus it can be concluded that Microfinance movement is having a good impact on members, in their ability to express their feelings and has made people more confident to express themselves.

6.1.1 Frequency of interaction with outsiders

Table 3 presents the changes that occurred in the frequency of interaction with outsiders or officials during pre-and post-SHG period. Members generally, got lesser opportunity to interact with bankers, government officials, NGOs and others in the Pre-SHG period. It can be seen that in the Pre-SHG period 51 per cent of the members were not interacting with officials whereas after associating with SHGs, 91 per cent members had interacted with the outsiders, out of which 44 per cent have interacted more than four times with outsiders. This interaction has helped them articulate their problems and improve their self-confidence.

Table 3: Frequency of Interaction with Officials

Frequency of interaction with officials	*Pre-SHG*		*Post-SHG*	
	Number	*Percentage*	*Number*	*Percentage*
None	82	51	14	9
Once	50	31	24	15
2-4 times	22	13	52	32
More than 4 times	8	5	72	44
Total	162	100	162	100

In order to test whether there is any significant difference in the level of communication among the members and the number of officials met before and after joining the SHGs, the Sign Test was used. For that purpose, the following null hypothesis was framed.

There is no significant difference in the level of communication between the members and the number of officials met by the members in the Pre- and Post-SHG period'.

The results of the Sign Test for the level of communication and the number of officials met are depicted in Table 4.

Table 4: Results of Sign Test for Communication Skill & Interaction with Officials

Sl. no.	*Particulars*	*Z Value*	*Level of significance*	*Result*
1.	Level of communication	- 9.394	0.000	***
2.	Number of officials met	- 10.453	0.000	***

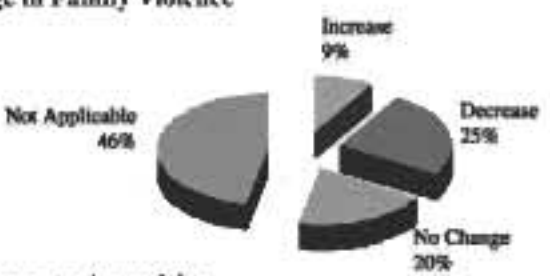
Note: *** Significant at 5 per cent level.

It is observed from Table 4 that the calculated values of Z for different types of communication and the number of officials met are less than the Table value (-1.96) at the 1 per cent level and hence the null hypothesis is rejected. It is concluded that there is a significant difference in the level of communication between the members and the number of officials met by the members before and after joining the SHGs.

6.2 Change in Family Violence

Family violence being a sensitive topic was difficult to be ascertained from the members, especially women. Figure 12 depicts that family violence is reported to have increased after joining SHG by 29 per cent of sample households. It has been seen that the most important element in violence is verbal abuse. Involvement with SHG has reduced this violence in 25 per cent cases, especially due to reduction in economic difficulties. In most of cases the members suggested that their husbands should also be involved in SHGs.

Figure 12: Change in Family Violence



6.3 Status of Access to Amenities

Since SHG programme has economic as well social implications, it is necessary to evaluate the various dimensions of the programme. Lack of infrastructure facilities, access to amenities like health, sanitation, education, market, water supply, affect the economic and overall development of the members. Table 5 presents the status of access to above mentioned facilities for the sample members. It can be seen that there has been an increase of 40.53 per cent in SHG members in terms of their status of access to amenities factors. Therefore, it can be concluded that after joining SHG, the members have been benefited in getting access to amenities like medical, sanitation, education, market, water supply, and transport.

Table 5: Status of Access to Amenities

Particulars	*Pre-SHG*		*Post-SHG*	
	Number	*Percentage*	*Number*	*Percentage*
Medical facilities	82	50.6	146	90.1
Sanitation facilities	50	30.8	134	82.7
Water supply facilities	48	29.6	106	65.4
Market facilities	74	45.67	132	81.4
Adequate transport facilities	68	41.97	140	86.41
School for children	76	46.91	134	82.71
Average	66.33	40.92	132	81.45

6.3.1 Health care facility

Different types of health-care facilities such as homeopathy, allopathic, unnani, siddha, ayurvedic and herbal medicines are available to both the urban and the rural people. Private and the government sectors provide these medical facilities. The membership in the SHGs creates awareness among the members to avail themselves of the different types of medical facilities provided by different agencies to lead a way to happy life. There are some members who are shy of going to medical practitioners for treatment and they resort to self-medication.

Table 6 shows the distribution of members based on the extent of availing themselves of medical facility before and after joining the SHGs. It could be observed that 82 (50.62%) members availed themselves of medical facility before joining the SHGs whereas the number of members increased to 134 (82.72%) after joining the SHGs.

Table 6: Availing of Medical Facilities by Members

Sl. no.	*Response*	*Pre-SHG*	*Post-SHG*
1.	Availing	82 (50.62)	134 (82.72)
2.	Not Availing	80 (49.38)	28 (17.28)
	Total	162	162

Note: Figures in brackets indicate percentage to total.

Source: Primary Data

6.3.2 Sanitation

Sanitation inside the house, in the locality of the village and in the urban area is indispensable for healthy living of people. Poor sanitation results in the spreading of different types of diseases among the people. Therefore, the individuals and local government authorities like corporations, municipalities and panchayats pay special attention to the provision of sanitary facilities to the people. The banks grant loan to the people for construction of toilets. The improvement in sanitation by availing of the existing facilities and creation of new facilities is due to the awareness created by the SHGs among the members.

The distribution of members with sanitary facilities in their houses before and after joining the SHGs is depicted in Table 7. It is evident from Table 7 that 146 (90.12%) members reported having sanitary facility within their houses after joining the SHGs. But the members with sanitary facility in their houses before becoming members in the SHGs are nil.

Table 7 : Members Having Sanitary Facility within Their Houses

Sl. no.	*Response*	*Pre-SHG*	*Post-SHG*
1.	Having water supply	48 (29.63)	106 (65.43)
2.	Not having water supply	114 (70.37)	56 (34.57)
	Total	162	162

Note: Figures in brackets indicate percentage to total.

Source: Primary Data

6.3.3 Water supply

It is the foremost duty of the government to make available good drinking water to its citizens. Keeping this in view, the government, corporations, municipalities and panchayats provide drinking water facility in public places and also to residence of individuals. The water tax is also collected from the individual users. During deficiency situation, special efforts are made to provide drinking water in the rural and in the urban areas. The membership in the SHGs creates awareness among the members to get drinking water facilities to their houses by using of facilities available in the residential localities. If the water facilities are not available from government sources, they themselves take the initiative for digging bore-wells to augment their water resources.

Table 8 discloses the distribution of members according to responses on water supply within the house before and after joining the SHG. It could be seen from Table 8 that about 106 (65.43%) members reported that they had water supply within their houses after joining the SHGs whereas none of the members expressed their opinion that they had such facility before becoming members of SHGs.

Table 8: Members Having Water Supply within Their Houses

Sl. no.	*Response*	*Pre-SHG*	*Post-SHG*
1.	Adequate	74 (45.68)	132 (81.48)
2.	Inadequate	88 (54.32)	30 (18.52)
	Total	162	162

Note: Figures in brackets indicate percentage to total.

Source: Primary Data

6.3.4 Market facilities

The accessibility of market in the locality would enable the people to buy fresh commodities at competitive prices. In the absence of market facilities, the members have to buy the necessities in the few shops in the locality that charge high price for the commodities.

Table 9 highlights the opinions of the members regarding market facilities before and after joining the SHGs. Table 9 shows that about 132 (81.48%) members expressed the opinion that they had adequate market facilities only after joining the SHGs whereas 74 (45.68%) members alone expressed the same opinion before joining the SHGs.

Table 9: Opinion of Members regarding market facility

Sl. no.	*Response*	*Pre-SHG*	*Post-SHG*
1.	Having adequate facility	68 (41.98)	140 (86.42)
2.	Not having adequate facility	94 (58.02)	22 (13.58)
	Total	162	162

Note: Figures in brackets indicate percentage to total.

Source: Primary Data

6.3.5 Transport facilities

In Jammu and Kashmir (J&K) the urban and rural areas are well connected by the network of road transports except for the remote rural areas. If there is no bus facility in the particular locality, the members of the SHGs had approached the appropriate authorities to provide transport facility. In Phale Pur Village, members of the SHGs approached the government for providing transport facilities in their village and have been able to get sanctioned two matadors (local transport vehicle) for their village.

Table 10 discloses the distribution of members with adequate transport facility to go to markets and nearby towns before and after joining the SHGs. It could be observed from Table 10 that 68 (41.98%) members expressed positive opinions on the adequacy of transport facilities before joining the SHGs while 140 (86.42%) members expressed the same opinion after joining the SHGs. This shows that SHG members could negotiate for better transport facilities after joining the SHGs.

Table 10: Availability of Adequate Transport Facilities

Sl. no.	*Response*	*Pre-SHG*	*Post-SHG*
1.	Sending to Educational Institutions	76 (46.91)	134 (82.72)
2.	Not Sending to Educational Institutions	86 (53.09)	28 (17.28)
	Total	162	162

Note: Figures in brackets indicate percentage to total.

Source: Primary Data

6.3.6 Children's education

Education is a device for social transformation. Only through education, people could develop their individual and social life. Keeping this in mind, the SHGs educate the members to send their children to schools. Through rigorous efforts, the members of the SHGs are made to realise the benefits of sending their children to schools and colleges.

Table 11 discloses the number of members sending their children to schools and colleges before and after joining the SHGs. It is evident from Table 11 that now 134 (82.72%) members are educating their children after joining the SHGs in comparison to 76 (46.91%) members before joining the groups.

Table 11: Responses of Members regarding sending of children to schools

Sl. no.	*Response*	*Pre-SHG*	*Post-SHG*
1.	Sending to Educational Institutions	76 (46.91)	134 (82.72)
2.	Not Sending to Educational Institutions	86 (53.09)	28 (17.28)
	Total	162	162

Note: Figures in brackets indicate percentage to total.

Source: Primary Data

6.3.7 McNemar Test for availing of amenities by members in pre- and post-SHG period

To test the null hypothesis that there is no significant difference in availing themselves of the amenities by the members before and after joining the SHGs, McNemar Test was conducted. The results are shown in Table 12.

It is evident from Table 12 that the calculated value of the Chi-square for all facilities acquired by the sample members before and after joining the SHGs is more than the table value (3.84) at 5 per cent level of significance. Therefore, the null hypothesis is rejected. Hence, it could be inferred that there is significant difference in availing themselves of the facilities by the members before and after joining the SHGs.

Table 12: McNemar Test for Availing of Amenities by Members

Sl. no.	*Particulars*	*Calculated Chi-square Value*	*Level of Significance*	*Result*
1.	Health Care Facility	52.224	0.000	***
2.	Sanitary Facility	68.890	0.000	***
3.	Water Supply	36.100	0.000	***
4.	Market Facility	43.905	0.000	***
5.	Transport Facility	34.914	0.000	***
6.	Educational Facility	46.414	0.000	***

Note: *** Significant at 5 per cent level.

6.4 Self-confidence among Sample Members

The group formation brought out the hidden talent and leadership qualities among the members. Table 13 presents the proportion of members showing positive responses to various aspects of self-confidence. It can be seen that there has been an increase of 45.6 per cent in number of SHG members with respect to confidence-building factors. Therefore, it can be concluded that after joining the SHG, the members are getting more respect in family, getting more respect in society, have become helpful in family finance and have become capable of helping others too.

Table 13: Self-confidence among Sample Members

Sl. no.	*Particulars*	*Calculated Chi-square Value*	*Level of significance*	*Result*
1.	Members revealed confidence	78.844	0.000	***
2.	Getting respect in family	46.944	0.000	***
3.	Getting respect in society	46.944	0.000	***
4.	Helps in family finance	75.690	0.000	***
5.	Help others	45.224	0.000	***

Note: Figures in brackets indicate percentage to total.

Source: Primary Data

6.4.1 McNemar Test for self-confidence of members in pre- and post-SHG period

To test the null hypothesis that there is no significant difference in the self confidence of the members before and after joining the SHGs, McNemar Test was conducted. The results are shown in Table 14.

It is evident from Table 14 that the calculated value of the Chi-square for all facilities acquired by the sample members before and after joining the SHGs is more than the table value (3.84) at 5 per cent level of significance. Therefore, the null hypothesis is rejected. Hence, it could be inferred that there is significant difference in the self-confidence of the members before and after joining the SHGs.

Table 14: McNemar Test for Self-confidence of Members

Features	*Pre-SHG*		*Post-SHG*	
	Number	*Percentage*	*Number*	*Percentage*
Members revealed confidence	Yes – 44	(27.16)	Yes – 132	(81.48)
	No - 118	(72.84)	No - 30	(18.52)
Getting respect in family	Yes – 62	(38.27)	Yes – 128	(79.01)
	No - 100	(61.73)	No - 34	(20.99)
Getting respect in society	Yes – 60	(37.04)	Yes – 126	(77.78)
	No - 102	(62.96)	No - 36	(22.22)
Helps in family finance	Yes – 60	(37.04)	Yes – 148	(91.36)
	No - 102	(62.96)	No - 14	(8.64)
Help others	Yes – 60	(37.04)	Yes – 122	(75.31)
	No - 102	(62.96)	No - 40	(24.69)
Average	Yes - 57.2	Yes - 35.2	Yes - 131.2	Yes - 80.8
	No – 104.8	No – 64.8	No – 30.8	No – 19.2

Note: *** Significant at 5 per cent level.

6.5 Overall Utility of SHGs

The aim of the SHG programme has been to provide microfinance, i.e., credit-plus services and also focus on empowerment of the members with special emphasis on women. However, the perceptions and expectations of the people, who joined the SHG programme, might have been quite different. Table 17 depicts the opinion expressed by the sample members about the utility of SHGs. It can be seen that 26 per cent members feel that SHGs have inculcated a habit of saving in the members, 10 per cent members revealed that it is an easy way of getting bank loan, 37 per cent members as a source of consumption loan, 16 per cent members as a source of production loan and only seven per cent and four per cent members as a link to other government agencies and as a source of creating awareness respectively. So it can be concluded that highest proportion of SHG members consider it as a source of consumption loan.

It was further thought to know the perceptions of the respondents on the SHGs. This would help understand the extent to which the SHGs were successful in fulfilling the

Table 15: Overall Utility of SHGs

Particulars	*Number*	*Percentage*
Source of production loan	26	16
Source of consumption loan	60	37
Link to get bank loan	16	10
Link to other govt. agencies	12	7
Source of creating awareness	6	4
Helps in thrift habit	42	26
Total	162	100

expectations of the members and the shortfalls, if any, on the part of SHGs. The opinions of the SHG members about ranking of the utility of SHGs were obtained and rankings were converted to scores through Garrett Ranking Technique. The results are presented in Table 16.

Table 16: Opinion on the Utility of SHGs through Garrett Ranking Technique

Sl. no.	*Particulars*	*Rank*	*Average score*
1.	Source of consumption loan	I	66.06
2.	Helps in thrift habit	II	63.70
3.	Source of production loan	III	62.94
4.	Link to get bank loan	IV	51.77
5.	Link to other govt. agencies	V	41.30
6.	Source of creating awareness	VI	40.04

A look at Table 16 would show that the members had perceived 'source of consumption loan' as the first and the foremost advantage of the SHGs, followed by 'helps in thrift habit', 'source of production loan', 'link to get loan from banks', 'link to other agencies' and-source of creating awareness', in their order of importance. Most of the members ranked loans for both consumption and production purposes and helps in thrift habit as important services of microfinance interventions by the SHGs. According to them, prior to joining the SHGs, they depended largely on usurious moneylenders who provided loans at higher interest rates. They have repaid these loans under great stress and through their nose. Also, they were unable to get loans directly from the banks in the absence of tangible securities. Their joining in the SHGs has solved all these problems, as microfinance has been made available to them by the SHGs. They also perceived the SHGs as agencies to solve their social problems by creating awareness regarding the easily available credit sources through

Table 17: Social Impact of SHGs

Sl. no.	Particulars	Pre-SHG (%)	Post-SHG (%)
I	Communication level		
1.	Free talks	24	72
2.	Sometimes talks	38	21
3.	Hesitates to talk	38	7
II	Self-confidence		
1.	Members revealed confidence	27	81
2.	Getting respect in family	38	79
3.	Getting respect in society	37	78
4.	Helps in family finance	37	91
5.	Help others	37	75
III	Interaction with outsiders		
1.	None	51	9
2.	Once	31	15
3.	2-4 times	13	32
4.	More than 4 times	5	44
IV	Status of access to amenities		
1.	Medical facilities	50.6	90.1
2.	Sanitation facilities	30.8	82.7
3.	Water supply facilities	29.6	65.4
4.	Market facilities	45.67	81.4
5.	Adequate transport facilities	41.97	86.41
6.	School for children	46.91	82.71

microfinance and as a link to other government agencies. Thus the members could achieve their objectives through collective actions by coming together to fight for common causes.

7.0 Policy Implications

The study has indicated that the people, who have joined SHGs have been greatly benefitted in terms of improved communication, increased confidence, better access to amenities like health, sanitation, education, market, water supply etc. Therefore, the J&K Government needs to carry out campaigns for increasing awareness of the Microfinance programme. Separate allocation in the budget for Microfinance under Rural Development should be made in every five-year plan. NGOs, banks and other agencies should be motivated to form more of SHGs.

As any programme, if left to it, without any monitoring can go awry, there is a need to continuously monitor the programme. As part of policy, a separate Department of Microfinance under Ministry of Rural Development should be formed, which should be given the responsibility of facilitating the formation of SHGs and monitoring the progress of the programme.

Universities, colleges and research organisations should be motivated and facilitated to carry out continuous research in the area of Microfinance throughout the J&K state. Such studies should be sponsored by the Department of Microfinance in collaboration with National Bank for Agricultural and Rural Development, a nodal agency in the arear of Microfinance.

8.0 Conclusion

In nutshell, it can be concluded that the SHGs have been working effectively with very low-attrition rate, high attendance in the meetings and an average SHG age of four years and five months. Housewives and labourers have been a major constituent of SHG members. After joining SHGs, the level of communication and interaction with officials have improved significantly as it has been revealed through the sign test. There has been a significant improvement in access to various amenities as revealed through McNemar Test. There has been an increase of 45.6 per cent in the number of SHG members in terms of confidence-building factors, and the difference is significant. With respect to overall utility of SHGs analysed through Garret Ranking Technique, these are mainly perceived as source of consumption loans followed by helping in thrift habit and source of production loans.

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Assessment of Post-Harvest Losses of Potatoes in Bangladesh

M. Ayub Hossain* and M. A. Monayem Miah**

Abstract

Six major potato growing districts, namely, Comilla, Jessore, Munshiganj, Bogra, Rajshahi and Thakurgaon were selected for this study. A total of 940 respondents (Farmers, cold storage managers, traders and consumers) were randomly selected for collecting primary data. Average harvesting loss was found to be 5.65 per cent. Home storage loss for three months storage period was 7.35 per cent. The average loss in cold storage during nine months storage period was 3.82 per cent. Two different types of potato-marketing systems were identified for home-stored and cold-stored potatoes. The average losses at traders' level for home- and cold-stored potatoes were 11.95 and 9.61 per cent, respectively. Household and restaurant levels losses were 3.24, and 4.52 per cent, respectively. Total post-harvest losses of home-stored and cold-stored potatoes were 31.48 per cent and 25.59 per cent, respectively.

1.0 Introduction

Potato (Solanum tuberosum L.) is one of the most important food crops grown almost all over the world. Over one billion people consume potato worldwide, and it is the staple diet of half a billion of people. Because of the dry matter, edible energy and edible protein content, potato is considered nutritionally a superior vegetable as well as a versatile food item not only in Bangladesh but also throughout the world (CIP 2009). Potatoes have been grown in Bangladesh since the 19th century. In 1920, the first commercial production of the crop was established in the country (Islam 1983). Now, potatoes have become an increasingly an important crop in Bangladesh. For the introduction and adaptation of HYV potatoes and production technology, the area and production of potato sharply increased after '90s. Still now the area and production of potato is following increasing trend.

Nowadays, potato has emerged as a major food crop in Bangladesh and is being cultivated throughout the country. In 2006-07 the total production of potato was 6648 thousands tons from the area of 400 thousands hectares (BBS 2008). Though Bangladesh has become a major potato producer in the SAARC countries, the status of this crop has remained vegetable in the country. The time has come now for all concerned to understand and appreciate the role of potato that can play an important role in the present food situation of Bangladesh. Bangladesh has been relying heavily on rice-based cereal crops to feed the ever increasing population in Bangladesh. Such an over dependence on cereals should be reduced gradually if food security is ensured. Potato can help widen the food supply base and thereby help minimise the risk of food shortages.

* Farm Machinery and Post-Harvest Process Engineering Division, Bangladesh Agricultural Research Institute, Gazipur, Bangladesh. E-mail: mhossain.fmpe@gmail.com
** Agricultural Economics Division, Bangladesh Agricultural Research Institute, Gazipur, Bangladesh.

The potato is a living and semi-perishable commodity. Appropriate and efficient post-harvest technology and marketing are critical to the entire production-consumption system because of its bulkiness and perishability. In Bangladesh the potato is harvested in the beginning of summer. Due to inadequate cold storage facilities to hold the produce for longer periods, large quantities are spoiled before they could be consumed. Therefore, there is a need for both short- and long-term storage of potato. After harvesting, a series of operations need to reach in the consumers' table termed as post-harvest operations. During these operations, some losses occur, which is called post-harvest losses (Ritenour 2003).

There are about 300 cold storages in Bangladesh with a capacity of 2.2 million tons. In the year 2008, about 27.5 per cent of total production of potato was stored in the cold storage including seeds (Miaruddun and Chowdhury 2009). The rest were stored by the farmers using their traditional storage systems. In Bangladesh authentic data on post-harvest losses of potato at different post-harvest operations are lacking. It is necessary to quantify the post-harvest losses of potatoes in different post-harvest operations like harvesting, cleaning, grading, bagging, transportation, processing and storage. Therefore, this study was undertaken to identify different storage systems of potato in Bangladesh and quantify the post-harvest losses of potato at different post-harvest operations.

1.1 Objectives

i. To quantify post-harvest losses of potato at different post-harvest operations
ii. Identification of different marketing channels for traditional and cold stored potatoes
iii. To make some recommendations for reducing post-harvest losses and to improve storage systems of potato

2.0 Methodology

2.1 Selection of Study Areas

Six major potato growing districts, namely, Jessore, Comilla, Munshigonj, Bogra, Rajshahi and Thakurgaon were selected for this study. Some data on total land area, cultivated land area, population, number of farm holdings, cropping intensity, potato area and potato production are given in Table 1 as background information of six selected district of Bangladesh. These information helped to select populations and samples of the study areas. Two upazilas from each district including sadar upazila were selected for field data collection. Sadar upazila was selected for each of the district because most of the cold storages and big markets are situated in the district towns. The list of the study areas is given in Table 2.

Table 1: Some Basic Data as Background Information of Six Selected Districts of Bangladesh

Particulars	*Comilla*	*Jessore*	*Munshigonj*	*Rajshahi*	*Bogra*	*Thakurgaon*	*Bangladesh*
Population	4961699	2646607	1379224	2417185	3219372	1334555	137649414
Population engaged in agriculture (% of population)	1125622 (22.69)	1010737 (38.19)	229410 (16.63)	685929 (28.38)	1651172 (51.28)	626692 (46.96)	37614992 (27.33)
Number of Farm holdings	561965	361308	108556	312877	432011	201871	15089087
Land area (ha)	637483	346359	93209	242674	75753	181177	14400000
Cultivated area, ha (% of land area)	455687 (74.58)	319725 (88.49)	65234 (69.98)	152556 (62.86)	56649 (74.78)	138884 (76.65)	9050000 (62.85)
Cropping intensity	181	192	162	178	218	190	180
Potato area (ha)	18441	4425	33685	30169	25566	14997	320479
Potato production (ton)	309498	86362	942455	516925	406971	272451	5761669

Source: BBS (2008)

Table 2: Selected Study Areas for Primary Data Collection

District	*Upazila*	*District*	*Upazila*
1. Jessore	i. Sadar	4. Bogra	i. Sadar
	ii. Bagherpara		ii. Shibgonj
2. Comilla	i. Sadar	5. Rajshahi	i. Sadar
	ii. Chandina		ii. Poba
3. Munshigonj	i. Sadar	6. Thakurgaon	i. Sadar
	ii. Tongibari		ii. Peergonj

2.2 Sampling Technique and Sample Size

A total of 940 respondents were randomly selected for collecting primary data and information for the present study. The sample size of each respondent group was sufficient to represent the population of this respondent. For convenient equal sample size was taken from each of the study area but they were statistically representative of the highest and the lowest group of population. Among total respondents, a total of 300 potato farmers (taking 25 farmers from each upazila) were selected for interview irrespective of farm size. A total of 40 cold storage managers were interviewed taking 6 to 8 managers from each district. On the other hand, a total of 360 potato traders taking 60 Beparis (big trader), 60 Farias (petty trader), 60 Aratdar (commission agent), 60 Paikers (wholesaler), and 120 retailers were interviewed for gathering data and information regarding potato marketing and post-harvest losses. Interviews were also held with potato consumers both at household level and restaurant level. Hence, 120

potato consumers at household level (taking 20 consumers from each upazila), and another 120 consumers at restaurant owners/managers (taking 20 from each upazila), were selected and interviewed for the study.

2.3 Method of Data Collection

Four sets of pre-tested interview schedules were used for collecting data and information from potato farmers, potato traders (intermediaries), and potato consumers. In this study, post-harvest losses of potato from different stakeholders were estimated quantatively for Bangladesh taking statistically representative samples from six potato growing districts by direct interviewing method. Interview is the accurate method of estimation of post-harvest loss of potato for such big sizes of samples and various stakeholders. Data and information were collected by the authors and enumerators. Enumerators were scientific assistant of local agricultural research station and senior scientific assistant of Agricultural Economic Division of Bangladesh Agricultural Research Institute. Secondary data were gathered from BBS, journal articles, research reports, and internet etc. Metrological data were received from the Metrological Stations from relevant districts or nearby districts.

2.4 Method of Estimation of Different Post-Harvest Losses

Field data from different respondents were collected on quantity basis and post-harvest losses obtained at different operations as well as different levels. For example, the sampled potato farmers were asked through direct interviewing what quantity of potatoes they produced during 2008-09. Regarding post-harvest losses, farmers were asked how much quantity of potato was lost during each operation (harvesting, curing, sorting etc.). Farm-level storage loss was estimated on the basis of the quantity of potato stored during the storage periods (3-4 months). In cold storage, potatoes were stored for maximum of nine months. Losses were estimated on what quantity of potato lost during storage period in terms of total quantity of potato stored. Traders' levels losses were estimated on the quantity potato lost during one week of trading in terms of potato bought in the same period. During interviewing, the traders (Bepari, Faria, Paiker, Aratdar and retailer) were asked about what quantity of potato bought and sold in one week. Losses at consumers' level were also estimated on the basis of quantity lost in one week in terms of quantity bought. Post-harvest losses were also estimated for different types of losses such as weight loss, rotten or spoilage loss, insect damage, physical injury etc. The characteristics of different types of losses were explained to the respondents, and they are asked to quantify the losses. Then the individual losses were calculated in terms of total quantity and expressed in percentage. Moisture content is mainly considered for dried products as there is big difference between initial (fresh) and final (dried) moisture content. Potato tuber is always fresh and moisture difference at different stages is negligible and hence moisture differences at various stages are ignored.

3.0 Results and Discussion

3.1 Productivity and Profitability

Productivity and profitability of potato cultivation in the study areas are given in Table 3. The productivity or yield of potato in all areas was 23.12 ton/ha which is higher than the national average yield of 16.0 ton/ha (BBS 2008), but close to the average farm level yield (22.25 ton/ha) of Comilla and Munshigonj (Azimuddin et al. 2009). Average gross return, gross margin and net return in all the study areas were Taka 346,800, 168,849 and 154,485 per hectare respectively. Average benefit cost ratio (BCR) in all study areas was 1.80 over total cost and 1.95 over variable cost basis. BCRs were highest in Comilla followed by Thakurgaon. The reasons might be that in Comilla the price of potato was higher and in Thakurgaon the labour cost lower than other areas. The estimated BCR of this study was lower but, close to the result presented by Hoque et al. (2006) 2.41. Also average BCR for potato production in Comilla and Munshigonj was presented by Azimuddin et al. (2009) 1.58 which is lower than that of the present study.

Table 3: Profitability of Potato Cultivation in the Study Areas

Cost heads	*Comilla*	*Jessore*	*Munshi-gonj*	*Rajshahi*	*Bogra*	*Thakur-gaon*	*Average*
A. Variable cost	148386	198575	195882	239004	172551	113307	177951
B. Total cost	161177	214443	212880	256236	185843	123309	192315
C. Yield (ton/ha)	24.26	22.28	24.74	25.36	22.76	19.32	23.12
D. Price (Tk/ton)	15500	15000	15000	15000	15000	14500	15000
E. Gross return	376030	334200	383470	380400	330020	280140	346800
F. Gross margin	227644	135625	187588	141396	157469	166833	168849
G. Net return	214853	119757	170590	124164	144177	156831	154485
H. BCR over total cost	2.33	1.56	1.80	1.48	1.78	2.27	1.80
I. BCR over variable cost	2.53	1.68	1.96	1.59	1.91	2.47	1.95

Note: F = E-A; G = E - B; BCR = Benefit cost ratio.

3.2 Post-Harvest Losses at Farm Level

Potatoes are semi-perishable commodity, which contain more than 70 per cent of moisture. Thus, they undergo a lot of physical, chemical and physiological changes during the whole process of harvesting, curing, storage, handling, transportation and marketing, resulting in a deterioration of quality and loss in weight. The post-harvest losses of potato at different stages of post-harvest operations at farm level in the study areas are shown in Table 4. Average harvesting loss of all areas was found to be 5.65 per cent of total production. Average harvesting loss comprised insect damage (1.21%), rotten loss (1.40%), cutting loss (1.14%), under-soil less (0.89%), and other losses (1.02%) such as off-size potato etc. Potatoes in all the study areas were harvested manually using country ploughs or spades. Potato remains under soil was included in

the total production, but most of the farmers avoid collecting it due to labour intensive operation. These potatoes are generally collected by poor women and children. One experimental study was conducted in Tuber Crops Research Sub-Station, Munshigonj during 2008-09 to find out the harvesting loss of potato and found similar results as found by interview method (BARI 2009). The harvesting loss of potato in Bangladesh is found to be 5.65 per cent, which is, for example higher than the result presented Meyhuay (2007) for Costa Rica (3%). Potato is generally harvested manually using country plough or spade.

Table 4: Average Loss of Potato at Farmers' Level at Different Post-harvest Operations in the Study Areas

Figures in kg

Particulars	*Comilla*	*Jessore*	*Munshi-gonj*	*Rajshahi*	*Bogra*	*Thaku-rgaon*	*Average*
A. Production per farm house	6985.6	9585.2	30868.8	27855.2	10104.3	15501.3	16816.7
1. Harvesting loss	415.08	527.19	1707.04	1735.38	539.57	832.42	950.15
	(5.94)	(5.50)	(5.53)	(6.23)	(5.34)	(5.37)	(5.65)
a. Insect damage	69.30	99.64	395.12	467.96	103.06	192.21	203.48
	(0.99)	(1.04)	(1.28)	(1.68)	(1.02)	(1.24)	(1.21)
b. Rotten loss	99.20	120.77	487.73	353.76	138.43	232.52	235.43
	(1.42)	(1.26)	(1.58)	(1.27)	(1.37)	(1.50)	(1.40)
c. Cutting loss	93.60	117.89	299.43	328.69	127.31	133.31	191.71
	(1.34)	(1.23)	(0.97)	(1.18)	(1.26)	(0.86)	(1.14)
d. Remain under soil	81.03	91.06	197.56	295.27	66.68	128.66	149.67
	(1.16)	(0.95)	(0.64)	(1.06)	(0.66)	(0.83)	(0.89)
e. Other loss	71.95	97.79	327.21	289.69	104.07	145.71	171.53
	(1.03)	(1.02)	(1.06)	(1.04)	(1.03)	(0.94)	(1.02)
2. Curing loss	58.68	71.89	188.30	256.27	67.69	224.77	147.98
	(0.84)	(0.75)	(0.61)	(0.92)	(0.67)	(1.45)	(0.88)
3. Sorting loss	118.06	167.74	546.38	440.11	167.73	196.87	201.80
	(1.69)	(1.75)	(1.77)	(1.58)	(1.66)	(1.27)	(1.62)
B. Pre-storage losses (1+2+3)	591.68	766.82	2441.72	2431.76	774.99	1254.06	1370.56
	(8.47)	(8.00)	(7.91)	(8.73)	(7.67)	(8.09)	(8.15)
4. Home storage loss	584.69	662.33	2278.12	2008.36	2526.07	1092.84	1236.03
	(8.37)	(6.91)	(7.38)	(7.21)	(7.18)	(7.05)	(7.35)
C. Total loss (B+4)	1176.38	1429.15	4719.84	4440.12	1500.48	2346.89	2606.59
	(16.84)	(14.91)	(15.29)	(15.94)	(14.85)	(15.14)	(15.50)

Note: Figures inside the parentheses indicate percentage of total production.

Potatoes are usually cured after harvest to remove excess moisture and improve skin-set. Curing is essential for healing the wounds of tubers resulted from cutting and bruising during harvesting. Wound-healing prevents infection and water loss from the tubers

during storage. Curing is normally done by spreading tubers in open shade at the temperature of about 25°C for about one week (Saha 2007). Different methods of curing were practised in different study areas. In Munshigonj, potatoes were heaped in the field and covered with straw for one or two weeks. Then the heap was broken; potatoes were sorted, bagged and carried to home or market or cold storage. The proper method of curing was observed to follow in Comilla and Jessore areas. In Rajshahi, Bogra and Thakurgaon (Northern part of Bangladesh) potatoes were harvested and directly bagged from the field. Average curing and sorting losses were found to be 0.88 and 1.62 per cent, respectively. The average pre-storage loss in all study areas was 8.15 per cent including harvesting loss, which was about 1.40 tons per farm house. Average farm size in the study area was 1.76 ha, cropped area 1.14 ha in which average potato cultivated area was 0.81 ha. The average production per farm house was 17.64, tons and yield was found to be 23.12 ton/ha which was higher than the national average yield of 16.0 ton/ha (BBS 2008), but close to the average farm level yield (22.25 ton/ha) in Comilla and Munshigonj (Azimuddin at al. 2009).

3.3 Post-Harvest Losses at Storage Level

3.3.1 Post-harvest losses at home storage system

About 97 per cent of sampled farmers stored potatoes in home following traditional methods. Rest of the sampled farmers sold their whole quantity of potatoes in the harvesting season. In the traditional method, farmers stored potatoes at home by stacking them on the earthen floor of dwelling houses or stacking them on bamboo or wooden made platforms (Macha) for better aeration. Farmers did not store potato in separate store house to avoid extra storage cost. Height of bulk storage potato varied from 15 cm to 1.0 m. During storage period, they frequently checked their home stored potatoes to sort out rotten ones and diseased ones which otherwise would cause damage to the whole quantity of stored potatoes. In this method, farmers cannot maintain proper temperature and humidity that cause large-scale damage due to rot by disease, insect damage and weight loss. During three to four months of storage period, about 7.35 per cent potato was lost. For example, Meyhuay (2007), referred to in International Potato Centre (CIP 2009) reports that home storage loss of potato in Peru for a period of one, two and three months were 4.0, 10.5 and 15.2 per cent, respectively. Average total farm level loss in all study areas was 15.50 per cent for three months of storage period. Walker and Fuglie (2006) reported that post-harvest loss of traditional storage of potato was as high as 24 per cent for only three months storage in Peru.

3.3.2 Post-harvest losses at cold storage system

3.3.2.1 Description of cold storage system

Cold stores have permanent establishment such as land, building with office room, cool chamber, pre-cool chamber, machine room, curing shed, etc. There are several permanent staffs like manager, accountant, foreman, machine operator and supervisor. Loading, unloading, inversion, etc. are carried out by contact labours. These labours are engaged in works through an intermediary called 'Labour Member'. The labour member generally makes contact with the cold storage owner to accomplish the necessary works during the

storage period. He then pays wages to the labours on a daily basis. Generally two types of clients store potatoes in cold storage such as farmers and traders. Traders (stockiest) buy potatoes from farmers during harvesting season, store them in the cold storage to get good price in off-season. In the study areas, about 66 per cent of the sampled farmers (Most of them also stored potato traditionally in home mainly for table purpose and sale within 2-3 months) and 46 per cent of sampled traders stored potatoes in cold storage. The cost of keeping potatoes in cold storage varies from one cold storage to another. Some cold storage owners provide loan to the stockiest to buy and store to his cold storage. This loan is paid during release of potato from cold storage (Hossain and Miah 2009).

3.3.2.2 Capacity utilisation, related factors and storage loss

Capacity utilisation, storage loss and other related factors of cold storages are shown in Table 5. The highest numbers of cold storages were found in Munshigonj (69) and the lowest in Thakurgaon (7). The average capacity of cold storages in all areas was 7,904 tons of potato. The highest size of cold storages was found in Rajshahi (10,000 tons) followed by Bogra (9,837 tons), Munshigonj (8,468 tons) and Thakurgaon (8,017 tons), whereas the lowest capacity of cold storages was observed in Comilla (5,773 tons) and Jessore (4,467 tons). In Comilla (103.51%) and Munshigonj (103.07%) cold storages were loaded above their capacity. But in other study areas, capacity utilisation of cold storages was below the capacity limit (93.49%). After nine months (March-November) storage, the average potato loss in cold storage was 3.82 per cent of total potato stored. This loss comprised the weight loss (57%), spoilage loss (34%) and other loss (9%) caused due to sprouting, shrinkage, cold injury etc. Weight loss in the present study was 2.15 per cent which is very close to the result presented by Islam et al. (2008): between 1.2 to 2.38 per cent in Bangladesh.

Average electricity supply in the study areas was 18.78 hours per day. Most of the cold storages had their own generator for supply of electricity during load-shedding time, but most of them were used only for lighting. The storage temperature in all selected cold storage was 2-3°C; those were within the recommended range of temperature (2-4°C). But the clients of cold storage informed that the cold storage managers did not give the correct information regarding temperature. According to their (clients) opinion, temperature in the cold storage remained higher than the recommended temperature. The relative humidity of all cold storages was 80-83 per cent which are below the desirable value (>90%). Most cold storages did not measure the temperature and relative humidity in the storage chambers. Average pre-cool period of all the studied cold storages was 17.65 hour which was below the required minimum pre-cool period (24 hours). Potato should be stored in the cold storage in good quality bag. Yet, low quality bags were used in about 25 per cent of the cases for packing of stored potato. Immature potatoes deteriorate rapidly and suffer from heat or cold stresses. The maturity of cold stored potato in all cold storages was 88.98 per cent. Generally, early harvested potatoes are immature. The average number of inversion in the studied cold storages was 4.60 times. The minimum and maximum inversions recorded were three and six times respectively. The number of bags (layer) per stack ranged from 5 to 7. The maximum storage period started from the middle of February and ended in mid-December. The customers had to pay for a fixed amount of money as rent to the cold storage. They could take the potatoes out from the cool chamber at any time but rent remained fixed.

Table 5: Capacity Utilisation, Storage Loss and other Related Factors of Cold Storages

Particulars	*Comilla*	*Jessore*	*Munshi-gonj*	*Rajshahi*	*Bogra*	*Thaku-rgaon*	*Average*
Available cold storage	17	9	69	24	36	7	27
Average storage capacity (ton/store house)	5773	4467	8468	10000	9837	8017 7904	
Capacity utilisation (ton)	5975 (103.51)	3774 (84.56)	8722 (103.07)	8920 (89.22)	8534 (86.75)	7415 (92.51)	7389 (93.49)
Good potato obtained (ton)	5715 (95.65)	5519 (95.57)	8399 (96.26)	8624 (96.68)	8255 (96.73)	7119 (96.08)	7107 (96.19)
Loss during storage (ton)	285 (4.35)	725 (4.43)	310 (3.61)	322 (3.31)	537 (3.28)	539 (3.92)	444 (3.82)
Availability of electricity in 24 hours	17.83	18.67	18.37	18.86	20.00	18.83	18.78
Store temperature (^{0}C)	2.01	2.31	2.32	2.27	2.25	2.31	2.25
Storage RH (%)	81.33	83.00	81.13	82.43	82.71	80.00	81.78
Max. outside temp. (^{0}C) (April-May)	33.00	37.80	35.00	35.70	32.70	31.6	34.33
Pre-cool period (h)	14.00	20.00	17.00	18.00	18.86	18.00	17.65
Good bag used (%)	75.00	76.00	75.63	75.57	73.43	75.83	75.23
Matured potato (%)	87.00	89.50	88.13	90.71	90.14	88.17	88.98
Number of inversion of bag during storage	5.17	5.33	4.25	4.14	5.29	3.50	4.60
Number of bag per stack	5.83	5.67	6.38	6.29	5.86	6.00	6.02
Maximum storage period (month)	9.50	8.17	9.75	9.43	9.42	9.33	9.30

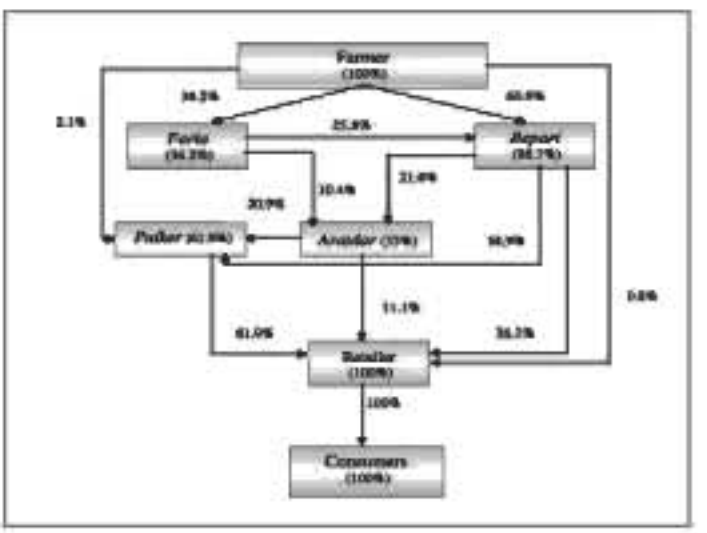
Note: Figures in the parentheses indicate percentage.

3.4 Marketing Channels of Home-stored Potatoes

The marketing chain refers to the sequential arrangements of various marketing intermediaries involved in the movement of products from producers to consumers. In the present study, different marketing chains of potato were identified. The marketing channel of traditionally stored potatoes is illustrated in Figure 1. In the marketing flow diagram, percentage of transferred (sold) quantities of potatoes is figured out excluding the losses. For example, in Figure 1, a farmer sells 100 per cent of potato to the intermediaries excluding loss. Similarly, a retailer sells 100 per cent of his sorted potato to consumer and thus consumers get 100 per cent of potato for consumption. Bepari (Big trader) and Faria (Petty trader) buy potatoes from farmers. The share of the cases where potatoes are purchased by Beparis (60.9%) is higher than the one by Farias (36.2%).

Bepari, Paiker and Faria play a crucial role in the process of traditionally stored potato marketing in the study areas. Bepari buys a large amount of potatoes from farmers and directly sells to Paiker (38.9%), retailers (26.2%) and again retailer (21.6%) through Aratdar. Similarly, Faria buys potatoes directly from farmers and mostly sell them to Bepari (39.2%) and a small portion (6.6%) to retailer through Aratdars. Paiker buys a major portion of potato directly from Bepari (38.9%) and a very small amount from farmers (2.1%). They also buy a good amount of potatoes (20.9%) from Faria and other Beparis through Aratdar. Paikers sell all their potatoes directly to the retailers. Retailers sell their whole quantity (100%) of potatoes to consumers.

Figure 1: Flow Diagram of Home-stored Potato Marketing at Farm Level (Excluding losses)



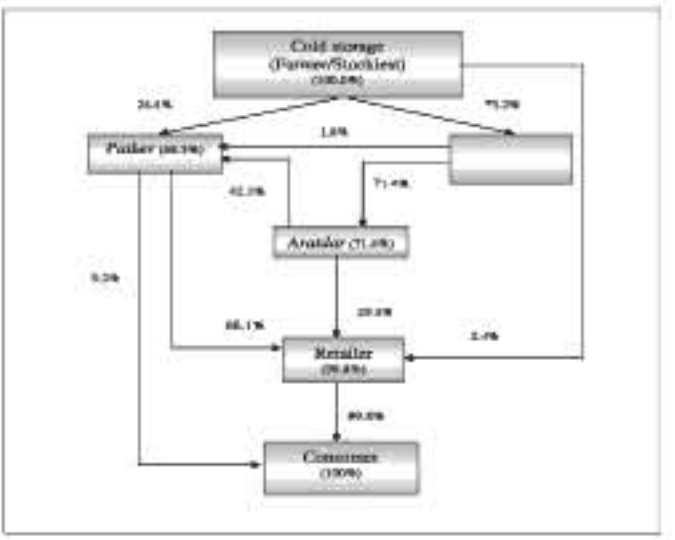
3.5 Marketing Channels of Cold-stored Potatoes

The process of cold-stored potato marketing starts from the cold storage in and around urban areas and continued through certain channels until the potato reached the final consumers. A number of intermediaries are involved in the marketing systems. Some of the big farmers store potatoes in the cold storage to sell them during off-season at a higher price. Some of the Beparis and Paikers buy potatoes in the harvesting season and store them in cold storage. These Beparis and Paikers then become potato stockists. When the market price of potato becomes high (traditional stored potato quantities go from the market), they bring out potatoes from cold storage and sell them to another Beparis and Paikers. Sometimes, they directly sell potatoes to Aratdars or retailers. During the interview period, all the intermediaries were found to deal with locally produced high yielding varieties of potatoes, not imported potatoes.

The marketing channel of cold-stored potato is shown in Figure 2. Beparis and Paikers buy potatoes from cold storage (farmer/stockiest). The share of Beparis purchasing potatoes from cold storage is higher that the share of Paikers (73.2% against 24.4%).

Paikers also buy some potatoes (1.8%) from Bepari. Aratdars buy all their potatoes from Beparis and sell 42.1 per cent of their stock to Paikers and 16.1 per cent to retailers. Paikers sell the majority of their potato stock (68.1%) to retailers and a very small quantity directly to consumers (0.2%). Retailers sell their whole stock (100.0%) of potatoes, but 99.8 per cent of the channel, to the consumers.

Figure 2: Flow Diagram of Marketing of Cold-stored Potato (Excluding losses)



3.6 Quantity Traded and Loss during Marketing at Different Levels

Average transaction and loss of home and cold stored potatoes at different intermediaries in the study areas are shown in Table 6. It is observed from the table that Bepari transacted the highest potato quantity of both home-stored and cold-stored potatoes. In the case of home-stored potato, Bepari bought about 50 per cent potato directly from farmers and another 50 per cent from Faria. But for cold-stored potato, Bepari bought 100 per cent potato from the stockiest. Bepari sold 55.6 per cent home stored potato to Paiker followed by Aratder (41.4%) and small quantity (2.9%) to retailer. But for cold-stored potato, Bepari sold highest quantity of potato to Aratder (75.7%) followed by Paiker (21.2%) and a small quantity (3.1%) to retailer. In the period of buying and selling, some potatoes were lost at Bepari's level. The losses of home stored (2.4%) and cold stored (2.8%) were similar and weight losses were the highest for both types of potatoes.

Faria bought 100 per cent of potato from farmers during the harvesting season and sold it to the Bepari (58.5%) and Aratder (32.8%). During the off-season, the presence of Faria was not found in the potato intermediary group. Actually Faria is a seasonal petty trader and he has no own capital to purchase potato. Faria generally got money from Bepari and Aratder to purchase potato and during the buying and selling process, he got some profit. In the case of Faria, the total post-harvest loss was found to be 2.5 per cent of potatoes bought. Aratder bought 56.4 per cent home-stored potato from Bepari and 43.6 per cent from Faria. In the case of cold-stored potato, Aratder bought 100 per cent potato from Bepari.

Table 6: Average Transaction and Loss of Home- and Cold-stored Potatoes at Different Intermediaries in the Study Areas

Particulars	*Bepari*		*Faria*		*Aratder*		*Paiker*		*Retailer*	
	Home stored	*Cold stored*	*Home stored*	*Cold stored*	*Home stored*	*Cold stored*	*Home stored*	*Cold stored*	*Home stored*	*Cold stored*
A. Bought	21179	25849	456	-	10469	12242	29762	16915	555	463
from	(100)	(100)	(100)		(100)	(100)	(100)	(100)	(100)	(100)
Farmer	10453 (49.7)	-	456 (100)	-	-	-	26 (0.1) -	-	10 (2.2)	-
Stockiest	-	25849 (100)	-	-	-	-	-	-	-	12(2.6)
Bepari	-	-	-	-	5900 (56.4)	12242 (100)	23194 (77.9)	2298 (13.6)	262 (49.7)	-
Faria	10725 (50.3)	-	-	-	4569 (43.6)	-	-	-	-	-
Aratder	-	-	-	-	-	-	6543 (21.9)	14617 (86.4)	23.50 (4.2)	70 (15.1)
Paiker	-	-	-	-	-	-	-	-	259 (46.8)	381 (82.3)
B. Sold to (100)	20678 (100)	25120 (100)	444 (100)	- (100)	10307 (100)	12242 (100)	29146 (100)	16650 (100)	536	447
Bepari	-	-	260 (58.5)	-	-	-	-	-	-	-
Aratdar	8393 (41.4)	19379 (75.7)	146 (32.8)	-	-	-	-	-	-	-
Paiker	11281 (55.6)	5442 (21.2)	-	-	8660 (84.0)	10014 (83.2)	-	-	-	-
Retailer	599 (2.9)	807 (3.1)	-	-	1647 (15.9)	2025 (16.8)	29146 (100)	15158 (91.0)	-	-
Consumer	-	-	-	-	-	-	-	1516 (8.9)	536 (100.0)	447 (100)
C. Quantity lost	499.8 (2.4)	729 (2.8)	11.6 (2.5)	-	162 (1.5)	198 (1.6)	616 (2.1)	257 (1.5)	19 (3.5)	17(3.6)
Weight loss	175.8 (0.8)	258.5 (1.0)	3.8 (0.8)	-	162 (1.5)	80.0 (0.6)	221.2 (0.7)	99.5 (0.6)	8.1 (1.4)	0.3 (1.3)
Rotten loss	127.1 (0.6)	206.4 (0.8)	3.1 (0.7)	-	-	53.3 (0.4)	162.7 (0.5)	76.1 (0.4)	5.6 (1.0)	0.3 (1.1)
Handling loss	137.6 (0.7)	161.1 (0.6)	2.8 (0.6)	-	-	41.6 (0.3)	139.4 (0.5)	52.2 (0.3)	3.2 (0.6)	0.2 (0.7)
Transportation loss	59.3 (0.3)	103.4 (0.4)	1.8 (0.4)	-	-	28.2 (0.2)	91.8 (0.3)	29.3 (0.2)	2.3(0.4)	0.1 (0.5)

Note: Figures in the parentheses indicate loss as percentage of total quantity bought.

Aratder sold about 83.5 per cent of potato to Paiker and rest 16.5 per cent to the retailer for both home-and cold-stored potatoes. Total losses of both home-stored (1.5%) and cold-stored (1.6) potatoes were similar. But, for home-stored potatoes, there were no rotten, handling and transportation losses because Aratder did not open bag during transaction but assumed 1.5 per cent weight loss. Paiker bought a very small quantity (1%) of home stored potato from farmer. He bought most of the home stored potato from Bepari (77.9%) followed by Aratder (21.9%). Paiker bought major portion of for cold stored potato from Aratder (86.4%) and rest from Bepari (13.6%). For home-stored potato, 100 per cent was sold to retailer but for cold-stored potato major portion (91.1%) was sold to retailer and small portion (8.9%) to consumer. Total Post-harvest losses of home-stored potato (2.1%) were higher than those of cold-stored potato (1.5%). Retailer traded smallest quantity of potato compared to other intermediaries due to his small market size. Retailer bought potatoes from many sources to get maximum profit from low capital investment. For home-stored potato, retailer bought 2.2, 49.7, 4.2 and 46.8 per cent from farmer, Bepari, Aratder and Paiker, respectively. He bought most of the cold-stored potato from Paiker (82.3%), followed by Aratder (15.1%) and a small quantity from stockiest (2.6%). For both home-and cold-stored potatoes, retailer sold 100 per cent to the consumer. Total post-harvest losses of both the home (3.5%) and cold-stored potatoes (3.6%) (one week preservation) are almost similar.

3.7 Post-Harvest Losses at Consumers' Level

In Bangladesh potatoes are mainly consumed as a vegetable. Other uses of potatoes are in *potato chips, singara, samucha, alupuri* etc. Before the preparation of food, it is necessary to process the potato into a desirable form. Peeling, cutting, slicing, smashing etc. are the methods used for potato processing. Table 7 shows the losses of home- and cold-stored potato at household and restaurant levels. The results represent the average values of six study sites. Consumers purchased more home-stored potato than cold-stored potato. Generally March to May home-stored potato was in the market and in this period price of potato remains lower than the months of June to November when only cold-stored potato was found in the market. Due to low price, people consumed more potato (home stored).

Table 7: Post-Harvest Loss of Traditional Stored Potato at Household and Restaurant Levels in the Study Areas

Particulars	*Household*		*Restaurant*	
	Home stored	*Cold stored*	*Home stored*	*Cold stored*
Potato bought in a week (kg)	3.28(100)	2.79 (100)	63 (100)	43.28 (100)
Total loss (kg)	0.12 (3.54)	0.092 (3.28)	2.88 (4.52)	2.05 (4.73)
(i) Rotten loss (kg)	0.04 (1.08)	0.03 (1.15)	1.26 (2.07)	0.35 (0.80)
(ii) Processing loss (kg)	0.08 (2.46)	0.06 (2.14)	1.61 (2.46)	1.70 (3.93)

Note: Figures in the parentheses indicate percentage loss of total quantity bought.

This loss comprised rotten loss and processing loss. In all the cases, the processing loss was found higher than the rotten loss. The loss of potato at the restaurant level was found to be higher than the household level for both home-and cold-stored potatoes. This might be that at household level, small quantities of potato were purchased and much care taken at the time of purchase avoiding possible defective tubers. But in the case of restaurant, bulk quantity of potatoes was purchased at a time and there was less possibility for sorting and rejecting the defective potatoes. Sometimes, bagged potatoes are purchased, and there was no chance for sorting.

3.8 Comparison of Post-Harvest Losses of Home- and Cold-stored Potatoes

Total post-harvest losses of home and cold stored potatoes were found to be 31.48 and 25.59 per cent, respectively (Table 8). Post-harvest losses of potato in different countries were reported, such as 25 per cent in Colombia, 24 per cent Costa Rica, 20 per cent Dominican Republic and 24 per cent United States (Meyhuay 2007). Eltawil et al. (2006) reported that post-harvest loss at farm level was 20-30 per cent in India. Another study shows that the post-harvest losses of potato in India was 17 per cent and in Pakistan ranged from 15 to 40 per cent (Iqbal 1996; Ilangantileke 1996). The findings in this study are supported by the above reports

Table 8: Post-Harvest Loss of Home- and Cold-stored Potatoes at Different Levels in the Study Areas

Figures in percentage

Particulars	*Home stored*	*Cold stored*
A. Pre-storage	8.15	8.15
B. Home storage	7.35	-
C. Cold storage	-	3.82
D. Trader	11.95	9.61
1. Bepari	2.36	2.82
2. Faria	2.50	-
3. Aratdar	1.55	1.66
4. Puiker	2.07	1.52
5. Retailer	3.47	3.61
E. Consumer*	4.03	4.01
1. Household	3.54	3.28
2. Restaurant 4.52	4.73	
F. Total loss	31.48	25.59

Note: * Average of household and restaurant.

4.0 Conclusions and Recommendations

Farmers stored 3.34 per cent of potato in traditional storage for a period of 3 to 4 months. In this period the storage loss was found to be 7.35 per cent. The average loss in cold storage during nine months storage period was 3.82 per cent of total potato stored. Two different types of potato marketing were identified- traditional home-stored and cold-stored potato marketing. The average losses at traders' level for home-and cold-stored potatoes were 11.95 and 9.61 per cent, respectively. Average post-harvest losses in the household and restaurant levels were 3.24, and 4.52 per cent, respectively. Total losses of home-stored potatoes were found to be 31.48 per cent while for cold stored potatoes, it was 25.59 per cent.

Following recommendations might be made from this study:

i. In order to reduce the post-harvest loss, more cold storage needs to be established at farm level.

ii. Low cost mechanical harvesters may be introduced for proper harvesting of potatoes so that the farmers can use this harvester within their financial capacity.

iii. Continuous electricity should be supplied to cold storage so that cooling machines can be operated as and when necessary to maintain a proper temperature in the cold storage.

iv. Market infrastructure should be developed in terms of quick transportation, proper storage and other physical facilities to reduce post-harvest loss of potato. Potato should be packed in 50 kg bags for easy handling and proper cooling.

v. Traditional storage systems may be improved through research so that the farmers can store potato for comparatively longer period with lower storage loss.

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Role Performance of Char-land Women in Bangladesh for Maintaining Sustainable Livelihood

Sultana Al-Amin*, M. Mostafizur Rahman** and M. Abdul Momen Miah***

Abstract

The main purpose of the study was to determine the role performance of char-land women for sustainable livelihood activities. The fieldwork for the study was carried out in four villages namely Munnitar char, Ghunapara, Halkerchar and Balugram under two Upazilas of Jamalpur District in Bangladesh during November 2006 to March 2007. Data for the study were collected from 200 randomly selected char women by using interview schedule out of 2000. The role performance of char-land women was measured by computing a 'composite role performance index' based on each of the five components of livelihood asset pentagon: 'human capital', 'natural capital', physical capital', 'social capital' and 'financial capital'. The collected items in these regard were finalised through judge rating, validity and reliability test. The interview schedule had a five-point response continuum as 'high involvement' 'medium involvement', 'low involvement', 'poor involvement' and 'not at all involvement' against each of the items and the weights were assigned as 5, 4, 3, 2 and 1 respectively. Finally, role performance index was determined by computing a weight for an individual item first, followed by determining role performance index of a single component and computation of a composite role performance index including all these five components against each of the respondents. The role performance of the women in supporting household livelihoods revealed that 95 per cent of the char women were found to perform medium role compared to 4 per cent low and 1 per cent high role.

1.0 Introduction

Chars in Bangladesh can be considered a by-product of the hydro-morphological dynamics of its rivers. The entire country is delta located with in the flood plains of three great rivers: the Bramanputra-Jamuna, the Padma and the Meghna. In addition, there are more than 230 rivers that criss-cross the country. All the rivers are either contributory or distributary channels of three main rivers. There are around 900 numbers of chars (7200 sq. km, islands chars and attached chars) which are familiar with river erosion and flood. Cultivation and settlement of all rivers, the Jamuna has by far the highest land under chars. Thus, while this figure works out to be 45 per cent for the Jamuna, the corresponding figures for the Padma 30 per cent (BBS 1997). However, 5 per cent to 7 per cent of total population of Bangladesh lives in these char areas. The majority of these people (65%) live in the Jamuna chars. It is to be noted that

* Senior Programme Officer, Gono Kollayan Trust, Shamolli, Dhaka, Bangladesh.
** Associate Professor, Department of Agronomy and Agricultural Extension, University of Rajshahi, Bangladesh. E-mail: mostafizur2001@yahoo.com
*** Professor, Department Agricultural Extension Education, Bangladesh Agricultural University, Mymensing, Bangladesh.

the population density of chars is less than half of the national average in Bangladesh and 76.47 per cent of her total population lives in the rural areas (Agricultural Dairy 2007). About half (48.6%) of the population are women, and they are playing different role in economic and non-economic sectors (FAO 2003). The livelihood approach is founded on a belief that people require a range of assets to achieve a positive livelihood outcome. The major livelihood assets are *human, natural, financial, physical* and *social capitals*. Women are playing pivotal roles to make sustainable livelihoods by using and formation of these assets which are surrounded by them. Agriculture is the principal means of livelihoods in Bangladesh. Rural women are intimately involved in all phases of agricultural activities in rural areas. Besides the rice cultivation, pulse, wheat, ground nut, chili, maize, vegetables etc. are also cultivated by char people. Farming occupation includes owner cultivation as well as sharecropping. Wage labour is used in various agricultural operations. In some chars, fishing, rearing of cattle, trading of miscellaneous commodities is the primary occupation for many households. So, people of char areas contribute in the national economy of Bangladesh which is not negligible. Based on the above discussion, this study is designed mainly with the objective of role performance of char-land women for maintaining sustainable livelihood.

2.0 Methodology

2.1 Locale of the Study

Two upazila, namely Islampur and Dewanganj, were selected randomly from Jamalpur District for the study. From each of the two upazilas, one union, namely, Belgacha of Islampur Upazila and Chukaibari Union of Dewanganj Upazila were purposively selected for the study. Because these two unions fully consider as char area relatively than others. Village Munniar Char and Ghunapara from Belgacha Union of Islampur Upazila, Village Halkerchar and Balugram from Chukaibari Union of Dewanganj Upazila were randomly selected. A map of Jamalpur District with study area in Islampur and Dewanganj upazilas has been presented in Figure 1, 2 and 3 respectively.

2.2 Population and Sample of the Study

The total number of housewives of the households of four villages, namely, Munniar Char, Ghunapara, Halkerchar and Balugram was the population. A total of 10 per cent women of this population were randomly selected as sample by using simple random sampling method. Thus, the total sample size was 200.

2.3 Data Collection

Data for the study were collected from 200 randomly selected char women by using interview schedule in face to face condition out of 2000 during November 2006 to March 2007.

Figure 1: Map of Jamalpur District showing Islampur and Dewanganj Upazila

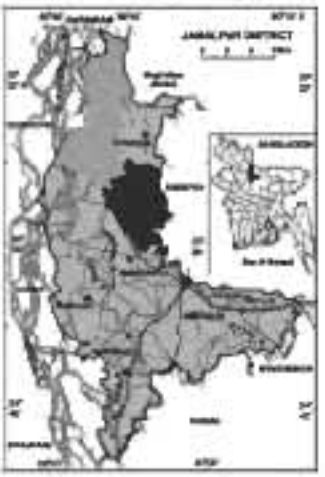


Figure 2: Map of Islampur Upazila showing the study area

Figure 3: Map of Dewanganj Upazila showing the study area

2.4 Measurement of Role Performance

The variable role performance was measured by computing a 'composite role performance index' based on each of the five components of livelihood asset pentagon: (i) human capital role performance index, (ii) natural capital role performance index, (iii) physical capital role performance index, (iv) social capital role performance index, and (v) financial capital role performance index.

For computing each of the role performance indexes, 10 appropriate roles/activities were selected going through a rigorous process of item collection, items screening through field verification, judge rating, piloting, development of instruments etc. A total of 10 activities were used to determine the role performance of char women based on each of the capitals. The respondents were asked to indicate their extent of performance for each of the 10 selected activities, which were related in supporting and strengthening their livelihoods. The role performance of char women was measured by using a 5-point rating scale. These are high, medium, low, very low and not at all. The char woman was asked to indicate to what extent she involved in performing the activities by indicating any of the five responses under each of the capitals. Appropriate weights such as 5, 4, 3, 2 and 1 were assigned to each of these responses. The role performance score of a respondent was calculated individual capital-wise and then was combined into over-all performance. The detail procedures for computation of 'role performance index' based on five components of livelihood asset pentagon are presented below:

2.4.1 Human capital role performance index

The computation of 'human capital role performance index' involved two stages: (i) determining item weights for each of the 10 selected roles/activities, and (ii) determining the weighted role performance for human capital.

2.4.1.1 Determining item weights for each of the selected roles/activities

Human capital role performance was determined by putting 10 items as shown in Table 1. Each of these 10 items were tested its relevancy (5, 4, 3, 2 and 1; where 5 for most relevant and 1 for least relevant) through judge rating. A total of 15 judges put their responses against this five-point relevancy continuum. The product which was obtained through multiplication of relevancy value and the number of judge's response against each of these continuums were added together. The result was then divided by the maximum possible score and was expressed in terms of percentage. To operationalise the whole process, the following formula was used.

$$W_{ij} = \frac{X_1 f_1 + X_2 f_2 + X_3 f_3 + \dots \dots \dots + Xnfn}{M} \times 100$$

$$= \frac{\sum_{i=1}^{n} X_i f_i}{5\sum_{i=1}^{5} f_i} \times 100$$

Where, W_{ij} = Weight of i^{th} item based on human capital

X_i = Relevancy score (1 to 5; where 1 for least relevant and 5 for most relevant) assigned by the judges against an individual item

f_i = Number of judges who responded against each cell of relevancy continuum

$M = 5\sum_{i=1}^{5} fi$ = 5 X 15=75 (Maximum possible score i.e. maximum score given in an item multiplied by no. of judge's)

$n = 5$

For 10 items based on human capital, there were 10 weights calculated as shown in Column D of Table 1.

Table 1: Computation of Individual Item Weight based on human capital

A		B					C	D
Items		*Relevancy score of the items (Xi)*					*Total*	*weight of an item(wi) D=C/(5*15) *100*
		Most relevant (5)	*Relevant (4)*	*Somewhat relevant (3)*	*Little relevant (2)*	*Least relevant (1)*	*X fi*	
Number of judges put their response against each item (fi)	item-1	10	0	4	1	0	64	85.3
	item-2	8	5	1	0	1	73	97.3
	item-3	6	6	1	2	0	61	82.3
	item-4	6	5	3	1	0	55	73.3
	item-5	9	5	0	1	0	76	101.3
	item-6	3	4	4	3	1	50	66.6
	item-7	2	4	4	3	2	46	61.3
	item-8	1	5	6	1	2	47	62.6
	item-9	5	6	1	2	1	57	76
	item-10	6	5	2	1	1	59	78.6

2.4.1.1 Determining weighted role performance for human capital

At the second stage, the individual item weights were multiplied by their corresponding field scores. The field scores were the responses of the char women against each of those 10 items of activity based on human capital. The responses were 'high involvement', 'medium involvement', 'low involvement', 'very low involvement' and 'not at all involvement'. The weights were given as 5, 4, 3, 2 and 1 respectively. Thus, 10 item weights were multiplied by each of their corresponding field scores and 10 product values were obtained which were added together. The result was then divided by the product of the summation of 10 item weight and maximum score for the response continuum i.e. 5. To operationalise the whole process, the following formula was used to determine the weighted role performance index for human capital:

$$RPI_{ij} = \frac{W_1Y_1 + W_2Y_2 + \ldots\ldots\ldots + W_nY_n}{MS\,(W_1 + W_2 + \ldots\ldots\ldots + W_n)} \times 100$$

$$= \frac{\sum_{i=1}^{n} WiYi}{MS\sum_{i=1}^{n} Wi} \times 100$$

Where, RPI_{ij} = Weighted role performance index of i^{th} woman based on human capital

W_i = Weight of i^{th} item of a component derived from judge ruting

Y_i = Value of response of the respondents against i^{th} item (1 to 5; where 1 for not at all involvement and 5 for highly involvement) of a component (field data)

MS = Maximum score assigned for a response of i^{th} item of a component (i.e. 5)

n = 10

For easy understanding of the whole process, an example has been set forth showing determination of computation of weight of role performance for human capital in Table 2.

Table 2: Computation of Weighted Role Performance for Human Capital

A		B					C	D	E	F
Items		*Relevancy score of the items (Xi)*					*Total*	*Weight of an*	*Field*	*WiYi*
		Most relevant (5)	*Relevant (4)*	*Somewhat relevant (3)*	*Little relevant (2)*	*Least relevant (1)*	*Xi fi*	*item (Wi) D=C/(5*15)*10 0*	data *(Yi)*	*F=DxE*
Number of judges put their response against each item (fi)	item-1	10	0	4	1	0	64	85.3	5	426.5
	item-2	8	5	1	0	1	73	97.3	4	389.2
	item-3	6	6	1	2	0	61	81.3	1	81.3
	item-4	6	5	3	1	0	55	73.3	1	73.3
	item-5	9	5	0	1	0	76	101.3	1	101.3
	item-6	3	4	4	31	1	50	66.6	4	266.4
	item-7	2	4	4	3	2	46	61.3	5	386.5
	item-8	1	5	6	1	2	46	62.6	1	62.6
	item-9	5	6	1	2	1	57	76	1	76
	item-10	6	5	2	1	1	59	78.6	4	314.4
Total item weight *Wi*								*783.6*		
Average item weight *(Pi)*								78.3		
MS *Wi* = (5X783.6)								= 3918.00	$\sum_{i=1}^{n} WiYi$ = 2177.5	

Computation of component weight of role performance for human capital can be done from the following formula:

$$= \frac{\sum_{i=1}^{n} WiYi}{MS\sum_{i=1}^{n} Wi} \times 100$$

$$= (2177.5/3918X100) = 55.57$$

Natural capital role performance index, physical capital role performance index, social capital role performance index and financial capital role performance index were determined with the same procedure.

2.4.2 Computation of composite role performance index

The composite role performance index, consisting of different components, was computed through summation of the product of weighted role performance index of each of the components and their corresponding average weight of all 10 items (p_1, p_2, p_3, p_4 and p_5). The result was then divided by the summation of average item weights of all 5 components. To operationalise the process, the following formula was used to determine the composite role performance index of a respondent:

$$CRPI_i = \frac{p_1RPI_{i1} + p_2RPI_{i2} + \ldots\ldots\ldots + p_NRPI_{iN}}{p_1 + p_2 + \ldots\ldots\ldots + p_N}$$

$$= \frac{\sum_{j=1}^{N} p_j RPI_{ij}}{\sum_{j=1}^{N} p_j}$$

Where, CRPIi = Composite role performance index of ith respondent

RPIij = Role performance index of i^{th} respondents for j^{th} components (weights of an individual component)

pj = Average weights of all 10 items of j^{th} component

N = Number of components considered under the composite role performance index i.e. 5.

Composite role performance index can be calculated from the following formula:

$$CRPI_i = \frac{p_1RPI_{i1} + p_2RPI_{i2} + \ldots\ldots\ldots + p_NRPI_{iN}}{p_1 + p_2 + \ldots\ldots\ldots + p_N}$$

$$= \frac{(55.57X78.3+31.16X75.9+59.16X74.1+48.46X74.8+36.2X75.8)}{378.9}$$

$$= 46.10$$

The above calculation for role performance index was done for an individual respondent.

3.0 Results and Discussion

3.1 Role Performance of the Char Women

The role performance of char-land women for maintaining sustainable livelihood, which is measured on the basis of various kinds of activities/roles based on each of the five components of livelihood asset pentagon. The women were classified on the basis of their involvement in activities for the capitals into four categories such as *high, medium, low* (where responses *under low* and *very low* were merged together) and *not at all*. The procedure was followed in measuring role performance of the char women regarding various activities for human, natural, physical, social and financial capitals.

3.1.1 Role performance of the women based on human capital

Human capital represents the skills, knowledge, good health, nutrition etc. that together enable people to pursue different livelihood strategies to achieve their livelihood objectives. Char women performed different types of activities/roles by using their skill, knowledge for the improvement of their household livelihood as well as the community livelihood through maximisation of outcome. A total of 10 activities were incorporated to determine the role performance of char women regarding the human capital and the results are presented in Table 3.

Table 3: Percentage Distribution of Char Women according to their role performance based on human capital

Activities	*Respondents*			
	High	*Medium*	*Low*	*Not at all*
1 Food preparation of and preservation	90.5	7.5	2	0
1. Taking care of family member	87.5	11	1.5	0
2. Creating health awareness among the family members	53	35	12	0
1. Awareness building for adopting family planning measures	17	25	57.5	0.5
2. Helping in child education	13	28	57	2
1. Helping in cultivation of high yielding variety of vegetables	3	16	68	13
2. Helping and giving emphasis on weed control	6	14	65	15
1. Using balanced fertiliser in vegetable cultivation	8	10	71	11
2. Taking opportunity to participate in training programme provided by GO/NGOs	18	8	36	38
1. Encouraging and involving family members in income-generating activities	32	37	27	4

The above findings revealed that the char women put high efforts in performing the household activities to a greater extent and had less participation in the activities related to outside of the household for maintaining sustainable livelihoods.

3.1.2 Role performance of the women based on natural capital

Natural capital is the term used to mean various natural resource stocks from which resource flows and useful services for livelihoods are derived. A total of 10 activities were incorporated to determine the role performance of char women regarding the natural capital and the results are presented in Table 4.

Table 4: Percentage Distribution of Char Women according to their role performance based on natural capital

Activities	*Respondents*			
	High	*Medium*	*Low*	*Not at all*
1. Involvement in homestead gardening	65	11	10	14
2. Taking part in the activities of field agriculture	2	6	14	78
3. Collection of pure drinking water	91	8	0	1
4. Plantation of timber tree	17	19	15	49
5. Plantation of fruit tree	7	12	23.5	57.5
6. Seed collection and preservation	34.5	32	16.5	17
7. Rearing of poultry birds	83	6	2.5	8.5
8. Taking care of livestock	30	7	4	59
9. Preparation and using organic manure	8	36	27	29
10. Using insecticide	0	4.5	9	86.5

3.1.3 Role performance of the women based on social capital

Social capital includes connection of people through kinship relation or otherwise under which they trust each other, membership of groups and association, security perspective and to some context social norms, values, beliefs, etiquettes also belong to social capital. A total of 10 activities were furnished to determine the role performance of char women regarding social capital and the results are presented in Table 5.

Table 5: Percentage Distribution of Char Women according to their role performance based on social capital

Activities	*Respondents*			
	High	*Medium*	*Low*	*Not at all*
1. Survival and transmission of local knowledge to the community	18.5	45	36	0.5
2. Maintaining communication with members or chairman of union parishad	1	5	4	90
3. Involvement in NGO activities or other voluntary services	44	17	26	13
4. Keeping good relation with the neighbour and villagers with faith	48	38.5	13.5	0
5. Try to solve in case of social problem	20	31.5	48	0.5
6. Development awareness for human rights	2	3	82.5	12.5
7. Social awareness for female education	13	22	61	4
8. Development awareness for pardha system	7	13	72	8
9. Development awareness against dowry system	0.5	4.5	53.5	41.5
10. Develop awareness for social norms and etiquettes	49	47	3	1

This means majority of the char women preferred to perform various activities inside their social system in improving their livelihoods and are less interested in the activities which they thought outside of their social system.

3.1.4 Role performance of women based on financial capital

Financial capital denotes financial resources that people use to achieve their livelihood objectives. However, it has been adopted to try to capture an important livelihood building blocks, namely, the availability of cash or equivalent that enables people to adopt different livelihood strategies. A total of 10 activities were furnished to determine role performance of the char women for maintaining their livelihoods regarding financial capital which is shown in Table 6.

Table 6: Percentage Distribution of Char Women according to their role performance based on financial capital

Activities	*Respondents*			
	High	*Medium*	*Low*	*Not at all*
1. Selling different agricultural product (vegetables, fruits, spices)	14	16.5	30.5	39
2. Production and selling of seed	12	25	27	36
3. Collection, production and selling the fuel materials	16.5	25	28	30.5
4. Work as day labourer	3	5	4.5	87.5
5. Preparing and selling handicraft	2.5	10	2.5	85
6. Food processing, preservation and selling	6.5	1	3	89.5
7. Selling reared goat, cow and poultry birds	74	7.5	12	6.5
8. Saving money in NGOs	70	2.5	3	24.5
9. Taking loan or credit	54	5	3	38
10. Using credit money properly	22	20	20.5	37.5

The findings revealed that the women are more concerned with the household activities related to generation of income and financial benefits. This means the women were interested and highly participative in household activities and less interested in the activities outside of their households.

From the above findings, role performance of the char women regarding various capitals of household indicates that the women are highly interested and participative in the household activities and the activities confined in homestead areas while less participative in activities outside the homestead. This is reasonable and rationale for the case of char women because of their low exposure on education and modern world as a whole. For harvesting better economic output from the existing system the char women should be provided with better job opportunity at household level. They should be provided with training and adult literacy for capacity building and soft credit, marketing opportunity and other facilities so that they can contribute better to livelihood improvement of char-landers.

3.2 Overall Role Performance of Char Women

Role performance of the char women was determined in three steps, firstly, determining weights for each of the selected roles/activities based on each of the five components of livelihood asset pentagon: human capital, natural capital, physical capital, social capital and financial capital. Secondly, determining the weighted role performance index for each of the individual component. And finally, a composite role performance index was computed based on the weights of these five components.

The role performance of the char women on the basis of role performance scores for each of the components ranged from 53.31 to 92.6, 28.24 to 91.90, 45.15 to 83.16, 35.94 to 85.19 and 20.0 to 77.7 against the possible range of 20 to 100 with a mean values of 71.36, 62.41, 60.43, 61.21 and 51.56 and coefficient of variation of 11.36 per cent, 21.95 per cent, 10.56 per cent, 15.06 per cent and 21.62 per cent for the five capitals respectively. The respondents were categorised on the basis of their performance score (possible range) into 3 categories such as, high, medium and low performance. Distribution of the char women according to their role performance based on various capitals was shown in Table 7.

Table 7: Distribution of Char Women according to their role performance based on various capitals

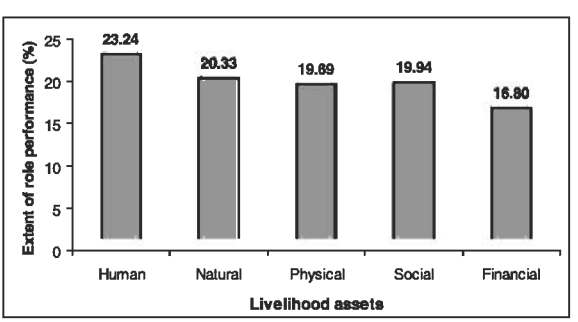
Categories of the char women according to their role performance	*Respondents*		*Range*	*Mean*	*CV%*
	Number	*%*			
1. Human capital					
Low (≤47)	0	0			
Medium	(48-75)	143 71.5	53.3-92.6	71.36	1.36
High	(76-100)	57 28.5			
2. Natural capital					
Low (≤47)	29	14.5			
Medium	(48-75)	141 70.5	28.2-91.9	62.41	1.95
High	(76-100)	30 15			
3. Physical capital					
Low (≤47)	2	1			
Medium	(48-75)	195 97.5	45.1-83.1	60.43	10.56
High	(76-100)	3 1.5			
4. Social capital					
Low (≤47)	15	7.5			
Medium	(48-75)	175 87.5	35.9-85.1	61.21	15.06
High	(76-100)	10 5			
5. Financial capital					
Low (≤47)	61	30.5			
Medium	(48-75)	137 68.5	20.0-77.7	51.56	21.62
High	(76-100)	2 1			

The information of the Table 8 shows that under role performance based on human capital, 71.5 per cent of the char women were found under medium role performance category compared to 28.5 per cent in high performance and nobody was found in low role performance category. In the case of natural capital, 70.5 per cent of the char women fell under medium role performance category compared to 15 per cent in high performance and 14.5 per cent in low role performance category. Medium role was performed by 97.5 per cent of the char women compared to only 1 per cent in low performance and 1.5 per cent in high role performance category based on physical capital. Regarding increase in social capital, 87.5 per cent char women performed medium role compared to 7.5 per cent in low performance and only 5 per cent performed high role performance category. In the case of financial capital, 68.5 per cent of the respondents were found under medium role performance category compared to 30.5 per cent in low performance category and only 1 per cent performance category in high role performance category.

The overall role performance by women in study area is not at satisfactory level. In the case of human and natural capital, majority of the respondents had medium to high role performance category. Most of char women have to perform household-related activities, and they are directly involved in taking care of their family members. For this reason, they have enough scope to utilise their human capital for the improvement of the livelihood status. In the case of utilisation of natural capital, most of the respondents were involved in vegetable production, poultry rearing and in some cases livestock rearing in their homestead area which help them for getting some economic output, strengthening their livelihood status. To access in social and physical capital, their opportunity is very limited. They are not aware about the positive effect of those capitals because it has no directly economic return. That is why they are not interested in utilising those capitals for their improvement of their livelihood status. In the case of utilisation of financial capital, 99 per cent respondents had under low to medium role performance category. It was found that limited options, less capital, unavailable structured of marketing channel in the char area, the respondents are not able to utilise their financial capital in large scale.

Analysing the role performance based on various capitals, it was found that the char women performed 23.24 per cent role by utilising human capital, 20.33 per cent role by utilising natural capital, 19.69 per cent role by utilising physical capital, 19.94 per cent role by utilising social capital and 16.80 per cent role by utilising financial capitals for maintaining their livelihoods. This means the char women utilised the assets at their disposal in varying extent to make sustainable livelihoods. Their extent of role performance regarding different assets is shown in Figure 4.

Figure 4: Role Performances based on different assets



The information of Figure 4 indicates that the resources, which were easily available, with relative advantage and compatible to the existing social values and norms and also directly related to the livelihoods, were found performed better. There are some potential activities, which were not performed better by the women because of social and religious barriers. The information also revealed that a good amount of potential activities are not being utilised by the women may be due to the limited scope and socio-cultural situation.

The range of composite role performance scores of all char women was 40.2 to 81.0 against the possible range of 20 to 100 with a mean and coefficient of variation of 61.49 and 11.43 per cent, respectively. Based on the composite role performance score, the char women were classified into three categories: low, medium and high role performance. The distribution of the char women on the basis of their role performance is presented in Table 8.

Table 8: Distribution of Char Women according to their composite role performance status

Categories of the char women	*Respondents*		*Range*	*Mean*	*CV(%)*
	Number	*%*			
Low role performance (20-47)	8	4			
Medium role performance (48-75)	190	95	40.2-81.0	61.49	11.43
High role performance (76-100)	2	1			

Majority (68.5%) of the char women were found under medium role performance category compared to 4 per cent of them fell under low role performance category and only 1 per cent of the respondents were found under high role performance category. The overall role performances of char women for sustainable livelihoods were medium level. Due to the vulnerable condition, the char women were engaged in different kinds of activities by utilising the assets at their disposal for improving the quality of livelihoods. To make their livelihoods more stable, they utilised the assets as per demand of the situation and availability of assets and opportunity.

Based on the above findings, it can be said that there is an ample scope for the development workers to work with the char women for creating awareness towards better utilisation of existing resources for improved livelihoods. The concerned GO and NGOs can organise capacity building activities and motivational campaign for the char-landers for changing their existing outlook towards the involvement of char women in development activities which in turn can improve quality of living standards.

Significant difference of role performance of the char women in different study areas was ascertained. The mean values of role performance of women in each of the four villages was compared through computation of 'Duncan's Multiple Range Test' (DMRT) and presented in the Table 9.

Table 9: Differences of Role Performance of Char Women in Four Selected Villages

Village	*Role performance*
Munniar char	66.47c
Ghunapara	62.34b
Halkerchar	60.13ab
Balugram	58.65a

Note: Mean value with different letters indicates significant differences.

The role performance of the respondents of four different villages showed significant differences. The mean role performance of the Munniar char (66.47) was highest and significantly different from other three villages followed by Ghunapara (58.65), Halkerchar (60.13) and Balugram (58.65). This means role performance of the respondents is varied due to variation of place, resources and individuals.

4.0 Conclusion

The overall role performance of char women for better livelihood ranged from low to medium level. Char women are working hard to reduce the level of poverty, increasing economic solvency through participation in different kinds of income-generating activities for maintaining their livelihood status. The women are working hard to maintain their livelihoods but not capable to utilise existing resources to its potentials so that maximum benefits are not achieved to a desirable level that hampered their living standards. The development agencies through capacity building can increase the mobilisation, proper utilisation of existing resources to a reasonable extent.

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Contribution of Ecotourism Destinations to Poverty Alleviation in Plateau State, Nigeria

H. M. Ijeomah* and I. A. Ayodele**

Abstract

Ecotourism management and poverty alleviation in Plateau State was studied using Focus group discussion, Oral interview and field observation. Ten communities bordering six selected ecotourism centres were surveyed. One focus group discussion participated by forty persons was conducted in each of the communities. About 80.00 per cent, 77.50 per cent and 67.50 per cent of participants from Pandam, Sop and Naraguta respectively perceived reduction in their poverty levels unlike in Kayarda where only 5.00 per cent of respondents perceived reduction in their poverty levels. All respondents from Dong and Kabon noticed an increase in their poverty level while most respondents from Kayarda (77.50%), Aningo (72.00%), Namu (70.00%), Kwang (65.00%) and Gwut (60.00%) did not notice any impact of tourism on their poverty levels. Major ways of households' poverty reduction were identified as revenue generation (72.50%), employment (67.50%), supply of animal protein (52.50%), and educational development (32.50%) in Pandam community. Poverty reduction was mostly through market expansion (65.00%) and employment (22.00%) in Naraguta; supply of free electricity (72.50%), employment (57.50%) and market expansion (40.00%) in Sop; availability of water for washing, source of fish for domestic use, and value addition to local resources in both Kwang and Gwut communities. In Namu community, perceived poverty reduction was through livestock rearing (27.50%) and supply of animal protein (15.00%)

1.0 Introduction

In order to check wanton destruction of wildlife resources in protected areas, services provided by resources in the wild could be 'traded' to provide at least needs of local nature to the rural inhabitants, who support their existence or that allowed wildlife species to exist. Trading of these services applies only to the aesthetic and environmental services of ecosystems or species. In essence, the environmental and aesthetic values of sensitive and rich ecosystems and pristine areas being freely enjoyed previously should now be monetised as capitalistic tendency is globally increasing, on daily basis (Ijeomah and Adetoro 2008). With this understanding, the rural people, who are mainly host to conservation projects, now directly or indirectly demand for proceeds derived from sales of both environmental and aesthetic values of ecosystems. And since at present people are eager to pay for most things they see, touch, and feel for the sake of vivid experience; it has become a general consensus among the proponents of ecotourism that money can be generated from tourism management to facilitate conservation projects, and compensate host communities deprived of their livelihood thereby alleviating poverty.

* Head of Wildlife Management and Ecotourism Unit, Department of Forestry and Wildlife Management, University of Port Harcourt, Port Harcourt, Nigeria. E-mail: henryijeomah@yahoo.com

** Head of Wildlife Management and Ecotourism, Department of Wildlife and Fisheries Management, University of Ibadan, Ibadan, Nigeria.

Put in another way, through ecotourism, pristine ecosystems and their wildlife components should be managed to generate revenues for their conservation by empowering households in adjourning communities, who will then ensure jealously, the protection of these sites because of the present and potential benefits derivable from them. In the analysis of revenue generating avenues from ecotourism, Miller and Tangeley (1991) reported that at the Parc Nacional des volcans in Rwanda, tourists flock to site mountain gorilla at the fee of U$170 for an hour per tourist. Also, the study by Ijeomah and Ayodele (2009) has revealed potential avenues of revenue generation from eco-destinations in Plateau State.

This is, therefore, the basis for introducing ecotourism in many eco-destinations and the principle behind the use of ecotourism for biodiversity conservation, poverty alleviation and rural development. However, experiences have shown that biodiversity conservation, poverty alleviation and rural development only appear theoretically in the objectives of many ecotourism projects without practical justifications in terms of evidences of positive impact on households' poverty level. This, therefore, calls for impact assessment of ecotourism projects using approaches, which can capture the desired impacts (Ashley and Hussein 2000). The sustainable livelihoods (SL) approach to development and poverty reduction aims to promote development that is sustainable not just ecological, but also institutionally, socially and economically, and to produce genuinely positive livelihood outcomes (Ashley and Carney 1999 cited by Ijeomah 2007).

Ashley and Hussein (2000) has emphasised that with an improved understanding of poverty in recent years, impact assessment must be based upon a detailed understanding of people's objectives as well as on an informed view of how their livelihoods are constructed and which factors are the essential causes and manifestation of their poverty. Since households have a better understanding of their objectives and livelihoods, the impact of any empowerment programme in their environment including tourism can best be assessed by them.

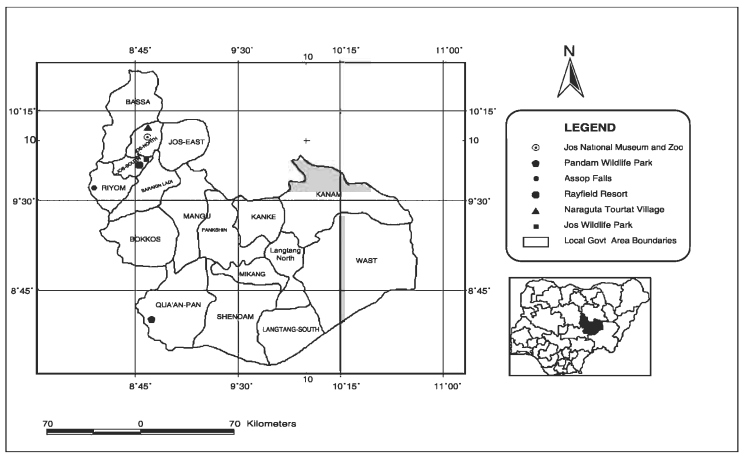
This study, therefore, assesses the perceived impacts of tourism on households' poverty level in Plateau State.

2.0 Materials and Methods

2.1 Study Area

Plateau State is located in the middle of Nigeria and lies between latitude 080301 and 100301 North, longitude 070301 and 080371 East of Equator (Ijeomah 2007; Ijeomah and Alarape 2009). Six functional ecotourism centres were selected for the study. The selection of five was based on their closeness to rural communities while the selection of Jos national zoo and museum was based on its location at the centre of Jos city and the most patronised tourism site in Plateau State (Ijeomah 2007). The selected five ecotourism destinations are Assop falls, Naraguta Tourist Village, Rayfield Resort, Pandam and Jos Wildlife Parks (Figure 1). Ten communities bordering these ecodestinations were selected based on ownership and impact on tourism. The communities are Sop, Namu, Pandam, Kayarda, Kwang, Kabon, Dong, Aningo, Gwut and Naraguta.

Figure 1: Map of Plateau State showing ecotourism destinations



Source: Adapted from Ijeomah (2007)

2.2 Data Collection

Data were collected through Focus group discussion, Oral interview and field observation. Ten communities bordering five selected ecotourism centres were surveyed. One focus group discussion participated by forty persons (reflecting gender and generation - below 25 years and above 25 years) was conducted in each of the communities and augmented with field observations and interviews conducted with people knowledgeable about the communities, and business activities within the tourism site - for the Jos national Zoo and Museum alone as that is located at the centre of the city).

3.0 Result and Discussion

3.1 Effects of Tourism on Households' Poverty

Table 1 shows that 80.00 per cent, 77.50 per cent and 67.50 per cent of household respondents from Pandam, Sop and Naraguta respectively perceived reduction in their poverty. Only 5.00 per cent of household respondents from Kayarda perceived reduction in their poverty levels. All respondents from Dong and Kabon indicated an increase in poverty level while majority of households from Kayarda (77.50%), Aningo (72.00%), Namu (70.00%), Kwang (65.00%) and Gwut (60.00%) did not notice any impact of tourism on their poverty levels.

Table 2 reveals that tourism reduces respondents' poverty level through revenue generation (72.50%), employment (67.50%), supply of animal protein (52.50%), and educational development (32.50%) in Pandam community. Poverty reduction was mostly through market expansion (65.00%) and employment (22.00%) in Naraguta; supply of free electricity (72.50%), employment (57.50%) and market expansion (40.00%) in Sop; availability of water for washings, source fish for domestic use, and value addition to local resources in both Kwang and Gwut communities. In Namu community, perceived poverty reduction was through livestock rearing (27.50%) and supply of animal protein (15.00%).

Table 1: Impacts of Tourism on Households' Poverty

Tourism site	*Communities (n = 40)*	*Impacts on households' poverty level*		
		Increased poverty	*Reduced poverty*	*No impact*
Jos Wildlife Park	Kabon	40(100.00)	0(0.00)	0(0.00)
	Dong	40(100.00)	0(0.00)	0(0.00)
Pandam Wildlife Park	Pandam	8(20.00)	32(80.00)	0(0.00)
	Namu	5(12.50)	7(17.50)	28 (70.00)
	Aningo	0(0.00)	11(27.50)	29(72.00)
	Kayarda	7(17.50)	2(5.00)	31(77.50)
Naraguta	Naraguta	0(0.00)	27(67.50)	13(32.50)
Assop Falls	Sop	0(0.00)	31(77.50)	9(22.50)
Rayfield Resort	Gwut	7(17.50)	9(22.50)	24(60.00)
	Kwang	4(10.00)	10(25.00)	26(65.00)

Note: Numbers in parentheses are percentage values.

Table 2: Touristic Ways of Households' Poverty Reduction in the Communities of Plateau State

Communities (n = 40)	*Means of poverty reduction*	*Percentage*
Pandam	Employment	67.50
	Sales of locally processed dairy products	15.00
	Revenue generation	72.50
	Multiplicity of private enterprises	30.00
	Supply of animal protein	52.50
	Palm wine tapping	17.50
	Educational development	32.50
	Population and demand increase	30.00
Naraguta	Market expansion for souvenir sellers and livestock rearers	65.00
	Employment	22.50
Sop	Employment	57.50
	Source of water	27.50
	Market expansion	40.00
	Supply of free electricity	72.50
Gwut	Availability of water for domestic use	42.50
	Source of fish for domestic use	40.00
	Value addition to local properties	22.50
	Creation of job for motor cyclists	15.00
Kwang	Availability of water for washings	42.00
	Source of fish for consumption	27.50
	Value addition to land in the community	27.50
	Creation of job for local transporters	17.50
Namu	Supply of animal protein	15.00
	Livestock rearing	27.50

3.2 Impacts of Tourism on Households' Poverty

Most households in Pandam, Sop and Naraguta communities perceived reduction in poverty due to tourism (Table 1). This could be attributed to the participation of these communities in tourism created activities, which agree with the findings of Akinboade (1995) in Kogi State. Besides, there have been conscious efforts made by respective tourism institutions purposively to empower households in these communities.

Strictly on economic basis, the management of Pandam Wildlife Park (PWLP) is running at a huge loss in their partnership with the indigenous Pandam fishermen. The expected landing mass of 30.0 kg of fish per day for the 20 fishermen (being 1.5 kg per person per day) is relatively small when compared with their actual daily catches. Besides, the fishermen rarely remit up to an average of 16.0 kg of fish on daily basis. However, this huge loss is environmentally justified; else assessment of the fishermen based on individual landing mass would have been a better option. If that is done, it would enable PWLP management to comparatively assess various parts of the Pandam Lake in terms of richness and mass composition (per time) as each fisherman operates within a defined territory. This would have also unveiled individual's level of commitment to the fishing partnership. On 7th November 2005, few days after fishing operation commenced in Pandam Lake for the 'open season', the management of PWLP urged the fishermen to return the expected landing mass of 30.0 kg (or quantity close to 30.0 kg) for the 'fish package' meant to welcome the newly appointed general manager of the Plateau State Tourism Corporation - the organisation that manages the Pandam Wildlife Park. But it was sadly observed by the management that the fishermen reluctantly returned only 4.0 kg of fish claiming that they made little catch. Based on management instruction, all the uniformed staff of PWLP ambushed the fishermen and seized their catches as they were going home through forest paths. On weighing the catches, surprisingly it was 78.0 kg. Yet, the partnership still continued. This is a clear evidence that the fishing partnership is mainly a way of compensating the surrounding communities of Pandam Wildlife Park by supplying the highly needed protein, and reducing unemployment, which also tend to reduce the rate of poaching. Kepe et al. (2000) noted that neighbouring villages to the Mkambati Nature Reserve in South Africa poach mainly to supplement their maize-based diet with bush meat. Similarly, Kemf (1993) reported that the Provision of incentives to locals also reduced poaching in the Indian Tiger Reserve. Based on this whether the fishermen submit their catches to Pandam Wildlife Park Management or not it will still get to the communities.

More so, it may be considered environmentally unfair if all their catches (below 30.0 kg) made within 6 days are collected, whereas they are heads of their respective households. Thus, if anything should prevent them from fishing on seventh day, 'the one day' allotted to them that may entail starving their families for two weeks.

Moreover, the relationship between the fishing partners and Pandam Wildlife Park management is quite democratic and cordial. Hence, agrees with the recommendations

of sustainable ecotourism advocates (sustainable Travel Report 2005) - the PWLP officials meet with the fishing partners whenever need arises. Also, the Plateau State Tourism Corporation meets with the fishermen on yearly basis (before re-opening a 'close season') and the terms of agreement is reviewed before the partnership is continued for the next season. In this seasonal review, each party lays its own complaints and makes new requests. The fishermen always demand for inclusion of more fishermen into the partnership to further reduce unemployment among professional fishermen in Pandam community. Consequent upon their request in the meeting of 2005, the numbers of the fishermen on partnership were increased from 15 to 20 in November 2005 with their expected landing mass not increased (still 30.0 kg per day).

Even though households surrounding Pandam Wildlife Park are not always allowed into the park to harness fuelwood, they are allowed once in a year. During this stated 'bonus day', households from Pandam, Namu, Kayarda, Aningo, Sabongida and Gallo hire labour to gather as much fuelwood as can serve them up to a year and store them for subsequent use.

As a result of the population increase in Pandam community caused by the influence of Pandam Wildlife Park, there is proliferation of private enterprises. About eight firms that package sachet water presently operate in Pandam with their water sourced from the Pandam communal borehole. Since they use the communal water for commercial purpose, Pandam community charges them per gallon of water fetched. Through this means Pandam community generated a lot of revenue. By the suggestive opinion of PWLP management, these proceeds that accrue on monthly basis were channelled into educational project, which in 2003 was used in building the Pandam secondary school. The chairperson of the Pandam secondary school project committee is a staff of Pandam Wildlife Park and a non-indigene of Pandam community. This agrees with the work of Narayan and Pritchett (1997) in East Africa on sustainable livelihood approach that tourism brings about local empowerment by strengthening community organisations and their capacity to work together for common objectives, and strengthening of communities in their relations with outsiders and wider society. As a result of significant increase in population, private nursery schools and private hospitals have also sprang up in Pandam unlike in Kayarda where community market, secondary school, privately generated electricity, good road, pipe borne water, borehole and even well water were non-existent.

During drought, the migrant Fulanis obtain permit from PWLP management on weekly basis to graze their cattle along the bank of Pandam Lake, where succulent grazing materials are abundant. Consequently, cattle rearing flourishes in Quaanpan Local Government, a herd of cattle, thus, ranges between 200 and 600. A particular Fulani farmer has a herd of 200 cattle into three places. Consequent upon this most of the Fulani women sell Fura danono (locally processed milk from cow). They move about selling this milk in Pandam and Namu markets. Goats are extensively reared in Pandam, Namu, Kayarda, Gallo and Aningo as they graze freely in different parts of

Pandam Wildlife Park. These goats look quite big due to availability of vegetation round the year. Besides, attacks of goats by baboons have not been noticed in PWLP. Thus, goats move freely with baboons unattacked unlike in JWLP where animal species that stray into the park environment are seized by park management.

Rural-dwellers also obtain permit to tap palm wine from the palm trees in Pandam Wildlife Park, especially in Gwayaka area (close to Gallo security post) with numerous palm trees. The Migali and Gwandara people of Nasarawa State being traditionally well endowed in palm wine tapping even migrate to Quaanpan Local Government particularly Pandam to tap palm wine. This is done during farming off-season as a way of supplementing their income. Experienced palm wine tapers get many litres from a single tree without the palm tree being destroyed. Palm wine business generates a lot of money to local inhabitants as consumption of alcoholic drinks is culturally well cherished in Quaanpan Local Government - at 'Gidan Catherine Burukutu sales center' in Pandam Tourist Village, 36 persons including men and women were observed drinking Burukutu (an alcoholic drink) on a Sunday, 12 February 2006 at 6:02 pm.

With permits obtained from managements, men and women from Neighbouring tourist destinations collect thatch grasses for personal use, for sale and as hired labour in both Pandam and Jos Wildlife Park. This is done before 'the controlled burning' management practice is embarked upon. Kepe et al. (2000) gave a similar report on individual empowerment in Mkanbati Nature Reserve of South Africa. Contrarily, fishermen from Gwut, Kwang, Letya and Dura Communities embark on fishing activities in water bodies in Rayfield Resort without making any payment.

Unlike in Sop, Naraguta and Pandam, households in Kabon, Dong and Kayarda perceived a non-appreciable alleviation in poverty. This can be attributed to the fact that Jos Wildlife Park management has not carried out any infrastructural development in Kabon and Dong communities. Moreso, the environment of Jos Wildlife Park is quite different from that of Pandam Wildlife Park and Rayfield Resort. Hence, the tourism products differ. Fishing activities cannot be carried out in Jos Wildlife Park due to absence of large water bodies. The non-alleviation of poverty in these communities can also be related to age-long land dispute between the Jarawa and Birom tribes over the ownership of Dong, Tudunwada, Kabon and neighbouring communities, which may have prevented them from fighting jointly for benefits from Jos Wildlife Park. Nevertheless, both Jarawa and Birom households in Dong and Kabon communities concurred (in group discussions) that Jos Wildlife Park, can positively impact their economies only when a significant percentage of revenues generated from the park is given to the communities as concessions and their indigenes given employment.

The impact of the Pandam Wildlife Park on households in terms of welfare provision and empowerment is more on Pandam households than Kayarda, Aningo and Namu. This can be attributed to the fact that Pandam community is the administrative

headquarter of the park. Besides, most of the tourism potentials such as the Pandam Lake are located in the Pandam section of the park. Inability to safe money and inaccessibility to credit facilities are major constraints to farmers in Quaanpan Local Government, particularly, the rich farmers in Pandam community. Even though Adashi (the traditional money saving scheme) also provides credit facilities to farmers at a low interest rate, the money previously contributed by members were always inadequate due to the fewness of financially buoyant, willing and trustworthy individuals to participate in the weekly contribution. However, with the population increase in Pandam due to the presence of Pandam Wildlife Park, the number of people and groups interested in Adashi has tremendously increased. Hence, farmers can easily obtain loan and make savings.

3.3 The Role of Jos National Museum and Zoo in Poverty Alleviation in Plateau State

Influence of Jos National Museum and Zoo on economic empowerment of households in Plateau State is quite obvious. As in the findings of Ashley (2005) in Sri Lanka, a lot of business activities created in the premises of Jos National Museum have helped in empowering people both at the formal and informal sector. The open-air theatre is hired by organisers of social programmes at N700.00k with the intention of selling tickets to the general public for profit making purpose. Craft sellers operate in the ten shops of the Museum market as tenants to Jos National Museum management. Many traders sell edible food items in the premises. During festivities whosoever that enters the museum premises with business motive including cyclists, taxi drivers, sachet water sellers, ice cream sellers etc. obtains a daily ticket that ranges between N20.00k to N50.00k. Nonetheless, small private business operators continue to troop into the museum in large numbers during festive periods. Analysis by Ijeomah et al. (2011) revealed that in 2002, 2003 and 2004, total of 208,109; 280,933; and 276,409 tourists visited Jos National Museum respectively. This implies that a monthly average of 17,342; 23,411; and 23,034 visited the Museum in 2002, 2003 and 2004 respectively. With tourism being seasonal, it also implies that some months full of festivities would have attracted double of the monthly averages. For instance in December 2002 and November 2003, a total of 58,249 and 123,600 tourists were in the Museum. These numbers of people would have made significant impact on the economies of the private operators in the museum. Some empty spaces in the museum premises are occupied by decorators (floriculturists) who pay monthly rent of between N2000.00k and N3000.00k for using the premises, but charge their patronises (who stay there for function such as wedding reception and launching) up to N20,000.00k per function. Sometimes two or more functions could hold there in a day or week. Though they could also stay for weeks without any patronage. Jos National Museum also offers an academic programme, which educationally empowers interested people on taxidermy.

Aside from gate fees, tourism centres have other means of generating revenues. Ijeomah and Emelue (2009) reported that Pandam Wildlife Park generated the sum of N287,115.00k; N283,631.00k; N373,632.00k and N345,888.00k in 2002, 2003, 2004 and 2005 respectively from sales of drink, fish and fishing permits. This money excludes penalty fees charged in courts, which offenders pay directly into the account of Plateau State Government. The auditorium of Jos National Museum is hired at the cost of N5, 000.00k per day. And in 2005, the Association of National Accountants of Nigeria booked for all the Saturdays though at the cost of N3000.00k per day (with discount). Using the museums facilities for shooting of films attracts a fee of N5,000.00k per day. Even in Jos Wildlife Park revenues are generated from various groups that use the pine forest for meetings and picnics. The incomes generated through tourism are used in funding projects by the federal and state governments.

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Padma Bridge in Bangladesh – An Opportunity and Challenges for Char-land Livelihoods Sustainability: A Case Study on Char-Janajat in the Ganges Active Delta

Shafi Noor Islam*, Reza Ul Karim**, Nahid Newaz***, Syed I. Alam****, Zahura Akter***, Shahina Akter***, Abdur Rouf*** and Hasibush Shaheed*****

Abstract

There are thousands small chars in the major rivers channels, and over 12 million people are living with the fragile and under extreme hazardous environment with intensive flooding and erosion in the char-lands of Bangladesh. The Char-Janajat is one of the largest potential chars in the Ganges-Padma River channel. The Char-Janajat is situated within the territory of four districts (Madaripur, Faridpur, Munshiganj and Shariatpur). Moreover this char-land is very unstable land where approximately 200,000 people are trying to survive and fighting against floods and erosion and secure livelihoods. The economy of the char-lands are largely based on agriculture, fishing and livestock-rearing. The participatory approach and PRA method has been used for data collection. The proposed Padma Bridge on the Char-Janajat area is a new challenge and opportunity for the local communities to improve their socio-economy and that can ensure livelihood sustainability in the char-lands of the Ganges-Padma River basin. The objective of this study is to understand the char-lands stability and development scenarios for Char-Janajat due to Padma Bridge construction in the region. The bridge will make a connection with east and west part of the country. The erosion and vulnerability of the Char-lands in the Padma River channel will be reduced due to Padma Bridge construction. The char-dwellers' livelihoods and socio economic improvement will be ensured. The findings of this study could be an important guideline to make the char-land management and livelihood sustainability plan for the Ganges active delta in Bangladesh.

1.0 Introduction

Bangladesh is a deltaic region allowing some of the major rivers like Ganges-Bramaputra-Meghna (GBM) flowing through it (Bormudoi et al. 2011). The GBM basins stretch over five countries like China, Nepal, India, Bhutan and Bangladesh. The drainage area of the combined basins is about 1.76 million km², of which about 62 per cent lies in India, 18 per cent lies in China, 7.5 per cent in Nepal, 7.5 per cent in Bangladesh and the remaining 4 per cent lies in Bhutan (Elahi et al. 1991; Islam and Gnauck

* Department of Ecosystems and Environmental Informatics, Brandenburg University of Technology at Cottbus, Germany. E-mail: shafinoor@yahoo.com
** Consultant, House No. KA - 7, South Badda, Gulshan, Dhaka, Bangladesh.
*** Research Assistant, House No. KA - 7, South Badda, Gulshan, Dhaka, Bangladesh.
**** Freelance Consultant, Virginia, USA.
***** Assistant Prof., Dept. of Geography and Environment, Govt. Azizul Hoque College, Bogra, Bangladesh.

2008; Mondal 2011). Most of the rainfall (80%) in the GBM region occurs during the summer monsoon prevailing from June to October. The entire Himalayan belt experiences snowfall during the winter as a result of the western depressions, which intensity declines from west to east, which is the reverse of the monsoon pattern (Ahmed et al. 1994).

A total average run-off of 1281400 Mm^3 flows through Bangladesh every year and debouches into the Bay of Bengal. The estimated total discharge is 1,369,000 m^3 per annum, of which more than 90 per cent originated from outside the country which is making massive floods in Bangladesh (Alexander 1993; FAP 21 1993). The cause of floods in Bangladesh is a consequence of monsoon precipitation in the GBM catchments; snow and glacial ice melt with monsoon rain in the Himalayas and runoff generated by heavy local rainfall (Islam 1995; Islam et al. 2010). There are no systematic records of annual floods available until the 20th century, including 1987 and 1988, 1998, 2002, 2004 and 2008. The recent flooded land area was increased from 35 per cent in 1974 to 71 per cent in 2004, comparing to the flooded land area in 1954 (Rashid 1993; Islam 1995; Chowdhury 2000; Islam and Gnauck 2008; Ahmed and Falk 2008). During the flooding period, suspended sediment load reached as high as 13 million tons per day, these suspended sediments formed new lands in the river channels (Coleman 1969; Kelly and Chowdhury 2002).

The newly formed sand bars and landmasses are locally known as 'char or diara' [1] in the Bengali term and are settled upon by people of both banks as new settlement frontiers and remain sources of perennial dispute among conflicting claimants (Zaman 1989; Baqee 1993, 1998; Schmuck 2001). While erosion takes place, new lands re-emerge and occasionally form river beds in the midst of the river channels where they did not exist before (Hutton 2003). Extensive char areas have been created along the bed or basin of big rivers Jamuna, Padma and Meghna. The char-lands of the three main rivers the Jamuna-Brahmaputra, Ganges-Padma and Meghna cover some 8, 450 km^2 (6 per cent of the total land area) with a population 6 million in 1992-93 (FAP 16/19, 1994a), and presently this char population has increased to 12 million which is covering 11 per cent (EGIS 2000; Thompson & Tod 1998; Islam et al. 2010; Arifur et al. 2011). This new land is fertile and a valuable natural resource (Baqee 1993) and landscapes are of great importance for its exceptional hydro-geological setting (Sarker 2008). The physical characteristics of the geographic location, the rivers morphology and the monsoon climate render the char-lands highly vulnerable to natural disasters (Coleman 1969; Mafizuddin 1992; Baqee 1986; Lein 2000).

The Char-Janajat riverine island of the Ganges-Padma River was undergoing rapid hydro-morphological changes due to natural and anthropologic causes (ISPAN 1995; Hooper 2001). The Ganges-Padma is a meandering river and highly affected by river bank erosion and accretion in the channel (Islam and Islam 1985; Baqee 1993, 1998; Sarker 2008). It has been estimated that between 2000 to 3000 km of river bank-line experience major

[1] The land which is newly emerged and deposit, locally known as char or diara. The word char-land is the Bengali term for mid-channel island (bar) that periodically emerges from the river bed as a result of accretion. Chars in Bangladesh can be considered a by-product of the hydro-morphological dynamics of its rivers (Islam, S.N. 2010). The active floodplain in Bangladesh is defined as extending up to existing or potential flood protection embankments and is commonly known as char-lands (Thompson and Tod 1998).

ion annually (Islam and Islam 1985). It has been revealed that the braided chann
nain rivers are on an average widening and shifting. With the result of that an esti
00 ha of land were lost to bank erosion along these three rivers during the decade
, while some 50,000 ha of land accreted (Mafizuddin 1992; FAP 16/19 1994
nated 728,000 people were displaced by river bank erosion during this period
y more people living on mid-channel islands had to move as the configurati
ds continually changed (Thompson and Tod 1998). The char people have to re
use of the frequent massive floods and trends of river bank and char-land e
ee 1993). The sediments carried by the rivers have aggraded the river beds which
tive impacts on the floodplain and the char-lands (Baqee 1993, 1998).

Char-Janajat Island is the part of the Ganges active delta and located in the
nel of the Ganges-Padma River (Islam 2000; Islam et al. 2010; Islam 2010). M
eople live on the river banks and newly accreted land along the rivers of Bangl
n 2000). Life in the char-land has undoubtedly a very special way of life. The
he char-land is a risky and vulnerable (Lein 2000; Hutton and Haque 2003)
llers are displaced from the char and return to the native char when new land em
e river channel (Baqee 1993; Islam 2000). The relocation distance of the settl
har-Janajat is about 11 km range on an average. The interval of displacement is
ars at the Char-Janajat Island. The main source of livelihoods in the Char-Jan
culture and cultivating land and small trading (Islam 2000, 2010). A major port
inhabitants are involved in crop sharecropping, agriculture labours, operati
s and fishing. Fishing and rearing animals are also an important additional sou
me and food security for many char households in the whole Char-Janajat. Acc
is an issue in char community, and violent conflicts over newly emerging char
n involve fighting (Zaman 1989, 1991; Baqee 1998). The char-land erosion,
ihoods and cyclic displacement of people are subject to floods occurrence an
ion at the Char-Janajat river island within the territories of four districts (Mada
dpur, Shariatpur and Munshiganj) (Islam 2000, 2010).

Objective of the Study

objective of this study is to understand the char-lands scenarios in the chann
eral to investigate the future hope and socioeconomic improvement of Char-J
ng to the construction of Padma Bridge in the Mawa-Janjira region, this could e
community livelihood sustainability in the active Ganges delta in Bangla
des this makes some practical recommendations for livelihood sustainability
-lands of the Padma River basin in the Ganges active delta. The specific obje
s follows:

To analysis the present changing behaviour of Char-Janajat due to floods-erosion
accretion and impacts on the char-lands in the river channels.

To introduce the Padma Bridge and its positive functions and potential role in improving local socio-economy in the Char-Janajat Island and the bridge area.

To analyse the scenarios on Char-land livelihoods sustainability in the Char-Jana
the Padma River channel in the Padma Bridge area.

To make some potential recommendations for future development and sustainab
of Char-lands around the Padma Bridge.

The Study Area

Char-Janajat riverine island is located within the territory of 5 upazilas (Sil
ira, Sadarpur, Srinagar and Lauhajang) within the 4 districts (Madaripur, Far
shiganj and Shariatpur) in the Ganges-Padma River basin in the Ga
maputra active delta in Bangladesh. Administratively, it is a union under Si
zila of Madaripur District (Figure 1). The administrative land area of Char-J
n is 31.94 km² is under the Sibchar Upazila of Madaripur District. The whol
nd) is turned as Char-Janajat and its area is estimated 84.09 km². It consist
ons within the territories of 4 districts. The population of the Char-Janajat Unio
58 until 2003, and the whole Char-Janajat people was estimated over 35,00
ent estimated population of Char-Janajat is estimated 200,000 (BBS 2007; Isl
2010; BBA 2010). The Char-Janajat is an area bounded by Char-Amirabad, A
r, Boro Khas Bandarkhola, Bandarkhola union, Kathalbari union, Panchchar un
har Upazila (Figure 1). The Char-Janajat is located within the districts borde
tories of Madaripur, Shariatpur, Munchiganj, and Faridpur. The Padma and
n Rivers have influential role in formation, erosion and accretion of the Char-J
ine har in the Padma River channel (Islam et al. 2010).

re 1: The Geographical Location of Char-Janajat in the Ganges-Padma River Channel

e: Islam 2010

e are junior high schools, primary schools, post offices, mosques and small baza
-Janajat Island, but there is no medical clinic in this char (Islam 2000, 2010). Ab
cent of the char inhabitants are farmers, but a portion of farmers are involv
ecropping (Islam 2000; BBS 2007; Islam 2010). Major portions are involved in
es, hookers, and seasonal carpenters in Dhaka mega city (Islam 2010).

Methodology

study was conducted based on primary and secondary data sources. The primary
char-land erosion, settlement relocation, people displacement, and char liveli
rmation were collected from the local people of Char-Janajat, Mawa Ferry
ira point and Kawrakandi ferry ghat through PRA practices and informal inter
A 2010; Islam 2010). An integrated practice of PRA (participatory rural Appr
hod was used to develop char-land maps on erosional trends, settlement reloc
ern and displacement of people. The PRA method is incorporated local know
perspectives, priorities and skills in the development process while facilitatin
owerment of local people. Essentially participatory methods offer local people
esearch and planning that can result in solutions, which are more appropriate f
l context and longer lasting. Besides this, a questionnaire survey was carried o
families at three locations of Padma Bridge area such as Mawa
nshiganj), Janjira point (Shariatpur) and Kawrakandi point of Char-Janaj
char Upazila (Madaripur) in 2003 and in 2008, and a three-month socioecon
ey with char-dwellers in 2008 was made and rechecked in
morphological, anthropological char village-settled study and questionnaire s
bench mark data collection were conducted. Complete enumeration o
seholds covering the land-holding pattern, tenancy, agricultural cropping sy
marketing, occupation, demographic characters, literacy etc. were collect
3 and 2008 at the Char-Janajat reverine island.

umber of standard approaches for information and data collection and an
hods were used including review of literature to get basic understanding of cha
elopment and rural livelihoods. The secondary data inputs were obtained
erent publications of government agencies, NGOs reports and research organis
angladesh. Collected data and information were analysed and visualised using V
nd ArcGIS 9.3.1 software to make the maps of settlement relocation pattern. The
es Remote Sensing (RS) imageries from 1995 to 2008 were used to investigat
pare the trends of char-lands erosion, settlement relocations, people displace
ern in the Char-Janajat Island. These data and information were used to analy
settlement relocation pattern and tendency of community livelihoods stabil
-lands of the Padma River channel.

Scope of the Study

his study stable sustainable char-land livelihood approach, which is comm
lighted, was neglected. These include floods and erosion, the multidimens
re of char-poverty itself, the vulnerability and complexities of accessin
tal assets. Therefore, Padma Bridge construction and char-land liveli
ainability approach has a significance scope to bring all issues influe
lihoods and core emphasis on poverty elimination. Therefore, it recognise
l of knowing livelihood holistically for the future sustainability of char-lan
river channels in Bangladesh.

Char-Janajat versus Padma Bridge and the Potentialities

Char-Janajat Island is one of the largest riverine bars in the Padma River chan Ganges active delta. It is located between Mawa Ferry Ghat (Munshiganj rakandi Ferri Ghat (Madaripur) (Islam 2010). The Padma Bridge is construct Char-Janajat area. The proposed Padma River Bridge is a new initiatives an es for the Char-Janajat dwellers in the Ganges-Padma River channel. This bri gladesh will be one of the largest river bridges in the world. The length of the 15 km long. The bridge connecting approach roads and associate structures are km at Mawa side in Munshiganj District and 12.8 km at Janjira side in Shar rict. There are 6 small bridges, 14 culverts, 7 underpasses and 11 junctions and ection points designed in the bridge blue print (BBA 2010). There are struction yards areas are located at Mawa (81 ha) and at Janjira (78 ha). Th ice areas are also located in Mawa (27.2 ha) and at Janjira (63.7 ha). The ect will displace 20,000 people, most of them are char-dwellers, and they w ttled in 4 resettlement corners in the both sides of the bridge (BBA 2010; 0). These resettlement sites are located at Jashaldia - Resettlement (RS) 2 wit 6 ha, Resettlement (RS) 3 at Kumbarhong with 15.46 ha at Mawa side, ement sites are located in Janjira side which are Resettlement (RS) 4 at Pa doba with area 19.95 ha and Resettlement (RS) 5 at Bakhorerkandi with area espectively (BBA 2010).

bridge is constructing between Mawa point (Munshiganj) to Janjira riatpur). The major portion of the bridge will pass on the Char-Janajat Island na River channel of Madaripur District. The Padma Bridge will be a large structure project, and its construction and operation will significantly benefit v ors of the economy of Bangladesh nationally and regionally (Sarker et al. re 2 shows the Padma Bridge and the Char-Janajat location and char-dw ilhoods scenarios in the Ganges-Padma river channel in the Ganges active delta.

ure 2: Padma Bridge location on Char-Janajat and Community Livelihoods Opportunity

e: Map: Authors 2011

The road distance from Dhaka to nearly all major destinations in the southwest region will be reduced by 100 kilometres or more. Easier communication will help expand education and training facilities, and the resulting skills development will ensure the availability of high-quality workers (BBA 2010; Islam 2010). River bank erosion protection will reduce bank erosion and the incidence of worsened vulnerability and poverty among people displaced by erosion. During construction, unemployed local people will get employment, and increase commercial activities which will facilitate income generation among locals including char people. Figure 2 shows the Padma bridge location which has crossed the Char-Janajat Island in the Padma River (BBA 2010; Islam et al. 2010). An estimate of multiplier effects on the Padma Bridge investment shows the bridge increasing the national GDP growth rate by 1.2 per cent and the gross product in the southwest region by 35 per cent, as well as generating additional employment opportunities of 743,000 person-years, which equals 1.2 per cent of the total labour force of Bangladesh. The economic internal rate of return of the main investment was estimated at 14.8 per cent by the JICA study and at 17.6 per cent by ADB's supplementary TA (BBA 2010).

The bridge area will cover the territory of four districts, and especially the Char-Janajat is located beside the Padma Bridge and approximately 50 thousand people will be dependent directly on the Padma Bridge services. Therefore, this char-land could be a stable char because of huge engineering construction of Padma Bridge (BBA 2010; Islam et al. 2010). The char people will get a chance to work at the construction places, and they will have the chance to sale their products at the local markets and the nationals markets. Char-Janajat people will get a chance to develop and improve their socio-economic in the Char-Janajat. This bridge will carry out the opportunity for the char-dwellers in the Ganges active delta; based on this bridge, a lot of employment opportunities could be created in the rural areas as well as at the bridge location (Islam et al. 2010). Therefore, Padma Bridge is a hope for the char-lands settlements stability and agricultural sustainability in the riverine channels, and these will ensure livelihood and food security. In light of trends above, new policies for the char rural areas, as well as a new set of practices and livelihoods in the rural societies, have emerged (BBA 2010; Islam 2010).

5.0 Results and Discussions

The viability depends on local conditions such as settlement patterns, existing adjustment to floods and flood erosion risks. On the other hand, the initiatives to flood mitigation would be depended on using local indigenous knowledge and river morphological trends and the preference of char people to identify more stable char areas which are not expected to be eroded for at least four years. Vulnerability of char-dwellers could also be reduced by other measures both main land areas, since the chars should not be considered in isolation from the rest of the country. Possible measures in the char areas include: improving agricultural returns in the dry season, better flood warnings based on upper catchments modelling in India, and implementing government policy for fair distribution of newly accreted land to erosion victims. In adjacent mainland areas, there may be scope to diversify incomes and create new opportunities for employment of erosion victims and

char people by assisting industrial development (Baqee 1998; Islam 2010). The total flood and erosion affected population of four districts is about 9 million.

The Char-Janajat (sometimes it is called Chowdhury Char[2]); is located just upstream side of the proposed Padma Bridge side, and it consists of 6 unions, and the population is estimated 200,000. The Padma bridge project will affect 76,211 people of whom 26,692 will require relocation from their homestead and commercial premises. About 46,637 people will lose their agricultural land and 2,882 will be affected indirectly from their income (BBA 2010) and livelihoods due to loss of access to fishing, trade, transportation and wage employment (BBA 2010). The estimated loss of top soil is 326,120 m^3 over the total 12.4 km approach road corridors. A total of about 764 ha agricultural land will be permanently acquired for this Bridge project components. It is estimated that yearly crop production (Rice, Potato, Sweet Potato, Onion, Sugarcane, Garlic and Wheat etc.) loss will be about 21,972 tons (Mawa 1079 tons and Janjira 20, 893 tons) due to the project interventions (BBA 2010; Islam 2010). Outsider immigrants, land ownership, social and local political conflicts will be raised in the Char-Janajat as well as in the project areas.

The main challenges are that the small farmers will loose their lands, perhaps industrial sites will be allocated around these areas, and other big challenges are floods, erosion and deposition rate will be increased and more small char-lands will emerge in the upstream and down stream of the proposed Padma Bridge. It will hamper the Hilsha - *Jatka* growth in the Char-Janajat area from March to May because this is the free movement period of Jatka fish in the upstream of the Padma River. There is a chance to rapid channel migration and bank erosion in the Arial Khan River in Sibchar Upazila of Madaripur District, because the main channel flow of the Padma River will be protected in the right side as the Char-Janajat is more stable in the right bank of the river. Therefore, the main flow can flows through the Arial Khan River channel. The rapid erosion could make the long width of Arial Khan River and in the off-take of the Arial Khan because this area is the part of active delta, and the soil is very soft and not mature. Therefore, erosion could be very massive that could create a new problem which could be another new challenge to the communities of Sibchar Upazila of the Madaripur District.

On the other hand, after construction of proposed Padma Bridge, the travel time saving is expected to be in the order of 2 hours for cars and bus, to 10+ hours for trucks by 2014. Opening traffic is expected to be 12,056 vehicles per day, growing over 75,636 in thirty-two years (BBA 2010). A total of 5,000 local employments will be created at the project areas during the Padma Bridge construction period (for 3 years). Through these activities income generation and char livelihoods will improve (BBA 2010). The major positive impacts are transport communication and economic improvement in the char-lands as well as Char-Janajat and surrounding of the proposed Padma Bridge location within the four district territories (Munshiganj, Faridpur, Madaripur and Shariatpur districts) (Ali 1980; Islam 2010).

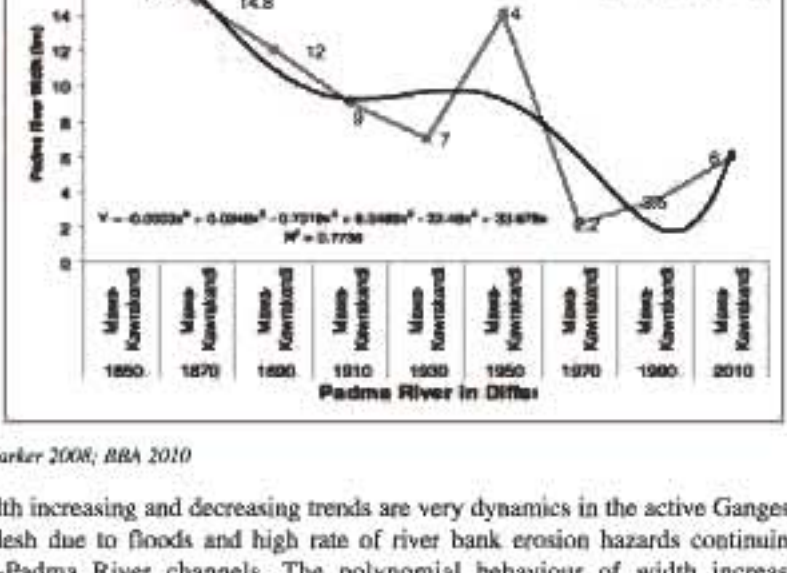
[2] As a whole this large char (Riverine bar) is called Char-Janajat, Char-Janajat is a union under Sibchar upazila. Besides this union there are more 5 unions territories are attached with this char. These 6 unions are under 4 districts territories. Some time it is called Chowdhury char, but most commonly it is popular as Char-Janajat.

des, the local farmers will get the real price of their agricultural products, and
be benefited and it could be only possible when the good communication w
blished through this proposed Padma Bridge. Therefore, a lot of positive opportu
open up for the Char-Janajat and surrounding local communities (Islam 2010).

The Width Changing Pattern and Land Use Types around the Bridge Area

orically the width of the Ganges-Padma River is not stable. The highest width
ma River was 16.5 km in 1850, 14.8 km in 1870 and 12 km in 1890, 9 km in 19
in 1930 and 14 km in 1950 (Figure 3). The Padma River width at the bridge a
ing from 2.2 to 6 km from 1970 to 2010. The width has increased 2 km in 196
in 1990 (BBA 2010; Sarker et al. 2011). In general the river has started sinkin
h of 4 km in 1995, and has kept widening to its present width of 6 km (Figure
Sarker 2008; BBA 2010). The highest width was 16.5 km in 1850, and 7 km in
again it has increased 14 km in 1950; after 1950 the river width was r
ging; it was only 2.2 km in 1970, 3.5 km in 1990 and 6 km in 2010 (Sarker
A 2010; Sarker et al. 2011).

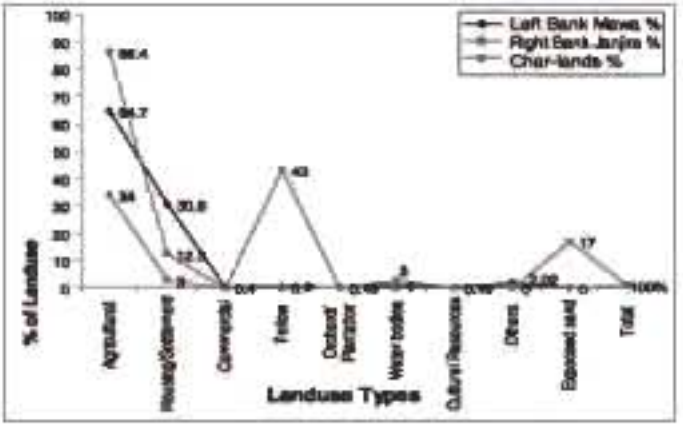
ure 3: The Historical Width of Padma River at Mawa-Kawrakandi Point



e: Sarker 2008; BBA 2010

width increasing and decreasing trends are very dynamics in the active Ganges d
gladesh due to floods and high rate of river bank erosion hazards continuing
ges-Padma River channels. The polynomial behaviour of width increasin
easing trend is a normal trend of a meandering river like the Ganges-Padma Ri
ctive Ganges delta. Figure 3 shows the Furrier polynomial curve of Padma River
re the Regression value $R^2 = 0.7738$, which is acceptable for the normal behaviou
value shows the average width from 1850 to 2010 (Islam and Gnauck 2010).

re 4: Land-use Pattern around the Padma Bridge Area



e: BBA 2010

Figure 4 illustrates the land use pattern in two locations (Mawa and Janjira nated the char-lands area in the Padma River bridge location. In the locatio cultural land use is 86.4 per cent in Janjira and 64.70 per cent in Mawa area a cent is char-land.

land use for settlement is 30.80 per cent in Mawa region, 12.30 per cent in J on 3 per cent Sand-land in the river channel. These 43 per cent char-land is new not fertile and presently it is used as fellow land, 17 per cent is exposed sand and used for water body, and lands are used for commercial purpose, plantation, cu urces, fallow and grass land purposes (Figure 4) (BBA 2010; Islam 2010). The lan ern in both bank sides and in the char-land could be changed and stable due to P ge construction. As the Figure 2 shows that geographical location of the Char-J ch is located in the right bank side of the Padma River. At present the Char-Jan e stable char, and the fertility of the char has been increased. Therefore, th dition is better than before and more suitable for crops and vegetable produ nan 1989; Islam et al. 2010; Islam 2010). All these initiatives and cha elopment programme could be considered and implemented in the char-land areas ma River channels in the Ganges active delta for sustainable development, land us ihoods sustainability. In this hostile situation, an adequate flood management ihood, settlement location plan and scientific agricultural cropping pattern for s areas are necessary (Weist 1998; Baqee 1998; Islam 2010).

The Challenges and Opportunities to the Local Communities

local communities are living in the char-lands and in the river bank areas for the emorial (Islam et al. 2010). The Char-Janajat island is one of the popula ntial char which is representing 5 upazila territories in the proposed Padma B . The majority of the char-dwellers are facing physical and social problems -lands in the Padma river channels. Flood and riverbank erosion is the most c homena in Bangladesh (Islam 2010). The floods and riverbank erosion hazar

ting char lives vulnerable; the land is becoming unstable (Baqee 1998; Islam
); Islam 2010). The farmers are facing the troubles for their agricultural crops fa
use it depends on the soil quality and fertility (Baqee 1986; Islam et al. 2010).
the physical land area in the river channels are changing its fertility, and due t
dition the cropping pattern is also changing. Therefore, instability of the char
its fertility is the root cause of settlement relocation, people displacemen
cure livelihoods in the char-lands in the Ganges-Padma River channels in the G
in Bangladesh (Weist 1987, 1991; Baqee 1998; Islam 2010).

e are three ferry ghats in the Padma Bridge area; these are Mawa ferry ghat on
, Kathalbari ferry ghat and Kawrakandi ferry ghats located in the Janjira side.
00 people are directly dependent and more 50,000 people are indirectly depend
economic activities at these three ferry ghats in the bridge area (BBA 2010;
0). After construction of the Padma bridge these ghats people, who are involv
urers, small traders and in other economic activities, will lose their job and acti
is a big threat for the people those are directly involved at the ferry ghats eco
vities. On the other hand, during the bridge construction, around 5,000 labours
nvolved for construction activities and 20,000 people could be involved for
ness, restaurant operation and small- and large-scale trading and supply acti
se activities could continue until the three years. Besides this, there are mor
rtunities to be created during and after construction of the proposed bridge. The
munities could open up their small enterprises for the tourists and to the
ple on the way to Dhaka and the western part of the bridge. Table 1 illustrat
ement relocation and people displacement pattern at the three points arou
na Bridge area.

le 1: People and Settlement Displacement Pattern in the Padma Bridge Are

rticulars	*Mawa Munshiganj*		*Kawrakandi Madaripur*		*Janjira Shariatpur*		*Tota*	
	Nr.	%	*Nr.*	%	*Nr.*	%	*Nr.*	
od, riverbank sion	9	8.91	16	15.84	4	3.96	29	2
ure livelihoods	2	1.98	6	5.94	2	1.98	10	
io-psychological action	7	6.93	10	9.90	2	1.98	19	1
ioeconomic rovement	4	3.93	6	5.84	4	3.96	14	1
w land right	4	3.96	4	3.96	2	1.98	10	
ployment and cation	3	2.97	4	3.96	2	1.98	9	
gration to cities	3	2.97	5	4.95	2	1.98	10	
al	32	31.68	51	50.39	18	17.82	101	

e: Field Survey in 2011

Char-lands community people, especially the Char-Janajat people, are fi
nst floods and river bank erosion for a long time and they have been shifte
rated several times in their life. Table 1 illustrates the char people migration patt
r-Janajat in three district locations such as at Mawa point of Munshiganj, Kawra

Kathalbari point of Madaripur and Janjira point of Shariatpur district. Majority
r-Janajat communities have been migrated and resettled their home more th
s. In Mawa point (Munshiganj), 12 per cent people have migrated more than 9
e are 18 per cent char people migrated more than 10 times in Kawrakandi-Kath
ts (Madaripur) and almost 37 per cent char people were migrated for more th
s in Janjira point (Shariatpur District). Table 2 shows the root causes of
ement relocation and people's displacement in the char-lands and outside the
e fundamental reasons are recognised by the char-dwellers those living with
river bank erosion in the Ganges-Padma river channels and in the river banks ar
Padma Bridge area. Many char people were displaced and settlements have
cated due to flood and river bank erosions - 9 per cent in Mawa, 16 per c
rakandi and 4 per cent in Janjira. Insecure livelihoods in the char-
hological attraction for better life, socioeconomic improvement, char-land
cation and employment opportunities, are the major issues for the protecti
ration from char-lands (Zaman 1989, 1991; Weist 1998; Islam 2010).

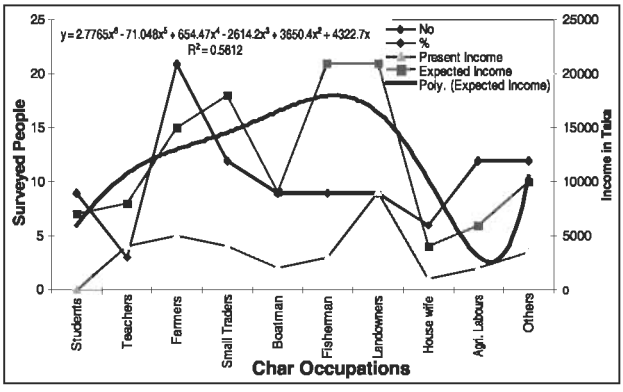
le 2: The Root Causes of Settlement and People Displacement

rticulars	*Mawa Munshiganj*		*Kawrakandi Madaripur*		*Janjira Shariatpur*		*Total*	
	Nr.	%	*Nr.*	%	*Nr.*	%	*Nr.*	
od, Riverbank sion	9	8.91	16	15.84	4	3.96	29	2
ure livelihoods	2	1.98	6	5.94	2	1.98	10	
cio- psychological raction	7	6.93	10	9.90	2	1.98	19	1
cio-economic provement	4	3.93	6	5.84	4	3.96	14	1
w land right	4	3.96	4	3.96	2	1.98	10	
ployment and cation	3	2.97	4	3.96	2	1.98	9	
gration to cities	3	2.97	5	4.95	2	1.98	10	
al	32	31.68	51	50.39	18	17.82	101	

e: Field survey 2011

survey was carried out in 3 points at the Padma Bridge area within the three d
tories in Mawa point in Munshiganj, Janjira point in Shariatpur and Katha
rrakandi point in Madaripur District (Figure 5). The respondents have been stated
ments based on their present situation and future hope based on the Padma
truction at the case area. Majority of the respondents gave their opinion that
ipurpose bridge is a good hope for the Char-Janajat as well for the whole
use physical stability, soil fertility and stable cropping pattern, crops pric
keting, socio-economic improvement, growth of cultural goods productio
keting will be improved. Figure 5 shows the recent income range of the local
nd the proposed Padma Bridge area and the people expectation of income
truction of the Bridge on the Char-Janajat Island. In Figure 5 the polynomial beha
e present and future expected income curve is showing the disordered trend.

Figure 5: The Present Char People Occupations, Income and Expected Income after Padma Bridge Construction



Source: Field survey 2011

The curve represents the behaviour of increasing and decreasing trends where the Regression value $R^2 = 0.5612$ which is not acceptable in statistical data regression analysis. This polynomial curve analysis carried out based on the char people future expectation of income on 10 occupations. The lowest expectations are the char women and agricultural labour's expectation income. This is the reason the polynomial curve has shown the typical behaviour. Majority of the char-people are expecting that after construction of the Padma Bridge, the Char-Janajat and surrounding areas will be stabled and the land area is already for fertile enough than previous years'. Therefore, the farmers can choose a sustainable cropping pattern, and the communication would be more sophisticated.

The farmers would be able to sale their crops and vegetable and agro-products to the nearest towns as well as to the Dhaka mega city. Besides, more new employment opportunities could be created around the bridge area and the local people will get the priority. Some new industries could be developed to the bridge area because of good communication, geographical location and the land value. New type of riverine tourism could be developed around the Bridge area and in the bank side of the Char-Janajat. Boat tourism and floating restaurant and Hilsha fish restaurant could be established in these areas. Bhaggokul cheese (ponir), sweet (rashogulla and monda), butter (ghee), card (doi) could be opened up as small cottage industries that could be operated by the rural women around the proposed Padma Bridge (Islam 2010). Therefore, the average income of the Char-Janajat Island could be reached three to four times more than the present income (Figure 5) (Islam 2010; BBA 2010). In general the char-dwellers income will be increased; therefore, the livelihoods of the char-land will be improved around the Padma Bridge.

The majority people in the Char-Janajat area are expecting that after the construction of the Padma Bridge on the Char-Janajat riverine island, the surrounding areas will be stable and the settlement and agricultural cropping systems will be stable. The income and socioeconomic status will be increased rapidly. The economic activities are increasing

around the bridge area and specially the left side (Mawa side) and right side (Janjira side) of the Padma River at the Bridge location. Besides this, other potential issue is that the proposed International Airport development has been proposed around the Padma Bridge area and if it is settled in the left side or right side of the Padma River as well as the Padma Bridge then the Char-Janajat island (Chowdhury Char) (Islam 2010; BBA 2010) would be the middle point around these economic and development activities in the region. There is a chance to establish a Satellite town or Sub-urban town (Upa-shahar)[3] near to the Padma Bridge area in Munshiganj District to reduce the urban migration to the large cities and trim down high pressure on Dhaka mega city. The urbanisation rate will increase very rapidly around the bridge area in both left and right sides of the Padma River basin. The land price would reach highest rate in this area considering the previous rate. The agricultural land will be reduced and the commercial and cultural activities will be increased. The local people will get this chance to use their natural resources to improve their socioeconomic condition. They could be able to participate as partner and establish their ownership right at such local development projects. The rural and char women will get chance to work and operate the different income-generating and small trade activities. The community especially the farmers, fishermen and other occupational people could sale their agricultural crops and vegetables in the local markets and then in the city/big markets-because of good communication.

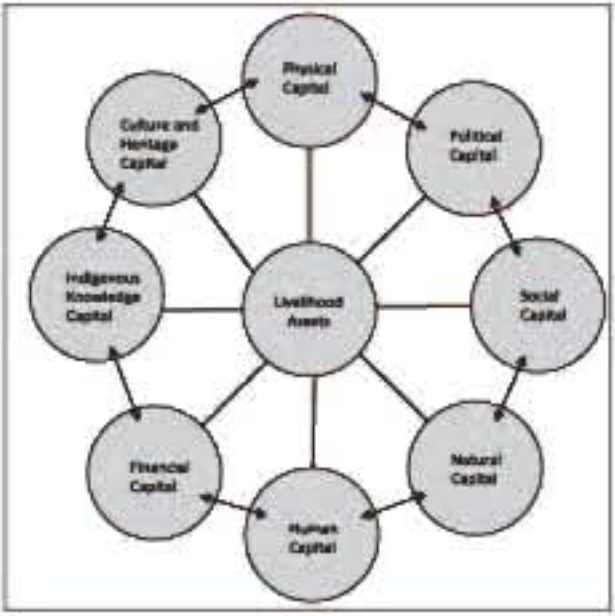
5.3 Char Livelihoods Sustainability in Char-Janajat

The livelihood approach is increasingly used by many development agencies and non-governmental organisations (NGOs) to achieve a better understanding of natural resources management systems (Allison and Horseman 2006). It seeks to improve char-rural development policy and practice by recognising the seasonal and cyclical complexity of livelihood strategies, helping to remove access constraints to assets and activities that complement existing patterns, and identify ways of making livelihoods as a whole to cope with adverse trends and shocks (Beddington 1999; Allison and Ellis 2001; Norton and Foster 2001). The concept of a livelihood seeks to bring together the critical factors that affect the vulnerability or strength of individual or family survival strategies (Allison and Ellis 2001). According to the DFID (1999) 'a livelihood comprises the capabilities, assets and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base.' The sustainable livelihoods approach (SLA) is prominent in recent development programmes that aim to reduce poverty and vulnerability in communities engaged in small-scale agricultural farming and micro-entrepreneurship and fisheries (Edwards et al. 2002). SLA is a way of thinking about the objectives, scope and priorities for development, in order to enhance progress in poverty elimination (Ashley and Carney 1999). It embraces a wider approach to people's livelihoods by looking beyond income-generating activities and provides means to consider factors that influence livelihoods, interactions between those factors, and sustainability of livelihoods (Mukherjee et al.

[3] Upa-shahar is a Bengali term which meaning is satellite town or Sub-urban town. After construction of Padma Bridge a new satellite town or uap-shahar can be developed near to the Padma Bridge area and it could be a suitable place in Srinagar-Lauhojang Upazila of Munshiganj District. It is located in a very short distance to Dhaka mega city.

2). Scoones (1998) stated that five key indicators are important for assessin
evement of sustainable livelihoods- (i) poverty reduction, (ii) well-being
abilities, (iii) Livelihood adaptation, (iv) Vulnerability and resilience, and (v) N
urce base sustainability. Figure 6 shows the network of char-land liveli
ainability where 8 potential elements are interlinked and interrelated. All the ele
ivelihoods framework are playing an important role to set up the livel
ework. The basic needs could be fulfilled in the char-lands when the dwellers
ble to use eight livelihood assets properly (Figure 6).

ure 6: The Network of Livelihoods Capitals in Charlands



ce: Authors 2011

char-lands livelihood improvement and sustainability the newly formatted fram
h eight assets) could be a suitable livelihood framework for poverty alleviatio
o-economic improvement in the rural Bangladesh. The livelihood security of the
llers is assumed to increase with the increase in income. A farming family can b
e 'livelihood secure' when members have adequate and natural resources to meet
ls (Carney 2002). Basic needs would include food, drinking water, stable ho
th and sanitation facilities and socioeconomic security (Islam 2010). The char p
ire a range of assets to achieve positive livelihood outcomes (Cambers 1992; A
Falk 2008). Therefore, the attempt to make livelihoods more secure and sustai
to be built upon an understanding of the assets that people already have, and hov
used safely. Failure to do this can lead to policies that undermine or destroy the
eople 'livelihoods' or make it more vulnerable. The sustainable livelihoods fram
vs attention to eight types of capitals upon which char-dwellers livelihoods d
mbers 1992; Lein 2000; Ahmed and Falk 2008).

A participatory approach to char-lands natural resource planning can consider the long-term interests of the char community. This approach is based on the assumption that char-lands management stability programmes will be more successful if local people are involved in planning and implementing char-land policies and programmes. Involvement of local char peoples in the natural resource protection, and management practice would give them a sense of awareness of the resources and ensure their continued livelihoods and economic well-being (Alam and Koudstaal 2000). In such way, the char-lands stability and management link ecology with economics, sociology and politics promoting policies and practices which discourage further degradation, provide incentives for improvement and provide sufficient resources for char people so that they manage themselves willingly (Alam 1989; Scoones 1998). In the char-lands, in the DFID livelihoods framework only six assets are considered. The present proposed livelihood framework (Figure 6) is prepared on the basis of local economy, culture, society, heritage and physiographic condition. This livelihood framework is most suitable for Char-Janajat as well as other char-lands and rural areas in Bangladesh.

6.0 Conclusions and Recommendations

Floods, riverbank erosion, settlement displacement and char livelihoods are interlinked in the Ganges delta in Bangladesh. Moreover, it is the common phenomena in the river channels, and over 200,000 thousand char-dwellers of Char-Janajat island struggle against floods, erosion and poverty. The dwellers are under threat; they always have to move and migrate because of unstable char-land and insecure livelihoods. The findings also show that the Char-Janajat changed its shape and size due to erosion and accretion owing to devastating floods. Therefore, the char inhabitants have been displaced 27 times and minimum 6 times within 60 years duration of char life which is a threat for char livelihoods and sustainable char-land development. As a result, the inhabitants of Char-Janajat had to relocate their settlements and migrate to the nearest flood safe and erosion-free places. The floods and the char-lands erosion is a challenge for managing char settlements, cultural landscape protection, agricultural cropping systems, crop biodiversity and riverine ecology of Char-Janajat Island. It is necessary to find an alternative approach or adaptation strategies for sustainable livelihoods option in the char-lands of the Ganges-Padma River channel in the Ganges active delta in Bangladesh. The proposed Padma Bridge will settle and stable the Char-Janajat island in the right bank of the Padma River. The char-land would be more stable and fertile which is positive sign and new hope for the char-dwellers of the Char-Janajat and surroundings. There are some negative points and challenges for Char-Janajat stability and sustainable livelihoods. The proposed Padma Bridge would be a connective tool to make the east and west part of Bangladesh more close and the distance short. The Padma Bridge can be used as a tool for the local socioeconomic improvement and to ensure Char-Janajat livelihood sustainability in the Ganges active delta in Bangladesh. As a whole, the Padma Bridge construction will open up the opportunities for the Char-Janajat inhabitants as well as for the whole region surrounding the Padma Bridge area.

following recommendations may be considered for char-lands stability ihood sustainability:

The char-lands have historically been considered as sand-land and have frequent been altered or lost because their ecological functions and resulting values to soc have not been understood; therefore, it should be introduced to the people as a common property, its importance and community rights.

The Padma Bridge construction should be used as a tool and policy for Char-Jan Island development and livelihood sustainability; therefore, an Environmental In Assessment (EIA) is necessary for such huge engineering construction in the Ga active delta.

The proposed Padma Bridge could be used as tool for river-tourism development through using local culture and heritage, where the local community will get the opportunity to open up the local tradition and culture that would help improve th socio-economy.

The community participation, local adaptation and capacity building, awareness education and applied research on floods and char-land erosion should be incorporated in the national development agenda. Local people could be equal partners in the char-land physical stability development through indigenous knowledge practices to ensure sustainable livelihoods of Char-Janajat in the Gan active delta.

Political commitment is necessary to construct the Padma Bridge and for the development and livelihood sustainability of char-lands in the river channels in t Ganges active delta in Bangladesh.

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The Diet of the Wild Grass-Cutters in Imo-State, Nigeria in Relation to Compositions of Gastro-Intestinal Tract Contents

M. C. Uchegbu*, I. C. Okoli*[a], J. I. Abiakalam*, M. N. Opara*,
U. E. Ogundu* and B. U. Ekenyem**

Abstract

This study was carried from January to April 2007 to determine the physical characteristics, proximate composition and digestibility of the gastro intestinal tract contents of 16 (8 males and females each) wild grass-cutters caught at Umuagwo, Ohaji Egdema Local Government Area of Imo-State, Southeastern Nigeria. The grass-cutters were eviscerated and their intestinal contents characterised, sun dried and analysed for their proximate chemical compositions across the study period. The males had heavier average carcass weight (5.36 kg) than female (3.26 kg). The increasing difficulty in identifying feedstuffs down the gastro intestinal tract and the reducing quantity of the intestinal content up to the rectum was an evidence of efficient digestive process. Average digestibility estimate for the period was 76.47 per cent. The nutrient values of the stomach contents of the adult grass-cutters were 16.38 per cent CP, 8.46 per cent CF, 5.44 per cent ASH, 4.02 per cent EE, 58.34 per cent NFE and of 2539.13 kcal/kg energy value. The grass-cutters thrived mainly on grasses and cassava tubers. Ration formulation for domesticated grass-cutters should reflect the natural nutritional needs of the wild grass-cutters as reported here.

1.0 Introduction

The grass-cutter has been found to be prevalent in secondary forests in many areas of Africa, where it is hunted as food. It is a favourite bush meat species and accounts for greater population of bush meat sold in most areas of Africa particularly, West Africa. It fetches higher prices than beef in most countries within the sub-region. Grass-cutters are herbivores; feeding on savannah grasses as their favourite fodder (Asibey 1994). In captivity, they thrive on sugar cane, corn stalks and cassava peelings. Grass-cutter is a wasteful feeder, cutting grass at a characteristic angle with its powerful incisor to cut more nutritious, succulent inter nodes, leaving scattered pieces of stem on the feeding ground. This characteristic feeding behaviour is exploited by hunters, who look for feeding sites as indication of where the animals were active the previous night in order to concentrate hunting efforts in such areas (Fitzinger 1995).

Earlier studies in Ghana have shown that grass-cutters could be kept in captivity (Asibey 1994). In addition, studies on many aspects of the biology and ecology of the animal (Asibey 1994; Ntiamoa-Baidu 1998; Opara et al. 2006) supported the feasibility of rearing the grass-cutter in captivity and demonstrated increased litter size as a result of better management.

* Department of Animal Science and Technology, Federal University of Technology, Owerri, Nigeria.
** Department of Animal Science and Fisheries, Evan Enwerem University, Owerri, Nigeria.
a Corresponding author: E-mail: dr_charleso@yahoo.com

The meat of grass-cutter is unique and is eaten as a delicacy by the rural and urban communities throughout Nigeria and other West and Central African countries (Ajayi and Ayodele 1995). The interest of Europeans in grass-cutter meat is overwhelming, despite the fact that the animal is absent in their ecological zone (Fitzinger 1995). The justifications for rearing the wild grass-cutter in captivity may include the facts that there are no known religious discrimination against its meat; it is a herbivore, feeding mostly on grasses; it has a high litter size of average of eight young ones per parturition and low mortality rate (10%) among the young; the droppings (feces) do not have offensive odor compared to those of rabbits, pigs and cattle; the meat has high carcass quality, and the protein is comparable to that of poultry; it does not require an extensive area to carry out its functions (Ajayi and Ayodele 1995; Fitzinger 1995; Asibey and Addo 2000).

The domestication of grass-cutter is not yet fully mastered as there are insufficient data on the feeding and nutritional requirements of the animal under intensive farming conditions. A critical examination of the gastro-intestinal contents of the animal, especially those caught in the wild could reveal the nature of the feedstuffs the animal thrives on and the extent of utilisation of these nutrients in the various segments of the gastro-intestinal tract.

This study was carried from January to April 2007 to determine the proximate composition and apparent digestibility of the gastro intestinal tract contents of wild grass-cutters caught at Umuagwo, Ohaji Egdema Local Government Area of Imo-State, Southeastern Nigeria.

2.0 Materials and Methods

Study area: This study was carried out in Imo state, which is situated in the southeastern region of Nigeria. The vegetation is typically rainforest with two seasons, the rainy and dry seasons; the period of rainy season is from the month of April to October, while the dry season runs through November to March. The temperature and humidity ranges from 25-300c and 70-80 per cent respectively. Population density of the area ranges from 500 - 2000 person per km^2 (NPC 2006). People in the rural and semi-urban areas keep livestock, such as pigs, cattle, sheep, goat and poultry (Okoli 2004). They also cultivate crops like yam, maize, cassava, cocoyam, and vegetables, among others.

Samples collection: Gastro intestinal tract contents were collected from sixteen adult grass cutters made up of eight males and eight females from January to April 2007. The animals were caught overnight with traps in the wild by hunters at Umuagwu, Ohaji Egdema Local Government Area of Imo-State, Southeastern Nigeria. Grass-cutters were, thereafter, killed and sold to caterers at the Amanchi (a hot sport for grass-cutter menu) spot at Umuagwo Ohaji. With the permission of caterers, the animals were weighed before subsequent evisceration.

The content of the stomach of each animal was carefully characterised in order to identify the feedstuff consumed by the animals in the study area. Thereafter, the contents of the various segments of the gastro intestinal tract (stomach, small intestine, large intestine

and rectum) were separately collected, sun dried and weighed. This was done after identifying the boundaries of each segment and tying them up to prevent the overflow of the content of one section into the other.

Chemical analyses: The various samples were taken to the Animal Science and Technology Laboratory of the Federal University Technology, Owerri and analysed for DM, CP, CF, EE and NFE according to AOAC (1995). The metabolisable energy values were also calculated with the prediction equation of Morgan et al. (1975), based on the proximate composition.

Apparent digestibility (AD) was determined using the method of Schnerder and Flatt (1975). The formula is given as:

$$AD = \frac{\text{Weight of nutrient in stomach content - weight of nutrient in rectal content}}{\text{Weight of nutrient in stomach content}} \times \frac{100}{1}$$

Data analysis: All the quantitative data obtained were subjected to analysis of variance (ANOVA) and where statistical significance was observed, the means were compared using the Duncan Multiple Range Test (Steel and Torrie 1980).

3.0 Results and Discussions

Comparative average carcass weight of the wild grass-cutters obtained from Ohaji Local Government Area of Imo-State were shown on Table 1. Out of the 16 animals, eight were males and eight were females. It was observed that the males had heavier weight than the females. For instance, the average carcass weight of the males during the study period was 5.36 kg, while that of the females was 3.26 kg. This agrees with the report of Baptist and Mensah (1986) that the weights of the male and female grass-cutters are 3-6 and 2-4 kg respectively.

The stomach contents of the wild grass-cutters were found to be mainly grasses and cassava tubers. This indicated that during the study period and in the study area, the grass-cutters thrived on there feedstuff and such materials could form the basal diet for their rearing in captivity. It should, however, be noted that the grass-cuter in the wild has evolved a peculiar method of cutting grass at a characteristic angle, with its powerful incisor to cut more nutritious, succulent inter nodes, leaving scattered pieces of stem on the feeding ground (Fitzinger 1995).

Table 1: Comparative Average Carcass Weight of the Wild Grass-cutters

Sex	*January*	*February*	*March*	*April*	*X*
Male (kg)	6.03	5.13	5.05	5.25	5.36
Female (kg)	3.50	3.00	3.10	3.45	3.26

It was observed that in all the segments of the gastro-intestinal tract, the nitrogen free extract had the highest value (Tables 2-5), followed by crude protein, while ether extract

had the least value. This report also agrees with that of Mensah (1993) that the nitrogen free extract requirement of an adult grass-cutter ranges from 45 to 65 per cent. The ranges of the crude protein, crude fibre, ash, ether extract and nitrogen free extract requirements for adult grass-cutter have been reported to be 12-18.5, 25-45, 2.5-4.5, 2.5-4.5 and 45-65 per cent respectively (Mensah 1993).

The mean metabolisable energy value of the stomach content (Table 2), at 2539.13 kcal/kg was higher than the energy values of the other segments (Tables 3-5). This shows that the animals were capable of meeting to a large extent, their nutrient requirements as the main feed ingredients identified in their stomach were grasses and cassava tubers. The mean proximate compositions of the stomach content reflected the nutritional requirements of the grass-cutters. The increasing difficulty in identifying these feed ingredients down the gastro-intestinal tract and the reducing quantity of the gastro-intestinal tract content was an evidence of efficient digestive process in the grass-cutters.

Table 2: Proximate Composition of the Stomach Contents of the Wild Grass-cutters

Parameters	*January*	*February*	*March*	*April*	*X*
% MC	7.18	4.50	8.55	9.74	7.49
% CP	20.05	10.36	19.85	15.26	16.38
% CF	5.43	10.63	7.74	10.09	8.46
% ASH	3.80	4.83	5.58	7.59	5.44
% EE	3.59	2.73	5.33	4.44	4.02
% NFE	59.97	66.98	52.97	53.46	58.34
Stomach content (g)	9.88	9.63	9.67	10.00	9.79
ME (kcal/kg)	2975.62	2502.39	2625.48	2053.06	2539.13

Table 3: Proximate Composition of the Contents of the Small Intestine

Parameters	*January*	*February*	*March*	*April*	*X*
% MC	11.80	10.00	8.55	10.77	10.35
% CP	19.32	7.28	17.73	14.07	14.59
% CF	6.27	14.60	9.44	9.02	9.83
% ASH	5.05	6.55	7.85	7.01	6.61
% EE	4.10	3.85	4.63	4.19	4.19
% NFE	58.47	57.73	51.50	54.47	54.54
GIT content (g)	5.25	5.13	5.08	5.25	5.17
ME (kcal/kg)	2845.36	1548.76	2154.64	1987.09	2134.02

Table 4: Proximate Composition of the Contents of the Large Intestine

Parameters	*January*	*February*	*March*	*April*	*X*
% MC	11.00	9.00	8.89	9.45	9.58
% CP	14.95	11.05	14.96	11.64	13.14
% CF	4.89	10.69	7.15	8.93	7.91
% ASH	3.08	4.66	4.35	6.94	4.75
% EE	3.70	3.21	4.73	4.09	3.93
% NFE	62.39	61.39	59.93	58.96	60.67
GIT content (g)	4.25	4.13	4.08	4.25	4.17
ME (kcal/kg)	2698.38	2149.85	2631.45	2122.37	2400.50

The average digestibility estimate for the period was 76.47 per cent (Table 6), which implies that the feedstuffs consumed by the grass-cutters were highly digestible (Fielding 1991).

Research has shown that when the dry matter digestibility of a diet falls below 67 per cent, voluntary feed intake declines, with declining digestibility. This decline is associated with the indigestible residue in the intestinal tract and the slower rate of digestion. When the digestibility of the diet is maintained above 67 per cent, digestibility and the rate of digestion no longer limits intake and other factors, including nutritional needs for production.

Table 5: Proximate Composition of the Contents of the Rectum

Parameters	*January*	*February*	*March*	*April*	*X*
% MC	8.85	7.50	5.89	8.03	7.57
% CP	6.86	10.75	7.71	6.03	7.83
% CF	4.84	13.85	8.54	10.50	9.43
% ASH	16.87	9.40	8.55	5.79	10.15
% EE	4.20	5.20	4.60	3.46	4.26
% NFE	58.39	53.33	64.72	66.56	60.74
GIT content (g)	2.50	2.50	2.73	2.50	2.55
ME (kcal/kg)	1613.31	1700.52	2311.18	2084.13	1927.28

Table 6: Apparent Digestibility Estimates (%) of the Wild Grass-cutters

Parameters	*January*	*February*	*March*	*April*	*X*
Digestibility Estimates (%)	78.87	76.37	75.12	75.54	76.47

For the grass-cutter to have attained a digestibility level of 76.47 per cent, it means that the feed it consumed in the wild were highly digestible and balanced in proteins and carbohydrates as well as other essential nutrients.

4.0 Conclusion

In the study area of Umuagwu, Ohaji Egdema Local Government Area of Imo-State, Southeastern Nigeria, the adult male grass-cutters were heavier weights than their female counterparts. The adult grass-cutters thrived primarily on grasses and cassava tubers and were able to select highly digestible feedstuffs. The proximate composition of the stomach content reflected the nutritional requirements of the grass-cutters.

Ration formulation for domesticated grass-cutters should reflect the nutritional needs of the wild grass-cutters as investigated. Farmers should be encouraged to practiced full time domestication of the grass-cutter as this will aid in improving protein production in the country and the world at large.

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Note to Contributors

1.0 Aims

The Asia-Pacific Journal of Rural Development (APJORD) is an interdisciplinary journal devoted to issues and discussions on rural development primarily in the Asia-Pacific region. APJORD focuses on poverty issues and rural transformation, keeping in view the four programme priorities of CIRDAP, namely (1) Agrarian Development; (2) Institutional/Infrastructural Development; (3) Resource Development including Human Resources; and (4) Employment.

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Articles are accepted for publication provided they are submitted to APJORD only. If there is more than one author, a statement to the effect that the article has been approved by all the authors must accompany it. It is the responsibility of the author(s) to obtain permission for the use of previously published or unpublished materials including tables and figures. All articles are subject to peer review and may be revised if necessary. The editor's decision regarding articles submitted for publication is final. Copyright rests with CIRDAP.

Authors are entitled to three complimentary copies of the issue in which their articles appear. Articles written between 4,000-5,000 words are preferred. Both the hard copy and soft copy of the write-up must have to be submitted to the editor. The soft copy either may be given in pen drive/CD or can be sent as an attachment to the e-mail address: infocom@cirdap.org.

Typescripts should be submitted in duplicate, on A4 size paper, typewritten on one side, in double space, with margins of at least 2.54 cm. (one inch). Statistical tables, illustrations and charts should be submitted on separate sheets, and their positions should be indicated in the text.

3.0 Style and Presentation

APJORD mostly follows the Chicago Manual of Style for preparing articles. Authors should, as far as possible, adhere to the following basic requirements of style:

i. The name and institutional affiliation of the author should appear as a footnote on the first page together with acknowledgement, if any.

ii. An abstract of approximately 100 words should precede the text on the first page. It should be titled 'Abstract' indented, italicised and centred.

iii. British and 's' spellings should be used. Numbers from zero to ten should be spelled out, and numerals should be used for all other numbers.

iv. Where references are made without any comment, they should be inserted at the appropriate places in the body of the text in parenthesis giving the surname of the author(s) and year of publication of the work under reference, e.g. (Shama 1915: 41), (Mayco and Santalines 1991: 18), (Jupitar 1985: 21; Razia 1999: 66).

v. Where references are made with detailed notes/comments, they should appear as Notes, numbered sequentially throughout the article by superscripting in raised Arabic numbers and the corresponding notes appearing as footnotes or listed sequentially at the end of the article.

vi. The reference list should appear after the Notes. For books give author's surname, other name(s) and/initial(s), year of publication, title of publication, place of publication, and publisher, e.g.

Syed, Shireen Kamal. 1992. Women in Post-harvest Loss Prevention. Dhaka: Centre on Integrated Rural Development for Asia and the Pacific.

Tamanga, A., N Shrestha., K. Sharma, and S. Kathi. 1994. Case Studies of Women with Abortion Experiences. Kathmandu: IDS.

Acharya, Meena. 1994. Political Participation of Women in Nepal. In Nelson, Barbara and Chowdhury, and Norma edited Women and Politics Worldwide. London: Yale University Press.

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Quarantelli, E.L. 1992. Can and Should Social Science Disaster Research Knowledge and Findings from Developed Societies be Applied in Developing Societies? Asia-Pacific Journal of Rural Development, Vol. II, No. 2, December, Pp. 1-14.

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The Centre on Integrated Rural Development for Asia and the Pacific (CIRDAP) is a regional, intergovernmental and autonomous institution. It was established in 1979 at the initiative of the countries of the Asia-Pacific region and the Food and Agriculture Organisation (FAO) of the United Nations with support from other UN organisations and donor countries/agencies. The member countries of CIRDAP are: Afghanistan, Bangladesh (host state), Fiji Islands, India, Indonesia, Iran, Lao PDR, Malaysia, Myanmar, Nepal, Pakistan, the Philippines, Sri Lanka, Thailand and Vietnam.

The main objectives of the Centre are to: (i) assist national action, (ii) promote regional cooperation, and (iii) act as a servicing institution for its member countries for promotion of integrated rural development through research, action research, training and information dissemination. Amelioration of rural poverty in the Asia-Pacific region has been the prime concern of CIRDAP.

The programme priorities of CIRDAP are set under four Areas of Concern: 1) Agrarian development; 2) Institutional/infrastructural development; 3) Resource development including human resources; and 4) Employment. Within these areas of concern, the thematic areas are: Poverty alleviation through participatory approaches with emphasis on social sector development (e.g. health, education and nutrition); Employment generation through microcredit support, infrastructure development and local resource mobilisation; GO-NGO collaboration; Gender issues; Governance issues; and Environmental concerns for sustainable rural development.

Operating through designated Contact Ministries and Link Institutions in the member countries, CIRDAP promotes technical cooperation among nations of the region. It plays a supplementary and reinforcing role in supporting and furthering the effectiveness of integrated rural development programmes in the Asia-Pacific region.

For Publications, Please Contact:

Director, Information and Communication Division (ICD)
CIRDAP
17 Topkhana Road, GPO Box 2883, Dhaka 1000, Bangladesh
Tel : (880 2) 9564776, 9556131; PABX : (880 2) 9558751, 9559686, 7169824-5; Fax : (880 2) 9562035
E-mail : infocom@cirdap.org
Website : www.cirdap.org