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Interlinkages of Agricultural Diversification in Bangladesh

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Centre on Integrated Rural Development for
Asia and the Pacific

Interlinkages of Agricultural Diversification in Bangladesh

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**Centre on Integrated Rural Development for
Asia and the Pacific**

Foreword

In Bangladesh, explicit focus on poverty eradication in the development agenda requires formulation and implementation of sustainable anti-poverty strategies. The availability of reliable and timely information on the state and processes of poverty assists the policy makers in understanding poverty in its manifold dimensions and in identifying the causalities. The above requires institutional mechanism to (i) monitor poverty using multidimensional indicators; (ii) analyze micro impact of macroeconomic and structural adjustment policies; (iii) provide feedback to the policy makers in designing effective macro and poverty reduction policies.

CIRDAP, with assistance from the International Development Research Centre (IDRC), Canada and Canadian International Development Agency (CIDA) initiated a project on 'Monitoring Adjustment and Poverty (MAP) in Bangladesh to address the above issues. Under the project, a number of 'focus studies' were conducted on poverty related issues. These studies generate information on the nature and conduits through which macro-policies create impact at the micro level along with providing relevant information on poverty.

In Bangladesh, agriculture still dominates the avenues for employment and accounts for a relatively large share of GDP. The labour force currently employed in agriculture is about 64 percent. On the other hand, the GDP share of agriculture is at nearly 32 percent. Also within agriculture, the different sub-sectors have undergone distinct structural changes following the diversification initiatives induced by credit supply, training input, and extension services. During the period from 1993-94 to 1997-98, the GDP share of crop agriculture has declined from 26 percent to 23 percent but for non-crop agriculture the share has increased from 8 percent to 9 percent.

The above macro changes are expected outcomes of the growth process. They also reflect the transformations underlying farm households at the micro level. Being typical agri-practice, the integrated farming has been practised by farm households as before. This has evened out employment of family labour in peak and trough seasons by combining various enterprises like crop cultivation, dairy and poultry farming, fishing, household vegetable growing, and agro-forestry raising. These integrated enterprises have constituted an agricultural 'system' for a farm household. Being holistic in nature the system has allowed maximising aggregate production of a farm household through complementary and supplementary linkages across the enterprises and also ensured reaping much higher welfare for household members through balanced food intake and nutrition linkage.

The recent expansion of small and medium scale commercial dairy and poultry farms as well as pond and inland fish culture have added a new dimension to non-crop agricultural sector progress. Here both backward and forward linkages have opened up opportunities for exploiting the development potentials of the non-crop activities and thereby accelerating the pace of overall economic growth.

The patterns of changes in organisation of farms due to agriculture diversification and the effects of linkages across farming enterprises need to be understood in much more detail for evaluating the growth potentials of agri-farming system and recommending policy reforms to sustain a higher growth in agriculture. This study is an attempt to provide analysis

about the nature and extent of current agriculture diversification and the interlinkages. Both macro and micro dimensions have been examined to draw implications about promoting efficiency in utilisation of resources and increasing productivity of various agro-enterprises. The study evidences will give insights to policy makers and planners into the impacts of current reform programmes in agriculture and also assist them in suggesting policy and planning options for rapid development of the agriculture sector.

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January 2001

Dr. Mya Maung
Director General

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Abbreviations and Acronyms

AEZ	Agro-ecological Zones
ASA	Association for Social Advancement
BADC	Bangladesh Agricultural Development Corporation
BAU	Bangladesh Agricultural University
BBS	Bangladesh Bureau of Statistics
BCSIR	Bangladesh Council for Scientific and Industrial Research
BIDS	Bangladesh Institute for Development Studies
BRAC	Bangladesh Rural Advancement Committee
CIRDAP	Centre on Integrated Rural Development for Asia and the Pacific
CPD	Centre for Policy Dialogue
DAE	Department of Agricultural Extension
DAM	Directorate of Agricultural Marketing
DLS	Department of Livestock Services
DOF	Directorate of Fisheries
DTW	Deep Tubewell
EPBB	Export Promotion Bureau, Bangladesh
GDP	Gross Domestic Product
HYV	High Yielding Variety
IFPRI	International Food Policy Research Institute
MP	Murate of Potash
MPO	Master Plan Organization
NGO	Non-government Organization
RDRS	Rangpur-Dinajpur Rehabilitation Service
SDC	Swiss Development Corporation
STW	Shallow Tubewell
TSP	Tripple Super Phosphate
VFFP	Village and Farm Forestry Programme

Executive Summary

Although the share of agriculture in the GDP has declined over the past years, agriculture still remains the leading sector of the economy of Bangladesh. While the overall share of agriculture in the GDP has declined over the past years, a noticeable change has also occurred in respect of relative shares of agricultural sub-sectors in the GDP. The contribution of crop sub-sector to GDP declined from 29.7 per cent in 1990/91 to 23.7 per cent in 1996/97. The contribution of livestock and fisheries sub-sectors, however, increased to 3.1 per cent and 3.2 per cent respectively from 2.7 per cent in each case during the same period. While the crop sub-sector showed only a marginal growth rate during the period 1990/91-1996/97, the growth rates for livestock and fisheries sub-sectors increased from 2.2 per cent and 5.8 per cent in 1990/91 to 8.0 per cent and 8.9 per cent respectively in 1996/97. This can be viewed as an aggregate indicator of diversification, induced presumably by recent policy changes. The growth in crop agriculture has been dominated by rice which accounts for about 70 per cent of gross farm revenue. In order to reduce emphasis on rice, crop diversification programme was launched in the country from late eighties. The programme has so far attained limited success.

It is maintained that there are bright prospects of diversification of agricultural activities along livestock, fishery and other household agricultural activities. Diversification of agricultural activities have also important backward and forward linkages. Expansion of pond fish culture has given rise to establishment of mini hatcheries, marketing of fish fries on the one hand and production and marketing of feed and fish products on the other. Similarly, expansion of dairy and poultry farming has opened up the avenues of production and marketing of cattle/poultry feed and dairy/ poultry products. Also increasing exports of shrimp and vegetable products to foreign markets have added new dimension for analysis of agricultural diversification. All these interlinkage aspects point to the need for examination of the nature and magnitudes of different effects on socio-economic classes of rural people. It is also important to examine the impact of public policy reforms on the pattern and extent of diversification and their linkage effects.

Some recent contributions to the study of agricultural diversification in Bangladesh have focused only on crop diversification (Metzel and Ateng 1993, Zohir 1993, Biswas and Mandal 1993, Mahmud et. al. 1994, World Bank 1995). Since a typical farm household in Bangladesh combines crop and other enterprises such as livestock, fishery, agroforestry and homestead activities in the overall farming system, it is worthwhile to examine the pattern of organization of the enterprises and their interlinkage effects which contribute to income, employment, family nutrition on the one hand and natural resource management on the other.

This study examines the pattern of changes that has been taking place in the organization of farms in terms of combination of crop and non-crop enterprises, and how the activities are integrated in the synergistic manner to yield greater benefit to the farm households and rural community as a whole. Attempts are also made to link the pattern of changes to policy interventions in vogue and to draw implications for future policy formulations for equitable and sustainable growth of the agricultural economy of Bangladesh.

Data and Methodology

The study is based on both secondary and primary sources of information. The main categories of information used in the study are:

- (i) synthesis of relevant findings from existing literature;
- (ii) secondary information from available sources; and
- (iii) primary data collected through sample survey from four locations of the four old administrative divisions namely Dhaka, Chittagong, Rajshahi and Khulna.

The pattern and extent of agricultural diversification and the interlinkage effects are examined both at macro and micro levels. At the macro level, cropping patterns and cropping intensities are examined for different locations in the country. Besides, crop diversity is examined in terms of proportion of crop enterprises in gross agricultural income. Evidence on establishment of dairy and poultry farms, expansion of fish ponds, hatcheries and other non-crop activities are taken as evidence of overall diversification. At the micro level, the extent of diversity is measured by the number of component enterprises within the farming systems and the relative shares of the component enterprises in the total farm income. Besides, employment, consumption and nutritional implications are examined for different size groups of farms.

Crop Sector Diversity and Interlinkage Effects

In addition to cropping pattern and cropping intensity, the crop sector diversity is examined in terms of relative importance of each crop in the cropping system. This measure implies that a more diversified farm is one which does not depend too heavily on any single crop such as rice in the context of Bangladesh. It has been evident from the analysis that for most of the non-cereal crops, area under crops as per cent of net cropped area either declined or remained static over the period from 1973 to 1990. While area under foodgrain (rice and wheat) as per cent of net cropped area increased from 111 per cent in 1973/74-1977/78 to 137 per cent in 1991/92-1995/96, per cent of net cropped area under non-foodgrain crops decreased from 38 per cent to 34 per cent during the same period. As regards gross value share of individual crops in the crop sector's gross value of output, it has been found that gross value share of foodgrain crops increased from 68 per cent in 1973/74-1977/78 to 75 per cent in 1991/92-1995/96. On the other hand, gross value share of non-foodgrain crops decreased from about 32 per cent to 25 per cent during the period. The only non-cereal crop

for which gross value share slightly increased was tubers. Thus if diversification is measured in terms of shift of acreage or production away from rice/cereals, crop-agriculture of Bangladesh cannot be considered to have moved along the path of diversification.

Successful agricultural diversification depends on the structure and pattern of consumer demand for agricultural commodities both in the domestic and international markets. In general, diversified growth is stimulated as consumers shift from basic cereals to higher-value foods as their incomes increase and farmers respond to market opportunities provided by changing pattern of food demands. A well developed agro-processing sector provides a vital link in the stimulation of agricultural diversification. Bangladesh has a number of agro-industrial enterprises which process a wide range of agricultural commodities. These enterprises are grain milling, sugarcane crushing, oilseed crushing, jute processing, cotton ginning, processing tobacco leaves and leather tanning. Besides, there are freezing, canning and some other processing activities which are of course, limited to a few products.

Small scale rice milling provides an excellent opportunity for rural employment, particularly, for rural women. Refrigerated storage facilities are mostly limited to storage of potato. Diversification will require expansion of refrigerated storage facilities for other commodities such as fruits, vegetables, fish and meat. Processing of sugarcane for *gur* making, in addition to acting as import substitute for sugar, offer additional employment opportunities for the farm families on the one hand and stimulates production of sugarcane in remote locations far away from sugar mills and thereby contributes to agricultural diversification. The major processing activity related to edible oil falls in the industrial processing activity in which crude oils imported from abroad are refined into edible oil. Local crushing of mustard, soybean, til and groundnut are done by traditional methods and hence not cost-effective. Successful exploitation of the export market for the high-value fruits, vegetables, fresh flowers and aquatic products will require high degree of sophistication in processing, packaging and handling of the products.

Expansion of Non-Crop Activities and Linkage Effects

The non-crop agriculture sector is particularly important for its contribution to rural employment and supply of balanced nutrition to rural as well as urban population. The non-crop agricultural activities provide full time employment to about 25 per cent of the rural population. A large number of rural people also work part time in the non-crop sector. The unique feature of the non-crop sector is that it can absorb a large segment of women labour force of rural Bangladesh.

Available evidences indicate that for most of the species of livestock animals/ birds, the number of new farms established increased between the period from 1990/91 to 1994/95. Total and per capita production of meat, milk and eggs also increased modestly during the

period. The expansion of activities along production and processing of these products, in addition to providing income and employment for the rural labour force, is contributing to nutritional balance for the vast majority of under nourished population.

With respect to the fishery sub-sector, total production and per capita availability of all fish increased from 754 thousand metric tons and 7.7 kg respectively in 1983/84 to 1200 thousand metric tons and 9.6 kg respectively in 1994/95. The improvements in fish production, particularly inland production, are attributed to different intervention measures taken by the government and non-government organizations (NGOs) in the area of fisheries research, extension and credit.

The last two decades have witnessed a phenomenal growth in commercial shrimp culture. Area under shrimp culture is estimated to have increased from merely 20,000 hectares in 1979/80 to 130,000 hectares by mid 1990s. As an export item, shrimp grew from next to nothing in the early 1970s to contribute about 11 per cent to the total export earning in the mid 1990s. The share of shrimp export in total primary export increased from 1.97 per cent in 1972/73 to as high as 51.88 per cent in 1997/98.

Commercial shrimp culture has created a substantial economic and social transformation in the shrimp belt of Bangladesh. In addition to providing direct income to the 'gher' owners, shrimp culture, through backward and forward linkage activities, has opened up employment and income earning opportunities for a variety of stakeholders. According to MPO (1986) estimate, shrimp culture generated 10.2 million person days of employment on-and off-farm from 51,000 hectares of shrimp area in 1983. With the projected increase in shrimp area, the volume of employment was projected to be 22.7 million person days in 1990 and 59.5 million person days in the year 2005. Shrimp culture has also opened up the avenue of new employment opportunities for women. According to one estimate, women represent about 73 per cent of shrimp depot workers and about 65 per cent in the shrimp processing plants. Shrimp fry collection is also an important source of employment for rural women in the coastal regions.

The forestry sub-sector is playing an important role by providing income earning and employment opportunities through a number of afforestation programmes undertaken by government and NGOs. These programmes have been able to bring about significant changes in the attitudes of people towards planting and protecting timber and fruit trees in their homesteads, crop fields and other places of public utilities. The results are visible in the form of renewed greeny looks of the villages, embankments, highways and other publicly owned *khas* lands.

Diversification Linkages: Results from Field Survey

The micro analysis of diversification and the linkage effects revealed important relationships between the extent of diversification and the level of household income, employment and consumption of different classes of households in different locations. Among the four locations studied, cropping intensity was the highest in Comilla and lowest in Mymensingh. As regards crop diversity, measured as proportion of non-rice area in the total cropped area, Jessore had the lowest proportion of rice area (57 per cent) and hence could be considered as having more crop diversity compared to Dinajpur area where the proportion of rice area in the total cropped area was the highest (64 per cent).

An examination of the number of crop, non-crop and non-agricultural enterprises practised by different farm size groups in different locations revealed that the total number of enterprises practised by the landless households were the lowest in all the locations. The highest number of enterprises were practised by medium farms followed by large and small farms, except in Mymensingh where small farms were found to have practised the highest number of enterprises. As regards composition of enterprises practised, landless farmers obviously had the lowest number of crop enterprises. The number of non-crop and non-agricultural enterprises were also one of the lowest for the landless farmers in all the locations studied. Among the non-agricultural enterprises, rickshaw pulling was common for landless and trading was common for small, medium and large farms in all the locations.

Regarding contribution of enterprises to household income, non-agricultural enterprises contributed the highest proportion of household income for the landless households. Crop enterprises had the highest contribution to household income for large farms in all the locations. Food expenditure as per cent of total expenditure was the highest for landless farmers in all the locations studied.

The number of enterprises practised was positively related with gross household income in all the locations. However, the level of employment increased with increase in the number of enterprises practised only upto certain level, and employment level generally decreased with further increase in the number of enterprises, particularly when the number of enterprises practised exceeded 10-12. Thus, in the extensive margin of the number of enterprises, farm households may have been deriving higher income not by extensive use of labour, but by improving labour productivity.

Policy Implications

In the context of crop agriculture there has not been enough of diversification, particularly in terms of expansion of area and production of non- cereal crops, although many non-cereal crops such as potato, vegetables, cotton and spices have higher financial and economic returns than HYV rice. This can be attributed to very high price risk, lack of storage and

transportation facilities associated with marketing of these crops. Also, the existing on-farm water management systems are not conducive to production of rice and non-rice crops in the same service units. These problems can be solved by (i) improving storage and transportation infrastructure and thereby reducing price risks; (ii) designing non-farm water management systems conducive to production of rice and non-rice crops in the same service units; and (iii) improving yield and hence profitability of the non-rice crops through technological change and introduction of price, marketing and structural policy reforms.

The domestic markets for some of the high-value non-cereal crops are limited because of the relatively lower living standard of the people. Successful exploitation of the export market of these crops will require high degree of sophistication in processing, packaging and handling of the products. This will also require some public investment in building marketing infrastructure and also in the promotional activities in the export market.

In the livestock sub-sector, the incentive bonus scheme introduced by the government had some positive impact on establishment of new dairy and poultry farms, production and consumption of livestock products and also employment generation. However, the impact was short lived because of the lack of proper monitoring of the programme and supporting intervention in the pricing of inputs and outputs, and development of marketing infrastructure. These aspects need to be incorporated in the public policy agenda.

Expansion of fishery related activities, particularly the pond aquaculture and brackish water shrimp culture has been significantly contributing to income and employment generation and household nutrition. However, shrimp culture is alleged to be making some negative impact on income distribution, environment and social harmony. This calls for quantification and measurement of the negative impacts and incorporation of the results in the pricing mechanism for sustainable development of the shrimp industry of Bangladesh.

In the forestry sub-sector, expansion of homestead forestry, agro-forestry and social forestry offer excellent opportunities for household income and employment generation on the one hand and protection of environment on the other. However, there seems to be lack of effective participation of people, particularly in the social and agroforestry activities. Public policy should, therefore, address the issue of motivation and training of prospective clientele groups for sustainable development of the forestry sub-sector as an effective linkage of agricultural diversification in the country.

Chapter I

Introduction

1.1 Background of the Study

Growth and sustainability of agricultural production is an important prerequisite for attaining higher rate of overall growth of Bangladesh economy. The agricultural sector still contributes about 30 per cent to the GDP. While the overall share of agriculture to GDP has declined over the years, as is expected in the growth process, a noticeable change has occurred in respect of relative shares of agricultural sub-sectors to GDP. The contribution of crop sub-sector to GDP declined from 29.7 per cent in 1990/91 to 23.7 per cent in 1996/97. The contribution of livestock and fisheries sub-sectors, however, increased from 2.7 per cent and 2.7 per cent to 3.1 per cent and 3.2 per cent respectively during the same period. While the crop sub-sector grew from 1.2 per cent in 1990/91 to 6.2 per cent in 1996/97, growth rates for livestock and fishery sub-sectors increased from 2.2 per cent and 5.8 per cent in 1990/91 to 8.0 per cent and 8.6 per cent respectively in 1996/97 (BBS 1998). Thus the non-crop agriculture exhibited a relatively high rate of growth during the recent years. This can be viewed upon as an aggregate indicator of diversification, induced presumably by recent policy changes.

1.1.1 The notion of crop diversification

Within crop agriculture, a serious concern has been raised over the last decade about rice bias in the crop production endeavor. The growth in crop agriculture has been dominated by rice which accounts for nearly 70 per cent of gross farm revenue. In order to reduce emphasis on rice, crop diversification programme was launched in the country from late eighties. The programme has, however, attained limited success. It has increasingly been realized that agricultural growth through crop diversification entails a number of issues concerning the nature of technological changes, farmer incentives, marketing prospects and comparative advantage in the production of different crops. There are also issues like employment, income distribution and nutritional linkages associated with diversification.

It is alleged that areas under non-cereal crops declined continuously from early seventies due to expansion of Boro rice cultivation using modern irrigation facilities. Non-cereal crops are grown either in non-irrigated or in traditionally irrigated lands. In fact traditional irrigation has been found to be conducive to diversified cropping pattern. Most of the higher-value non-cereal crops like vegetables, potatoes and spices are found to be grown under traditional irrigation facilities. Recent years have witnessed a considerable expansion of

intermediate irrigation technologies such as hand tubewells and treddle pumps for cultivation of vegetables, potatoes and spices. These irrigation technologies, although entail some amount of drudgery, offer more employment opportunities for family labour, particularly for female members and are therefore suitable for small and marginal farm families.

A higher growth rate of the agriculture sector will require increasing contribution of non-rice crops. A diversified cropping system, in addition to providing stimulation to growth, will contribute to employment generation, poverty alleviation, better nutrition, higher export earnings and sustainable natural resource management. Incorporation of minor crops such as vegetables, pulses, oilseed (including sunflower) in the cropping pattern generate additional employment opportunities, provide cash income and contribute to family nutrition in various ways. Diversified cropping ensures efficiency of farm resource use through multi-dimensional use of space, time and fixed labour. It also reduces production, price and income risks of the farmers. Besides, crop diversification help prevent deterioration of the ecosystem.

1.1.2 The notion of agricultural diversification

The notion of agricultural diversification obviously goes beyond crop sector activities and realistically speaking, the prospect of growth of the crop agriculture has formidable limitations because of land and technological constraints. The indicators of agricultural diversification consists of the degree of development in:

- i. Minor crops and horticultural produce;
- ii. Livestock sub-sector;
- iii. Fisheries sub-sector;
- iv. Forestry sub-sector and
- v. Linkage (both forward and backward) activities of the above sub-sectors.

Agricultural diversification can be examined in terms of diversity of both crop and non-crop enterprises. At the macro level the important indicators of diversity are cropping patterns and cropping intensities. The proportion of non-rice area in the total crop area represents an index of crop sector diversity. The overall diversification would however be reflected through expansion of non-crop agricultural activities. Thus the aggregate evidence on establishment of new dairy and poultry farms, expansion of fish ponds, hatcheries and related activities would represent an index of macro level diversification. At the micro level, the extent of diversity can be viewed in terms of number of component enterprises within a farming system and the relative shares of the component enterprises in the total farm income. Attempts to diversify the crop sector through national crop diversification programme have attained limited success. However, substantial expansion have occurred in the non-crop activities such as livestock, fishery and the related ancillary activities, and it is believed that substantial scope remains for further expansion of these activities in the country.

In recent years there has been significant expansion of livestock and fishery activities, induced by various support services such as credit, training and extension services provided by various government and non-government organizations. According to estimates of the Department of Livestock Services (DLS), year-wise establishment of new commercial dairy and poultry farms increased from 2,490 and 6,970 in 1990/91 to 6,067 and 7,505 respectively in 1994/95. Significant expansion also occurred in the establishment of goat and duck farms (DLS), 1996.

Expansion of fishery related activities also has contributed significantly to agricultural diversification in the country. There has been a spectacular increase in pond fish culture and production of inland culture-fishery which registered a growth of 346 thousand metric tons in 1994/95 from 117 thousand metric tons in 1983/84 (CPD 1997). Rice-cum-fish culture in different parts of the country and rice followed by shrimp in the coastal areas have expanded remarkably in the recent few years. Besides, homestead vegetable production and agroforestry have been popularised by the government and NGOs.

All these evidences give an average picture of diversification that has taken place in respect of agricultural activities in the country. It would be important to examine the nature and extent of diversification practised at micro level by the individual farm households. An investigation into these practices by agro-ecological zones and socio-economic classes of farm households would reveal important information about structural changes taking place in agricultural activities. The interlinkage effects of these diversified activities are conducive to overall growth of the agricultural sector.

Integrated farming is not merely a concept but a popular practice in rural Bangladesh. A typical farm produces neither specialized crops nor only crops, but combines other enterprises such as dairy, poultry, fish and other homestead activities to constitute a farming system through which farm families maximize their returns and family satisfaction in a unique way. This 'system approach' is holistic in its attribute in the sense that the complementary and supplementary interactions of the enterprises result in total output greater than sum of the outputs from the individual enterprises that would have been obtained had they been run separately.

1.1.3 Diversification and linkage effects

Diversification of agricultural activities have also important backward and forward linkages. The use of crop by-products as cattle and poultry feed, cattle and poultry by-products as manure for crop and fish culture is prominently visible in typical farming systems in rural Bangladesh. Besides, diversification of enterprises evens-out employment pattern of farm family labour across peak and trough seasons round the year. Consumption of diversified

home produced products contributes to balanced nutrition which is another linkage effect of agricultural diversification.

Expansion of pond fish culture has given rise to establishment of mini hatcheries, marketing of fish fries on the one hand and production and marketing of feed and fish products on the other. Similarly, expansion of dairy and poultry farming has opened up the avenues of production and marketing of cattle/poultry feed, and dairy/poultry products. Such linkage effects have gone beyond the domestic market arena and increasing exports of shrimp and vegetable products to foreign markets have added new dimension for analysis of agricultural diversification. While so many linkage effects of agricultural diversification are obvious, little attempt has been made to examine the nature and magnitude of these effects in relation to different farming systems practised by socio-economic classes of households in different regions of the country.

Some recent contributions to the study of agricultural diversification in Bangladesh have focused only on crop diversification (Metzel and Ateng 1993, Zohir 1993, Biswas and Mondal 1993, Mahmud et.al. 1994, World Bank 1995). As has been mentioned, a typical farm household in Bangladesh practices not only crop enterprises, rather combines other enterprises such as livestock, fishery, agroforestry and other homestead activities which represent a complex farming system. It would be worthwhile to examine the pattern of organization of the enterprises in the farming system, their contribution to farm income and the interlinkage effects which contribute to income, employment, family nutrition on the one hand and natural resource management on the other.

The study examines the pattern of changes that have been taking place in the organization of farms in terms of combination of crops grown, and how crop and non-crop agricultural activities are integrated in a synergistic manner to yield greater benefit to the farm households and rural community as a whole. Attempts are also made to link the pattern of changes to policy interventions in vogue and to draw implications for future policy formulations for equitable and sustainable agricultural growth.

1.2 Objectives and Scope of the Study

General

To promote equitable and sustainable agricultural diversification through promotion and development of agro-linkages in Bangladesh.

Specific

- a. To increase productivity and promote efficiency in utilisation of rural resources through:
 - i) examining the nature and extent of agricultural diversification through linkages in farming sector activities such as crop production, livestock, homestead, horticulture, fisheries etc.;
 - ii) identifying the impact of macroeconomic reforms at the micro level on agriculture, in terms of productivity and activity-mix with particular emphasis on growth of income at the farm level;
- b. To provide insights to the policy makers of the impact of current reform measures in agriculture and suggest policy options to promote diversification of farm activities by mobilising local resources.

1.3 Output of the Study

The major output of the study includes analysis of the existing pattern and extent of diversification of agricultural and related enterprises at the aggregate level. The analysis also traces the interlinkage effects of the activities and their contribution to national agricultural productivity and distribution of benefits.

At the micro level, the study generates useful information on the nature of organization and operation of rural enterprises and their impacts on income generation, employment creation, household food consumption and nutrition. The analysis also provides an useful insight into identification of the impacts of the macroeconomic reform measures and the micro level incidence of diversification for greater private as well as social benefits. The findings are expected to fill in the gaps in the existing literature with useful policy implications and recommendation for follow-up actions.

Chapter II

Data and Methodology

2.1 Introduction

The study is based on both secondary and primary sources of information. The main categories of information used in the study are:

- i. Synthesis of relevant findings from existing literature;
- ii. Secondary information from available sources; and
- iii. Primary data collected through sample survey.

The pattern and extent of agricultural diversification and interlinkage effects are examined both at macro and micro levels. At the macro level, cropping pattern and cropping intensities are examined at different locations in the country. In addition to cropping intensity, crop diversity is examined in terms of proportion of crop enterprises in gross agricultural income. The overall agricultural diversification is examined in terms of diversity of both crop and non-crop agricultural activities. The aggregate evidence on expansion of non-crop agricultural activities such as livestock and aquaculture is taken as an evidence of agricultural diversification i.e., allocation of resources away from crop agriculture or new investment in non-crop agricultural activities. Evidences on establishment of commercial dairy and poultry farms according to geographical locations are collected and analysed. Similarly, information on expansion of fish ponds, hatcheries and related activities are collected, collated and analysed. Information in all these aspects have been obtained from various published and unpublished sources, such as Bangladesh Bureau of Statistics (BBS), Department of Agricultural Extension (DAE), Department of Livestock Services (DLS), Directorate of Fisheries (DOF), Directorate of Agricultural Marketing (DAM) and other related bodies and organizations. Besides, different NGOs and other secondary sources constituted as important sources of information.

An important aspect of analysis in the study has been the examination of the pattern and extent of diversification practised at micro level by the farm households. As is evident in rural Bangladesh, a typical farm is organized in such a way that a number of crop and non-crop agricultural activities are confined to constitute a farming system. The extent of diversity is measured by the number of component enterprises within a farming system and the relative shares of the component enterprises in the total farm income. Besides, employment, consumption and nutritional implications are examined for different sizes of farms. All these aspects are examined in the study by utilizing the micro level data which were generated through farm survey in the following manner.

2.2 Selection of Study Area

It was decided that data would be obtained from four locations, one each from the four old administrative divisions of Bangladesh. In selecting the locations the criterion used was the extent of diversity of enterprises practised by farm households in rural Bangladesh. The initial step was to select one district which was covered by the crop diversification programme of the Department of Agricultural Extension (DAE) in the respective division. Accordingly four districts, namely Comilla from Chittagong division, Mymensingh from Dhaka division, Dinajpur from Rajshahi Division and Jessore from Khulna division were selected for the study.

The next step was to select one thana from each district, again on the basis of the criterion that the thana was covered by the crop diversification programme of DAE. Besides, the opinion of the Deputy Director of DAE of the relevant district was an important factor in selecting the thana. Thus on the basis of the extent of diversity of enterprises practised by the farm households, Chandina thana of Comilla district, Trishal thana of Mymensingh district, Birgonj thana of Dinajpur district and Bagherpara thana of Jessore district were selected for the survey. From each of the selected thanas, one agricultural block was selected from which primary data were collected from the farm households.

2.3 Sampling Design

Multistage sampling technique was used in selecting the farm households. As has been mentioned, data were collected from four locations of the four old administrative divisions of Bangladesh. The initial stage was to select one district from each division. In the second stage, one thana from each district was selected. In the third stage, one agricultural 'block' was selected from each of the selected thanas. In each stage, the criterion used was the extent of diversity of enterprises practised by farm households in the locations considered.

The four blocks selected for the study were Dumuria in Comilla, Boilor in Mymensingh, Sulandar in Dinajpur and Bagherpara in Jessore district. Within selected blocks, farm households were listed from the records available with the 'block supervisor' of the respective blocks and then grouped into landless (<0.20 ha), small (0.21-1.00 ha.), medium (1.01-2.00 ha) and large (>2.00 ha). The initial criterion chosen was to select a given proportion of farms from each group. However, since for especially large farm group, there were not enough farms in some locations, all the available large farms there were included in the selection. For other groups, 10 per cent farms were selected. The target aimed was to select at least 100 farms from each location. Accordingly, the farms finally selected for the study turned out to be 455. Their distribution by location and group is given in Table 2.1.

Table 2.1: Distribution of selected farms by location and group

<i>Farm Group</i> (<i>ha</i>)	<i>Location</i>				<i>All</i>
	<i>Comilla</i> (<i>Dumuria</i>)	<i>Mymensingh</i> (<i>Boilor</i>)	<i>Dinajpur</i> (<i>Sulandar</i>)	<i>Jessore</i> (<i>Bagherpara</i>)	
Landless (< 0.20)	16	20	20	18	74
Small (0.21 - 1.00)	60	40	40	39	179
Medium (1.01 - 2.00)	26	33	32	41	132
Large (> 2.00)	10	12	28	20	70
All (households)	112	105	120	118	455

2.4 Collection and Analysis of Data

The data from each location were collected through trained enumerators over a period of 4 months from March to June 1998. The reference accounting period of data was the whole year 1997. The field work was constantly monitored by a Research Officer and also was periodically supervised by the Principal Researchers. The collected data were checked and verified for consistency and were corrected through revisit to the field where necessary.

The data were processed through appropriate computer package in the pre-designed format. The analysis was done through derivation of a useful set of descriptive statistics and important relationships among the selected variables which represented the accomplishment of the objectives of the study.

Chapter III

Macro Analysis of Agricultural Diversification and Linkage Effects

3.1 Introduction

Sustainable agricultural development requires reallocation of resources both within agricultural sector and between agricultural and non-agricultural sectors. This is particularly true when technological development leads to increased production of crops for which international trade is limited. Rice production in many Asian countries including Bangladesh is often cited as example of having experience of such phenomena. The new rice technology has contributed to increased production of rice which in turn has led to decreased price of rice and hence reduced farm incomes. This situation has often called for transfer of resources away from rice to non-rice crop or non-agricultural activities.

In Bangladesh the major source of growth of agricultural production over the last two decades has been increased production of foodgrain, mainly rice. If the rate of conversion from local to HYV rice continues at the historical rate, it is estimated that within 10 years all suitable lands will be converted to HYV rice. After this stage, the rate of growth of rice production on a per capita basis is expected to decline unless yields increase further as a result of technological breakthrough. According to World Bank (1995) estimates, although the long run outlook for rice production is uncertain, Bangladesh is likely to produce surplus rice in the short to medium term under normal weather conditions. However, export of common rice is likely to face stiff competition in the world market, indicating little prospect of rice export from Bangladesh. Attaining high agricultural growth rates in the future will therefore require increasing contribution of non-rice crop activities, resulting in more diversification of the agricultural sector.

This section deals with a short review of structural policy reforms in agriculture and an examination of the pattern and extent of diversification that has been obtaining in the country from the macro point of view. The pattern of diversification is examined both for crop and non-crop agricultural enterprises and their interlinkage effects are identified. Attempts are also made to examine the impacts of policy interventions in vogue on the pattern and extent of diversification and implications for future policy reforms for sustainable development of the agricultural economy of Bangladesh.

3.2 Agricultural Policy Reforms and Public Incentives

3.2.1 Introduction

Since the late seventies, Bangladesh has been implementing a comprehensive structural reform programme to build an open, liberalized and market oriented private sector-driven economy. A short review of the evolution of agricultural policies will throw some light on the character of incentives within agriculture, as well as between agriculture and other sectors, as influenced by the policy regime of the government.

3.2.2 Policy reforms and incentives in the crop sub-sector

Agriculture being the largest private sector of the economy has been most noticeably liberalized by the policy reforms. It is more pronounced and visible in the crops sub-sector. Policy reform is a continuous process and needed close and constant review for adjustment. Reforms in the crops sub-sector have also been subjected to adjustment.

I. The nature of reforms

Since 1977 the government has been pursuing the privatization policy in order to make the agricultural sector more market oriented. The first of its kind was by disengaging BADC from the importation and distribution of pesticide and chemical fertilizers. Subsidy on fertilizer given at that time was withdrawn (however, it has again been reintroduced in 1996/97). The coverage of policy reform has gradually been expanded to include minor irrigation equipment, agricultural machinery, seeds and agro-business. The nature of the reforms for the items mentioned above is discussed below:

Fertilizer

In 1988/89, private traders/distributors were permitted to have direct access to the bulk purchase of chemical fertilizers as well as to import freely TSP and MP fertilizers. Subsidy on Urea, TSP and MP fertilizers was withdrawn by December 1992. The responsibility of BADC to continue fertilizer distribution ceased. Since 1990, fertilizer procurement and sale were completely privatized. The traders can import and sell them at any place of the country at any price they want to. The system of free trading of fertilizer has appeared to work for sometime, but ultimately resulted to a fertilizer crisis in 1995. To cope with the crisis, a district based dealership system was introduced and monitoring mechanism was strengthened from the Advisory Committee at the national level down to district level. This together with reintroduction of subsidy on fertilizer has been proved beneficial and effective in case of fertilizer distribution and in keeping the price within the reach of the farmers.

Minor irrigation equipment

As a policy reform, restriction on the import of small diesel engine was firstly removed and custom duties were withdrawn. After that the standardization restrictions were removed. Selling restrictions on tubewell in non-surface irrigation areas were abolished and the subsidy on DTWs and other irrigation equipment was withdrawn. The BADC is no longer permitted to procure and distribute minor irrigation equipment.

Agricultural machinery

As a continuous process of liberalization, import duty of agricultural machinery, including power tillers was abolished. Import duty on certain other agricultural inputs, machinery and spare parts such as seed potatoes, live bovine animals, hatching eggs, certain fertilizers, tractors, tractor tires and parts, DTW parts have been gradually reduced/withdrawn.

Seed

The government has liberalized the imports of seed and planting materials except rice, wheat, potatoes, jute and sugarcane. A seed policy was approved. The seed policy has given much greater role to the private sector in the multiplication, processing and marketing of improved seeds. The private sector is now allowed to import any improved germplasm for research and development and develop its own facilities for producing foundation seeds. The private sector has also been given permission to import hybrid seeds in 1998.

Trade policy

An import duty of about 7.5 per cent was imposed on rice in 1993-94 and import duty on wheat was increased to 15 per cent on ad valorem. Duties on other agricultural produce were at different rates. But as a measure of adjustment for price of these commodities, the import duties have been removed or lowered down as a macro-economic and sectoral policy reform.

Pricing policy

Public policies for pricing of agricultural products have largely been limited to jute and foodgrains. Public intervention in foodgrain markets in general and foodgrain pricing and distribution policies in particular have been motivated mainly by the imperative of protecting urban consumers and the rural poor. The chronology of reforms in agricultural input markets is summarised in Table 3.1.

II. Policy impact of reforms

The macro economic and sectoral policy reforms have removed/reduced several price distortions and made allocative decisions in the agricultural sector more sensitive to price signals in external markets. Withdrawal of restrictions on the importation and installation of irrigation equipment has contributed to the expansion of shallow tube-well irrigation and enhanced stability of agricultural production by enabling dry season cropping. The policy reforms together with institutional changes have substantially enlarged the role of private sector in agriculture inputs and output marketing and provision of services.

Table 3.1: Step-by-step liberalization of agricultural input markets, Bangladesh

<i>Actions</i>	<i>Time span</i>	<i>Remarks</i>
Fertilizer Market		
BADC withdrew from retail and wholesale markets at Thana levels, the primary distribution points.	1978/83	This was done at Chittagong Division first. Vigorous response from traders.
Licensing requirement was abolished and restriction on movement removed (except 5-mile border zones with India).	1982/83	-
Deregulation of fertilizer price.	1982/84	Real competition started.
Allowing private traders direct purchase from factory gates and port points.	1989	Vigorous response from traders.
Free import from world market.	1992	Good response, but fear of oligopoly persists.
Irrigation Devices		
BADC sold all its low-lift pumps to private parties backed by special credit arrangement for purchasers.	1980/82	Good response from farmers.
BADC sold all its tubewells for irrigation to farmers and co-operatives; sale supported by special credit arrangement for purchasers.	1983/85	Good response from farmers.
Restriction on import of engines and pumps withdrawn.	1988	Drastic fall in prices of engines
Standardization restrictions limiting makes and models removed.	1988	Drastic fall in prices of engines.
Power Tillers, Pesticides and Seeds		
Restriction on power tiller import and standardization requirement removed	1989	Modest response
Restriction on import by brand names liberalized for pesticides	1989	Modest response
Except rice and wheat, all seed import liberalized.	1990	Modest response

Source: Ahmed 1995

3.3 Composition of Agricultural Sector and Change

Although the contribution of the agricultural sector to the GDP of Bangladesh declined over the past years, it still contributes about 32 per cent to the GDP. It is evident from Table 3.2

that the share of crop agriculture to GDP declined from about 30 per cent in 1990/91 to about 23 per cent in 1997/98. The table also shows that the shares of livestock and fishery increased from 2.74 per cent and 2.70 per cent in 1990/91 to 3.20 per cent and 3.27 per cent respectively in 1997/98. The share of forestry sub-sector to GDP remained almost static on average at 2.4 per cent during the period.

Table 3.2: Contribution of different sub-sectors of agriculture to GDP at constant market price (Base: 1984/85=100)

<i>Sector/ Sub-sector</i>	<i>Contribution to GDP (%) in year</i>							
	<i>1990/91</i>	<i>1991/92</i>	<i>1992/93</i>	<i>1993/94</i>	<i>1994/95</i>	<i>1995/96</i>	<i>1996/97</i>	<i>1997/98*</i>
Agriculture	37.60	36.86	35.92	34.58	32.77	32.24	32.41	31.66
Crops	29.66	28.93	27.92	26.35	24.28	23.68	23.75	22.86
Livestock	2.74	2.73	2.77	2.88	2.99	3.07	3.13	3.20
Fishery	2.70	2.76	2.82	2.94	3.08	3.10	3.18	3.27
Forestry	2.50	2.45	2.42	2.41	2.41	2.39	2.35	2.32

* Provisional

Source: BBS 1998

An examination of agricultural production index reveals substantial changes occurring in the structure and composition of agricultural production in the country. It can be observed from Table 3.3 that taking 1991/92 as the base (100), overall production index increased to 108 in 1995/96. This increase could be attributed to increase in the non-crop production index. The overall crop production index decreased to 97. Although the production index of many non-cereal crops increased, because of larger weight of cereals, particularly paddy, in the overall crop production, the total crop production index decreased over the period under review. The most spectacular increase occurred in the case of minor cereal (132) and vegetables (125). Livestock and poultry production index increased to 133, representing 33 per cent increase during the period. The production indices of forestry and fishery increased to 121 and 135, representing 21 and 35 per cent increase respectively in the production of the sub-sectors. Table 3.3 shows that population growth slightly outstripped the overall agricultural growth which resulted in slight decline in per capita agricultural production index.

Table 3.3: Index of agricultural production and its components (Base: 1991/92=100)

<i>Items</i>	<i>1992/93</i>	<i>1993/94</i>	<i>1994/95</i>	<i>1995/96</i>
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<i>Items</i>	<i>1992/93</i>	<i>1993/94</i>	<i>1994/95</i>	<i>1995/96</i>
Crops				
Cereals	101	92	71	97
Paddy (all varieties)	101	97	92	95
Minor-cereals	113	107	117	132
Fibre (Jute and Mesta)	96	86	110	104
Beverage	106	108	106	108
Pulses	97	101	104	103
Spices	105	101	99	100
Oilseeds	105	99	101	103
Fruits	81	99	101	106
Sugarcane	95	95	89	85
Vegetables	142	149	107	125
All crops	98	94	92	97
Livestock and poultry	106	115	123	133
Forestry	103	115	116	121
Fishery	108	120	125	135
All agriculture	101	101	102	108
Population(million)	113	116	120	122
Index of population	102	104	107	110
Per capita index of	99	98	95	99
Agricultural production				

Notes: Per capita estimates are obtained by using mid-financial year i.e., 1st January estimates of population

Source: BBS 1998

The annual growth rate of agriculture and different sub-sectors at constant price reveals that while crop sector growth rate fluctuated over the past years, livestock, fishery and forestry exhibited moderate and steady rate of growth. Table 3.4 shows that the overall annual growth of agriculture ranged from 1.61 per cent in 1990/91 to -1.04 per cent in 1994/95 and 3.12 per

Table 3.4: Annual growth rate of GDP of agriculture and its sub-sectors at constant market price (Base: 1984/85=100)

<i>Sector/ Sub-sector</i>	<i>Annual growth rate (%) in year</i>							
	<i>1990/91</i>	<i>1991/92</i>	<i>1992/93</i>	<i>1993/94</i>	<i>1994/95</i>	<i>1995/96</i>	<i>1996/97</i>	<i>1997/98*</i>
Agriculture	1.61	2.19	1.81	0.34	-1.04	3.66	6.44	3.12
Crop	1.16	1.66	0.83	-1.62	-3.76	2.77	6.18	1.62
Livestock	2.15	3.64	6.21	8.50	8.30	8.04	7.98	8.00
Fishery	5.82	6.48	6.63	8.65	9.67	5.91	8.60	8.60
Forestry	2.06	2.35	2.96	4.00	4.51	4.26	4.19	4.30

* Provisional

Source: BBS 1998

cent in 1997/98. The crop sector growth rate resembled the overall growth rate with a lot of fluctuations during the period. Growth rates of livestock, fishery and forestry sub-sectors

have shown almost steady increase. Thus the growth of non-crop agriculture has been more steady than that of crop-agriculture during the past years.

3.4 Crop Sector Diversity and Change

The concept of crop diversity can be looked at from two points of view. Generally crop diversity increases with increase in the number of crops grown. The other notion relates to the relative importance of each crop in the cropping system. From this point of view, a more diversified farm is one which does not depend too heavily on any single crop. In the context of Bangladesh, for example, shift of area or production away from rice is often regarded as an index of diversification. Metzger and Ateng (1993) used “rice share index”, (ratio of rice area to total cropped area) as a measure of crop diversity.

Crop sector diversity can be represented through cropping pattern and cropping intensity. The cropping pattern in Bangladesh can be broadly classified into rainfed and irrigated patterns, both of which vary according to the degree of seasonal flooding. Irrigation generally has a favourable impact on the annual cropping intensity on high and medium high land, but a negative impact on relatively lower lands. The higher the elevation of land, the larger is the share of land devoted to non-cereal crops under any of the irrigation regimes. On the other hand, across flood depth levels, the proportion of land allocated to non-cereal crops is markedly higher under rainfed condition than under irrigated condition. Again, in contrast to modern irrigation, traditional irrigation is more conducive to diversified cropping pattern (Mahmud *et.al.* 1994). Traditional irrigation on highland enhances cultivation of not only wheat but also the high value non-cereal crops like potato, vegetables and spices. However, the prospect of increased cultivation of non-cereal crops through expansion of area under traditional irrigation does not seem to be quite promising.

Table 3.5 shows that for most of the non-cereal crops, area under crop as per cent of net cropped area either declined or remained static over the period from 1973 to 1996. While area under foodgrain crops (rice and wheat) as per cent of net cropped area increased from 111 per cent in 1973/74 -1977/78 to 136 per cent in 1991/92-1995/96, per cent of net cropped area under non-foodgrain crops decreased from 38 per cent to 34 per cent during the above period.

Table 3.5: Area under crops as a per cent of net cropped area *

<i>Crops</i>	<i>Individual crop area as a per cent of net cropped area</i>						
	<i>1973/74- 1977/78</i>	<i>1976/77- 1980/81</i>	<i>1979/80- 1983/84</i>	<i>1982/83- 1986/87</i>	<i>1985/86- 1989/90</i>	<i>1988/89- 1992/93</i>	<i>1991/92- 1995/96</i>
Foodgrains	111.04	114.19	119.72	120.52	119.31	134.58	136.63
Rice	109.40	110.61	114.02	114.31	113.06	127.27	128.53
Wheat	1.64	3.59	5.70	6.21	6.25	7.31	8.10
Non-foodgrains	38.07	39.22	36.85	35.61	33.58	33.53	33.74
Jute	7.36	7.91	7.09	8.23	7.45	6.80	6.61
Oilseeds	7.05	7.24	6.86	6.49	6.17	6.88	6.94
Pulses	9.55	10.31	9.57	8.45	7.90	8.93	9.04
Spices	1.65	1.67	1.64	1.59	1.56	1.79	1.83
Fruits	1.51	1.57	1.66	1.71	1.77	2.08	2.21
Vegetables	1.26	1.32	1.44	1.55	1.68	0.70	0.64
Potato	0.96	1.01	1.15	1.19	1.23	1.50	1.66
Sweet Potato	0.75	0.78	0.74	0.66	0.57	0.61	0.60
Sugarcane	1.61	1.64	1.72	1.79	1.86	2.27	2.32
Tea	0.47	0.47	0.49	0.49	0.50	0.58	0.62
Minor cereals	4.28	3.72	2.91	1.89	1.37	1.34	1.26
Others	1.62	1.58	1.58	1.57	1.53	0.05	0.01
All crops	149.11	153.41	156.57	156.13	152.89	168.11	170.37

(Cropping intensity)

* Based on 5- year average of area under crops and net cultivated area

Note: For area under pulses, oilseeds and minor cereals, consistent time-series estimates are derived by adjusting the official crop data preceding fiscal year 1984.

Source: Mahmud et.al. 1994, up to 1985/86-1989/90; own calculation for 1988/89-1992/93 and 1991/92-1995/96 from BBS data.

While jute area as per cent of net cropped area remained more or less static during the period, area under pulses as per cent of net cropped area declined from about 10 per cent to about 9 per cent during the period. Table 3.6 provides information on revenue yields of crops and value share of individual crops in the crop sector's gross value of output. It appears from the table that gross revenues per hectare of many non-cereal crops were much higher than those of the cereal crops. Although without considering production costs such revenue yields do not provide any valid criteria for comparison across crops/crop groups, increased revenue yield of the same crop over time would indicate sustainability of the crop in the cropping pattern. However, data presented in Table 3.6 provide little evidence of sustained improvements in the revenue yields of the non-cereal crops. As regards gross value share of individual crops in the crop sector's gross value of output, data presented in Table 3.6 show that gross value share of foodgrain crops increased from 68 per cent in 1973/74 -1977/78 to 75 per cent in 1991/92-1995/96. On the other hand, gross value share of the non-foodgrain crops decreased from about 32 per cent to 25 per cent during the period. Gross value share of both rice and wheat increased. For all other non-cereal crops, gross value share in the crop

sector's gross value of output decreased during the period under review. Thus if diversification is measured in terms of shift of acreage or production away from rice/cereals, crop-agriculture of Bangladesh cannot be considered to have moved along the path of diversification.

Table 3.6: Per hectare gross value of crop output and share of individual crops

Crops	Gross value of output per hectare ('000' Taka) ^a				Gross value share of the crop in crop sector's value of output (%) ^b			
	1973/74- 1977/78	1979/80- 1983/84	1985/86- 1989/90	1991/92- 1995/96	1973/74- 1977/78	1979/80- 1983/84	1985/86- 1989/90	1991/92- 1995/96
Foodgrain	7.7	8.4	9.6	10.4	68.4	71.2	74.0	74.8
Paddy	7.8	8.5	9.7	10.8	67.6	67.9	71.0	72.0
Wheat	5.6	8.2	7.3	8.7	0.8	3.3	3.0	2.8
Non-foodgrain	10.4	11.1	12.0	13.2	31.6	28.8	26.0	25.2
Jute	6.2	7.0	7.6	7.3	3.6	3.5	3.6	3.4
Oilseeds	5.7	5.9	6.3	7.2	3.2	2.9	2.5	2.4
Pulses	4.7	4.4	4.7	5.3	3.6	2.9	2.4	2.4
Spices	19.4	18.6	20.9	22.6	2.6	2.1	2.1	2.2
Fruits	52.5	47.4	44.1	45.8	6.3	5.5	5.0	5.2
Vegetables	15.8	15.7	14.8	15.6	1.6	1.6	1.6	1.8
Tubers	18.3	19.4	19.7	19.8	2.5	2.6	2.3	2.5
Sugarcane	23.6	23.5	21.7	23.7	3.0	2.8	2.6	2.5
Tea	37.0	44.6	44.2	44.5	1.4	1.5	1.4	1.3
Minor cereals	2.6	2.8	2.8	3.1	0.9	0.6	0.3	0.4
All Crops	8.4	9.1	10.1	11.8	100.0	100.0	100.0	100.0

a. 5 year average

b. Estimate from 5 year average of gross value of output; does not add upto 100 because some crops are excluded

Source: Mahamud et.al.,1994 and BBS 1997

At this stage it may be pertinent to have a look at the nature of crop diversity across farm size groups, as evident from a micro study. In Table 3.7 crop diversity is measured in terms of rice share index and cropping intensity according to farm size groups. The results show that cropping intensity decreased significantly with the increase in farm size. This may be due to the fact that more lands are kept fallow by large land holders. The rice share index suggested that crop diversity declined with increasing farm size, although the number of crops grown increased with farm size. This implies that larger farmers are more likely to specialize in a few crops than smaller farmers. One explanation of this behavior is that large farmers are more likely to grow some crops for market because they are less constrained by subsistence needs. This is in line with the argument that commercial

Table 3.7: Crop diversity by size groups of farms

Farm size	Cropped area Per farm (A)	Rice area per farm ($\sum ai^r$)	Rice share index $R = \frac{\sum ai^r}{A}$ A	Cropping intensity	(area in hectare)	
					Total	Non-rice
Small	1.55	0.76	0.49	244	11.4	9.1
Medium	2.74	1.42	0.52	195	12.9	10.4
Large	5.33	3.07	0.58	151	16.3	13.2

Source: Metzger and Ateng 1993

agriculture requires specialization of production at farm level rather than diversification so that marketable surplus can be generated. There are a number of factors which affect farmers' decision to diversify or produce the combination of crop enterprises. These factors are agronomic suitability, financial and economic returns, technological changes, marketing infrastructures and the macro level price and trade policies. Given the soil quality and topography of different locations, one important constraint to diversification is the irrigation and water arrangement system. Most of the existing irrigation systems in Bangladesh are planned, designed, constructed and managed primarily to irrigate rice fields and are unsuitable for cultivation of non-rice crops. Thus construction and management of irrigation system needs to be modified to provide irrigation support for production of diversified crops.

In a subsistence economy like Bangladesh, it is not unlikely that farmers instead of maximizing financial or economic returns will tend to produce the staple cereals upto certain threshold limit, given the stress on household food security. This does not, however, mean that farmers are not price responsive. In analyzing farmers' response to economic incentives, the related policy issues need to be taken into account.

The results of financial and economic analyses have shown that a number of crops, such as, potato, vegetables, onion and cotton have financial and economic returns which are significantly higher than those of rice. On the other hand, wheat, sugarcane and oilseeds have very low economic returns although private returns from sugarcane are quite high (Mahamud *et.al.*, 1994). Expected profitability analysis, based on the assessment of the likely impact of technological improvements on economic advantage, has shown that a number of crops such as potato, lentils, cotton and jute have the potential of becoming even more competitive with rice in their respective growing seasons (Table 3.8).

Table 3.8: Expected private and economic profitability of crops with technological innovations, 1990/91^a

<i>Crop</i>	<i>Price parity basis</i>	<i>Net economic returns (Tk./ha)</i>	<i>Net private returns (Tk./ha)</i>
Paddy (HYV Boro)	Export	6,094	9,176
	Import	18,068	9,176
	Non-traded	12,263	9,176
Wheat	Import	6,930	6,227
Jute (White)	Export	12,186	1,621
Cotton	Import	24,247	15,741
Sugarcane (for gur making)	Import	8,925	59,240
Mustard	Import (oil)	-3,473	4,823
	Import (oilseed)	-401	4,823
Lentil (Masur)	Import(high price)	16,318	10,205
	Import (low price)	11,589	10,205
Potato (Fresh)	Export	19,541	33,728
	Non-traded	52,135	33,728
Brinjal	Non-traded	120,393	88,759
Radish	Non-traded	105,060	74,013
Tomato	Non-traded	125,845	91,696

a. Crop yield and production cost underlying the profitability estimates are based on the assumption that modern variety of seeds are used with “medium” doses of fertilizer

Source: Mahmud et. al. 1994

There is thus an apparent paradox as to why farmers cling to production of rice when production of many high value non-cereal crops are financially and economically more profitable. The answer lies in a combination of the technical and economic factors. There are very high price risks associated with marketing of most of these non-rice crops. Besides, producers are not assured of reliable access to modern inputs, technology, credit and improved commercial facilities. Official policies also distort markets, create constraints and insecurity in commercial ventures. All these issues need to be resolved in order to achieve desirable success in crop diversification in Bangladesh.

3.4.1 Analysis of interlinkage effects

From the analysis presented in this exercise it becomes amply clear that notwithstanding the importance attached to production of non-cereal crops, rice production will continue to dominate the agricultural economy of Bangladesh, in view of its contribution to national economic growth, food security and rural employment generation. The contribution of any individual non-rice crop to agricultural growth is likely to be small. Attaining higher rate of growth would require strengthening production capacity for a large array of non-rice crops along with sustained growth in rice production.

The impact of crop diversification on productive employment generation would depend on which crops are promoted in the diversification programme. The productivity of labour from cultivation of oilseeds and pulses is higher compared to local variety of rice, but these crops are less labour intensive than rice. So if these crops replace traditional rice varieties, if not modern ones, it will have a negative effect on employment. However, these are short duration crops and if promoted on seasonally fallow land under carefully designed crop rotation practice, it may have positive impact on employment through increased cropping intensity. Potatoes, vegetables, and spices are highly labour intensive and productivity of labour for these crops are also relatively higher. Thus increased production of these crops will have positive impact on employment and productivity of labour. However, wide fluctuation of price and lack of storage, transport and processing facilities may constrain any large scale expansion of area under these crops.

This again implies the importance of rice as a source of growth and rural employment, and the possibility of employment expansion in the crop agriculture would have to be sought in the appropriate rice production strategy. One feasible option, would perhaps be to expand area under high yielding variety of transplanted Aman rice which does not compete with dry season non-rice crops. Aman already accounts for more than 50 per cent of total rice production in the country. Hence expansion of modern variety of Aman would significantly augment the production and employment potentials in the country (Talukder 1996).

3.4.2 Demand side linkage

Successful agricultural diversification depends on the structure and pattern of consumer demand for agricultural commodities both in the domestic and international markets. In general, diversified agricultural growth is stimulated as consumers shift from basic cereals to higher-value foods as their incomes increase and farmers respond to market opportunities provided by changing food demands. Table 3.9 shows the estimated annual growth rates of domestic consumer demand for selected food crops. Except for fruits, these growth rates are lower than the growth rate of the GDP in the respective columns. The projected growth rate of demand for rice is not much higher than the population growth rate presumably because of declining income elasticity and urbanization. The growth rate of wheat demand is projected to fall behind population growth rate because of negative effect of income growth on wheat demand in rural areas.

The above demand projections are not in conformity with the past growth performance of the major non-cereal crops in the country. The cereal based agricultural growth has led to near stagnant or even declining production of many of the non-cereal crops and hence increasing reliance on imports. The domestic market demand potential alone may not be enough to change the growth prospects of crop agriculture. Much will depend on the export potential and import substitution condition. However, a relatively high rate of growth of the

economy (6 per cent or more) would create large domestic markets for most of the non-cereal agricultural products. Thus the medium term growth prospects of Bangladesh economy can be achieved by strengthening non-rice crop production along with sustained growth in rice production.

Table 3.9: Consumer demand projections, 1991/92-2001/2002

Commodity	Annual growth rate of demand (%)		Per capita income elasticity	
	<i>r=4%</i>	<i>r=6%</i>	Rural	Urban
Rice	2.23 (2.36)	2.66 (2.81)	0.35	0.14
Wheat	1.46 (1.54)	0.93 (1.20)	-0.40	0.00
Sugar	3.56	5.19	0.99	0.59
Spices	3.12	4.35	0.59	0.51
Potato	3.40	4.83	0.89	0.41
Vegetables	3.24	4.65	0.82	0.54
Edible oils	3.40	4.77	0.67	0.51
Fruits	6.10	6.49	1.23	0.88
Pulses	2.95	4.01	0.61	0.32

Notes: 1. Figures in the parentheses are estimates corresponding to annual population growth rate of 2.0 % , otherwise the population growth rate is assumed to be 1.8 percent.

2. Sugar includes raw sugar i.e., gur

3. The GDP growth rate corresponding to the demand estimates is denoted by 'r'.

Source: World Bank 1995

3.4.3 Agro-processing linkage

A well developed agro-processing sector provides a vital link in the stimulation of agricultural diversification. If agro-processing activities can identify demand for particular products, farmers will be induced to produce them if the price is attractive. Bangladesh has a number of agro-industrial enterprises which process a wide range of agricultural commodities. These enterprises are grain milling, sugarcane crushing, oilseed crushing, jute processing, cotton ginning, processing tobacco leaves and leather tanning. Besides, there are freezing, canning and some other processing activities which are either limited to a few products or their development is constrained by a number of factors.

3.4.4 Rice milling

Small scale rice milling is extensively spread across rural Bangladesh and provides an excellent opportunity for rural employment, particularly for rural women. Parboiling and drying require substantial amount of human labour which is generally supplied by the rural

women labour force. However, many of the milling installations are crudely designed which cause great deal of efficiency loss. On the other hand, modern rice milling capacity is underutilized in Bangladesh because consumers are not generally willing to pay premium for higher quality rice.

3.4.5 Refrigerated storage

There are 173 refrigerated storage units in Bangladesh with a total capacity of 457,000 metric tons (World Bank 1995). However, most of these storage facilities are used for storing potatoes, and over half of the storage facilities are concentrated around Dhaka. About 350,000 metric tons of potatoes are stored annually in these storage facilities. About 80 per cent of the refrigerated facilities are used by operators and traders directly associated with potato marketing. In the non-crop sector, a large volume of seafoods are processed and stored by using refrigerated storage facilities. Diversification will require expansion of refrigerated storage facilities for other commodities such as fruits, vegetables, fish and meat.

3.4.6 Sugarcane crushing

Gur making is a familiar agro-processing activity in rural Bangladesh. However, gur making often affects sugar production in the mill zone areas. One virtue of gur making is that it uses local materials and production of gur and brown sugar acts as important substitute for sugar. Processing of sugarcane for gur making offers additional employment opportunities for the farm families on the one hand and stimulates production of sugarcane in remote locations far away from sugar mills and thereby contributes to agricultural diversification on the other.

3.4.7 Oilseed crushing

Domestic oilseed production accounts for only about one-fourth of total domestic edible oil consumption. Oilseed production is dominated by mustard which accounts for 60 per cent of total domestic production. The major processing activity related to edible oil falls in the industrial processing activity in which crude oils imported from abroad are refined into edible oil. Local crushing of mustard, soybean, til and groundnut is done by traditional methods and hence not cost-effective. Lack of suitable market for oilcake acts as a disincentive for the oilseed crushing industry. In recent years soybean and sunflower production is being popularised through the crop diversification programme (CDP) and several NGOs. However, lack of suitable marketing and crushing facilities is reported to be constraining the achievement of the programme. Operators of the traditional oilseed crushing devices (known as 'ghanees') are being trained in some new crushing technologies devised by the BCSIR.

3.4.8 Export linkage

A sustainable agricultural diversification strategy will have to be based not only on the domestic market, but also on the export outlets, particularly for the high-value crops which can fetch higher prices in the international market. The traditional export crops of Bangladesh are jute and tea, both of which are facing stiff competition in the export market and their prospects do not look bright. Among the non-traditional items, export of fresh vegetables has gained some ground. However, most of these exports cater to the demands of expatriate South Asian communities in the U.K. and the Middle East, and therefore are considered to be outside the mainstream of international trade in vegetable.

Although the current levels of non-traditional agricultural exports are low, the potential for expanding export of some items such as aromatic rice, high-value fruits and vegetables, fresh flowers and aquatic products is considered to be high. However, successful exploitation of these export potentials will require high degree of sophistication in processing, packaging and handling of the products. An important strategy would be to explore the possibility and expand export of non-traditional high-value horticultural and marine products to high-income consumers in the industrialized countries around the world. A success in this direction will provide stimulus to domestic producers and thereby contribute to diversification of agricultural production and national economic growth.

3.5 Non-crop Agriculture: Diversity and Change

As has been noted earlier, because of land and technological constraints associated with crop sector growth, agricultural diversification and hence contribution of the agricultural sector to national economic development will have to occur through greater expansion of the non-crop sector comprising livestock, fishery and forestry. The non-crop agricultural sector is particularly important for its contribution to rural employment and supply of balanced nutrition to rural as well as urban population. It provides full time employment to about 25 per cent of rural population. A large number of rural people also work part time in this sector. The unique feature of the non-crop sector is that it can absorb a large segment of women labour force of rural Bangladesh.

The contribution of the non-crop sector to GDP is generally underestimated because of omission of many value added components in the accounting process. The values of draft power and the dung used as fuel and manure are not usually taken into consideration in the calculation of livestock GDP. On the other hand, the forest based resources used by poor households for fuel and/or grazing livestock are also not accounted for the contribution of forestry sub-sector to GDP. If these factors are taken into consideration, the contribution of the non-crop sector to GDP would be much higher. The purpose of the present exercise is to examine the pattern of changes occurring in respect of the non-crop agricultural activities and

their interlinkage effects, to capture the overall direct and indirect contribution of the sub-sectors to the national economy.

3.5.1 Policy incentives in the livestock sub-sector

The livestock sub-sector has grown by 8 per cent in 1997/98 and contributed about 3.2 per cent to the total GDP and 10.11 per cent to agriculture. It is a potential sector for increasing employment and alleviation of poverty. Measures taken for development of this sub-sector include poverty alleviation through generation of self-employment in livestock development activities, extension of artificial insemination programme through implementation of technology like use of frozen semen and embryo transport and participatory livestock development project with the assistance from the Asian Development Bank.

The role of this sub-sector on commercial basis is commendable because of involvement of the private sector and NGOs. Under the development programme, the dairy farms were granted 20 per cent to 25 per cent subsidy and were permitted to import poultry and livestock feed without tariff. Liberal bank credit with easy terms and conditions were being provided by the banking and other organizations for the establishment of medium and large dairy farms. Transport subsidy was provided for the importation of improved breeds of cows for the dairy farms.

Improved varieties of cattle and poultry and vaccines are being supplied from the government breeding farms and artificial insemination centres to help the poor rearing such stock. Vaccine production in government laboratories has increased to 355 million doses (livestock and poultry) in 1996/97 as against 250 million doses in 1990/91. Under the extensive fodder cultivation programme throughout the country, improved seed and seedlings are being distributed to the general farmers and contact farmers from the seed nurseries, established at the district level and other artificial insemination centres including 460 thana livestock development centres.

3.5.2 Pattern of change in the livestock sub-sector

According to the 1983/84 census, there were 21.18 million cattle, 0.46 million buffaloes, 8.73 million goats, 0.49 million sheep, 66.37 million chicken and 12 million ducks in the country. Taking these figures as benchmark, the DLS provides annual estimates of the population of the above species of livestock. These estimates are presented in Table 3.10. The most spectacular change occurred in the goat population which increased by about 149 per cent over the period from 1983/84 to 1989/90. The next highest change occurred in sheep population (77.55 per cent) followed by change in buffalo population (55 per cent) during the same period. During the later period, also, the highest increase occurred in the case of

goat population which increased by 48.29 per cent. The next highest percentage increase was for chicken population which about 35 per cent during the period.

Table 3.10: Livestock population in Bangladesh, 1983/84 -1994/95

<i>Species of livestock</i>	<i>Number in million</i>							<i>% change</i>	
	<i>1983/84 Agri.census</i>	<i>1989/90</i>	<i>1990/91</i>	<i>1991/92</i>	<i>1992/93</i>	<i>1993/94</i>	<i>1994/95</i>	<i>1983/84 to 1989/90</i>	<i>1989/90 to 1994/95</i>
Cattle	21.18	22.47	22.65	22.83	23.02	23.20	23.30	6.09	3.96
Buffalo	0.46	0.69	0.71	0.73	0.75	0.78	0.80	50.00	15.94
Goat	8.73	21.70	23.48	25.41	27.49	29.75	32.18	148.56	48.29
Sheep	0.49	0.87	0.91	0.95	0.99	1.04	1.09	77.55	25.29
Chicken	66.37	89.86	95.88	102.31	109.96	116.47	121.27	35.39	34.95
Duck	12.00	13.10	13.29	13.29	13.38	13.47	13.56	9.17	3.51

Source: Official Records of the Department of Livestock Services 1998

Bangladesh is considered to have a relatively high density of livestock population compared to many other countries in the world. Yet the country suffers from an acute shortage of livestock products like milk, meat and eggs. The domestic productions of milk, meat and eggs are only 12.82 per cent, 10.42 per cent and 24.28 per cent respectively of minimum requirements (Alam 1995).

Table 3.11 shows that total milk production in the country increased from 1294 thousand metric tons in 1987/88 to 1412 thousand metric tons in 1994/95. This increase could be attributed to establishment of new dairy farms in the private sector and expansion of artificial insemination programme in the rural areas. This has also caused decline in the volume of milk import. The amount of money spent on imported milk declined from Tk. 330 core in 1989/90 to Tk. 231 core in 1995/96. Meat production showed a modest increase over recent past years. The per capita production of meat increased from 3.84 kg. in 1987/88 to 4.03 kg. in 1994/95. However, a large part of this availability is attributable to the import of cattle through cross border informal trade. There has been a significant increase in egg production during the past years. The per capita availability of egg increased to 20 in 1994/95 from 16 in 1987/88. This increase in egg production should also be attributed to the growth of private sector poultry farms over recent past years.

Table 3.11: Changes in production of milk, meat and eggs over the past years

Year	Popula- tion (‘000’)	Milk		Meat		Eggs (number)	
		Total (‘000’ mt)	per capita (kg)	Total (‘000’ mt)	Per capita (kg)	Total (million)	Per capita
1987/88	107756	1294	12.01	414	3.84	1754	16.28
1988/89	110290	1301	11.80	424	3.84	1843	16.71
1989/90	112683	1314	11.66	435	3.86	1941	17.23
1990/91	115128	1338	11.62	447	3.88	2047	17.78
1991/92	117630	1353	11.50	460	3.91	2158	18.35
1992/93	120179	1370	11.40	474	3.94	2277	18.95
1993/94	122790	1392	11.33	489	3.98	2404	19.58
1994/95	125450	1412	11.26	505	4.03	2539	20.24

Source: CPD 1997

As stated earlier, the Government took some important decisions in the late eighties for the development of dairy and poultry and these measures provided incentives for establishment of dairy and poultry farms in the private sector. By taking advantage of the public facilities, different classes of people came forward for establishing such farms which began in the late eighties. Different NGOs and credit institutions also became involved with this programme. Table 3.12 shows the cumulative total number of farms established in the livestock sub-sector from 1979/80 to 1997/98. It may be mentioned that the government introduced the subsidy scheme on the purchase price of hybrid cows from early 1993 to encourage growth of private sector dairy farming. Encouraged by this incentive, many private investors with relatively small capital came forward to establish new dairy farms of different scales and consequently there was an increasing trend in the establishment of new commercial dairy farms.

Table 3.12: Cumulative total number of dairy and poultry farms, 1979/80 - 1997/98

Types	1979/80	1993/94	1994/95	1995/96	1996/97	1997/98
Dairy farm	227	12539	17857	23924	26581	29649
Duck farm	2002	12226	16434	21225	21646	30760
Poultry farm	787	31363	40133	47638	53644	60670
Beef fattening programme (household/ farm level)	325	30200	37800	43600	49100	53200

Source: DLS 1999

However, the scenario proved to be a short lived one, as there are already reports of decelerating trend in the growth of private sector dairy farms. It is also reported that many of the established farms discontinued operation during recent past years. The main causes behind slower growth and closure of the existing farms are reported to be non-availability of

cattle feed at reasonable prices, lack of marketing facilities and the consequent prevalence of low prices of milk at farm level.

One micro study from Tangail district however revealed some encouraging picture on the operation of private sector dairy farming (Kabir 1995). The study was conducted in six thanas of Tangail district using data obtained from 26 dairy farms who obtained the subsidy benefits provided by the government. The study dealt with comparison of selected variables related to dairy farming before and after receipt of the subsidy benefits. It was found that ownership of animals increased by 5.36 units or 39.27 per cent after the subsidy benefits. The major change occurred in the ownership of calf, heifer and milch cow. Milk production and consumption of the participating households increased by 37.23 per cent and 34.48 per cent respectively after receipt of subsidy facilities. Labour employment per farm also increased by 26.84 per cent for the subsidy recipient farmers.

The absolute magnitude of labour employment increased by 136 mandays per farm of which family labour employment was 86 mandays representing 89 per cent increase in the family labour employment. Thus the subsidy programme could be considered to have contributed substantially to poverty alleviation by offering more employment opportunity. However, the results were obtained from a limited geographical area covering a small sample and any generalization about the impact of the subsidy programme should be based on a more broad based study.

Some achievements have also been made in the area of egg and meat production and related activities through the “Small Holder Livestock Development Project” currently being implemented by the DLS in 80 thanas. The main objective of the project is to increase income of the landless and marginal farmers, particularly the women, through small scale poultry and livestock rearing in the homestead compound. The project seeks to accomplish the objectives by offering training and credit to a number of identified beneficiary categories namely poultry worker, chick rearer, key chicken rearer, model rearer, duck rearer, feed seller, and mini hatchery owners.

The targets and achievements of the project from the year 1993/94 to 1995/96 are presented in Table 3.13. It appears from the table that a substantial improvement occurred in income generation through chick, egg and meat production. Egg production increased from 8 million units in 1993/94 to 90 million units in 1995/96. Monthly income per beneficiary increased by Tk. 224, Tk. 680, Tk. 248, Tk. 340, Tk. 444 and Tk. 1200 for poultry workers, chick rearer, key rearer, model rearer, feed sellers and mini hatchery owners respectively.

Table 3.13: Targets and achievements of production under the small holder livestock development project

Items	Targets and achievements (numbers in lakh)					
	1993/94		1994/95		1995/96	
	Target	Achievement	Target	Achievement	Target	Achievement
Day-old chick production:						
Govt. hatchery	33.00	44.00	36.00	45.00	40.00	41.00
Mini hatchery (approx nos)	1.50	1.20	4.00	3.50	4.80	4.00
Egg production (approx nos)	100.00	80.00	800.00	700.00	1000.00	900.00
Meat production (approx mt)	-	-	0.20	0.15	0.60	0.50
Vaccination (dose)	-	-	150.0	109.00	210.00	196.00
Average additional income per month per beneficiary	poultry worker Tk. 224, chick rearer Tk. 680, key rearer Tk 248, model rarer Tk. 340, feed seller Tk. 444 and mini hatchery owner Tk. 1200					

Source: Official records of the DLS

3.5.3 Policy reforms and incentives for the fisheries sub-sector

Fisheries play a major role in nutrition, employment and foreign exchange earnings and other areas of the economy of Bangladesh. About 60 per cent of animal protein is supplied by fish alone and about 1.2 million people are directly employed in this sub-sector. A new fisheries policy has been undertaken for delineating the scope and activities of aquaculture, shrimp culture, private entrepreneurship, marketing, human resource development, institutional strengthening and fisheries education, research, environment etc.

A national high power committee headed by Hon'ble Prime Minister and an inter-ministerial committee headed by the Hon'ble Minister, Ministry of Fisheries and Livestock, have been formed to oversee the problems of the shrimp culture and export and to suggest appropriate measures. To encourage private sector investment in fisheries, fish and shrimp culture activities and operation of hatchery have been declared as industry. This would facilitate the entrepreneurs in getting loan on concessional terms and conditions from the banks.

A New Fisheries Management Policy has been introduced for socio-economic development of fishermen communities through awarding fishing rights in the selected water bodies. Fish culture programme has been helpful in increasing fish production in derelict waterbodies created by the construction of irrigation and flood control structures. Food for Works programme has been introduced in the fisheries sector for developing derelict water bodies for increasing fish production. Under different programmes and projects massive training activities for the fish farmers have been undertaken in the field of fish and shrimp culture, pond and hatchery management. In order to get the optimum output, a long term biologically

productive leasing system (20 years) of government water bodies instead of existing short term (3-5 years) leasing system has been introduced. In phases all government water bodies would come under this system. Measures are being taken for conservation of fish sanctuaries throughout the country in order to prevent natural decline in fish production. Fish conservation and Fish Act has been made effective for preventing indiscriminate fishing. People's participation has created much enthusiasm in the management and conservation of fishes.

Fish production has increased due to concerted efforts both in public and private sectors. In the public sector, fish research and extension activities have been intensified along with development of infrastructural facilities. A large number of NGOs have been working in fish production activities through provision of training and incentives to fishermen. Fish hatcheries are being established in the private sector with assistance from the government and production activities have expanded.

3.5.4 Changes in the fisheries sub-sector

As mentioned earlier, contribution of the fisheries sub-sector to GDP increased from 2.70 per cent in 1990/91 to 3.27 per cent in 1997/98. In terms of nutrition, fish occupies a very important position in the diet of the people. About 80 per cent of total protein intake comes from fish alone. The fisheries sub-sector provides full time employment to about 2 million and part time employment to another 10 million people in the country. Total fish production in the country has demonstrated an increasing trend, rising from 754 thousand metric tons in 1983/84 to 1200 thousand metric tons in 1994/95 (Table 3.14). Per capita availability has also registered an increase from 7.7 kg to 9.6 kg during the same period (CPD 1997). The contributions of inland and marine fisheries to total fish production are estimated at 77 per cent and 23 per cent respectively. Of the total share of inland production, contributions of open water capture and closed water culture fisheries are 48 per cent and 27 per cent respectively, according to 1994/95 estimate. The contribution of inland open water capture fishery to total fish production declined slightly over the past years, from 78 per cent in 1983/84 to 77 per cent in 1994/95. This decline is attributed to over-fishing of different species, destruction of fish breeding grounds, decrease of water area due to siltation, irrigation and flood control schemes, indiscriminate use of pesticides and discharge of toxic industrial wastes in water bodies.

Production from inland culture fishery however, has shown an increasing trend, rising from 117 thousand metric tons in 1983/84 to 136 thousand metric tons in 1994/95. Overall inland fish production increased from 589 thousand metric tons in 1983/84 to 922 thousand metric tons in 1994/95. While per capita inland production slightly declined from 6 kg in 1983/84 to 5.4 kg in 1989/90, by 1994/95 it increased to 7.3 kg. Per capita marine fish production also increased slightly during the period under review. As a result, total production and per capita

availability of all fish increased from 754 thousand metric tons and 7.7 kg respectively in 1983/84 to 1200 thousand metric tons and 9.6 kg respectively in 1994/95. The improvements in fish production, particularly inland production, are attributed to different intervention measures taken by the government and non-government organizations in the area of fisheries research, extension and credit.

Table 3.14: Production and per capita availability of fish in Bangladesh

Year	Inland		Marine		Total	
	Catch (‘000’ mt)	Per capita (kg)	Catch (‘000’ mt)	Per capita (kg)	Catch (‘000’ mt)	Per capita (kg)
1983/84	589	6.0	165	1.7	754	7.7
1984/85	586	5.8	188	1.9	774	7.7
1985/86	587	5.7	207	2.0	794	7.7
1986/87	597	5.6	218	2.0	815	7.5
1987/88	599	5.5	228	2.1	827	7.7
1988/89	608	5.5	233	2.1	841	7.6
1989/90	613	5.4	235	2.1	848	7.5
1990/91	654	5.7	239	2.1	839	7.3
1991/92	706	6.0	246	2.1	952	8.1
1992/93	776	6.5	250	2.1	1026	8.5
1993/94	827	6.7	260	2.1	1087	8.8
1994/95	922	7.3	278	2.2	1200	9.6

Source: CPD 1997

The last two decades have witnessed a phenomenal growth in commercial shrimp culture in Bangladesh. In 1979/80, slightly more than 20,000 hectares were under shrimp cultivation (Ahmed 1988). According to Master Plan Organization (MPO 1986) estimate, total area under shrimp culture is expected to increase from 96,048 hectare in 1990 to 135,000 hectare in the year 2005. Rosenberry (1995) reports that already 130,000 hectare of land are currently under shrimp farming. According to Ahmed (1996), with the horizontal expansion of culture and improved management practices, shrimp production increased from 4.4 thousand metric tons in 1983/84 to 28.3 thousand metric tons in 1993/94. As a primary export item, shrimp grew from next to nothing in the early 1970s to contribute about 11 per cent of total exports in the mid-1990s (DOF 1995). In 1972/73, when shrimp farming started to gain ground, it contributed only less than one per cent to the total export (EPBB 1995). Over the last two decades, shrimp export has overtaken the most important primary export good such as raw jute. As would be evident from Table 3.15, the share of shrimp export in total primary export increased from only 1.97 per cent in 1972/73 to as high as 51.88 per cent in 1997/98, while raw jute export as a per cent of total primary export decreased from 89.36 per cent to only 21.47 per cent during the same period.

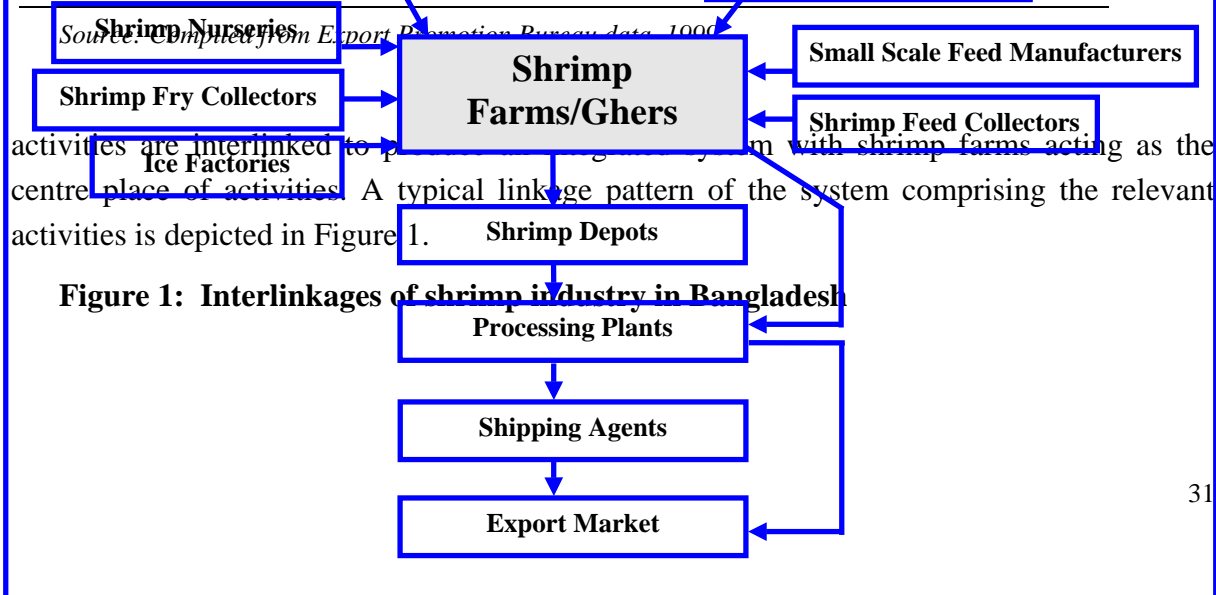
3.5.5 Interlinkages of the shrimp industry

The shrimp industry of Bangladesh consists of four distinct sub-sectors namely shrimp farms, shrimp hatcheries, shrimp feed mills and shrimp processing plants, each having a number of ancillary activities with the corresponding stakeholders. All these subsectors and ancillary

Table 3.15: Shrimp in Bangladesh export trade 1973/74 - 1997/98

(in million Tk.)

Year	Total export	Export of primary goods	Export of Shrimp	Export of raw jute	Share in the primary export (%)	
					Shrimp	Raw Jute
1972/73	2711	1165	23	1041	1.97	89.36
1973/75	2974	1226	33	1023	2.69	83.44
1974/75	3061	977	24	736	2.46	75.33
1975/76	5517	2323	145	1838	6.24	79.12
1976/77	6255	2679	246	1765	9.18	65.88
1977/78	7406	2551	253	1454	9.92	57.00
1978/79	9283	3534	446	2179	12.62	61.66
1979/80	11242	3457	529	2221	15.30	64.25
1980/81	11599	3419	550	1943	16.08	56.83
1981/82	12555	4228	904	2038	21.38	48.20
1982/83	16162	5724	1499	2585	26.19	45.16
1983/84	19902	6909	1555	2876	22.51	41.63
1984/85	24155	8185	1995	3898	24.38	47.62
1985/86	24314	8884	2693	3677	30.31	41.39
1986/87	32632	9044	3418	3161	37.79	34.95
1987/88	38081	8867	3612	2491	40.74	28.09
1988/89	40968	9539	3820	3086	40.05	32.35
1989/90	49764	10548	4443	4070	42.12	38.59
1990/91	60561	10794	4512	3674	41.80	34.04
1991/92	75909	10207	4557	3255	44.65	31.89
1992/93	92575	12195	6040	2888	49.53	23.68
1993/94	10096	13820	7877	2272	57.00	16.44
1994/95	13928	18137	10457	3187	57.66	17.57
1995/96	15879	19461	11064	3711	56.85	19.07
1996/97	18813	22415	11889	4953	53.04	22.10
1997/98	23416	22172	11815	4889	51.88	21.47



I. Shrimp farms

Shrimp farms operate as the centre place with all the backward and forward linkage activities of the shrimp industry. The organization of a farm varies according to the scale and method of operation practised. Before the widespread adoption of shrimp culture on a commercial basis, shrimp farms used to be operated on relatively small scale, usually in own lands. The system of farming could be identified as shrimp followed by T. Aman rice in southwestern (Khulna) region and salt in the southeastern (Cox's Bazaar) region. With the advent of widespread practice of commercial shrimp farming, the scale of operation has been expanded and a shrimp 'gher' now covers upto several hundred hectares of land. The larger 'ghers' usually require more physical structures such as sluice gates, security sheds, fishing equipment and the corresponding manpower to operate the 'gher'. The method of cultivation ranges from traditional to semi intensive, requiring varying levels of capital and labour inputs per unit of operated area. According to Rosenberry's estimate (1995), about 9,000 shrimp farms were operating in the coastal areas of Bangladesh.

II. Shrimp hatcheries

Shrimp fry from wild catch accounts for more than 90 per cent of fry requirement of the shrimp farms. There is an acute shortage of shrimp fries in the country. Future expansion of shrimp area would greatly depend on the availability of shrimp fry. According to DOF (1995), there were only 10 hatcheries operating in the country of which only one produced 'bagda' fries. Karim (1995) reported that a total of 20 million fries were produced by the hatcheries, against the total requirement of 2.6 billion fries. Thus farmers rely mostly on shrimp fries collected from wild catch and partly on imported shrimp fries from abroad.

However, collection of shrimp fry from natural source has serious concomitant effect on biodiversity. Collectors of wild fry catch not only the 'bagda' fish but also fish of many other unwanted species which are left on-shore and are eventually destroyed. Mozid (1994) reports that for every single 'bagda' fry collected from natural source, 99 fries of other shrimp and fin fish species are destroyed. Moreover, 50 per cent of the fries collected from wild source die before getting to the farms. Hatchery bred post-larvae, however, have higher survival rate during transportation and stocking.

In view of this situation, DOF provided plan for establishing 30 private hatcheries in the country. However, production of fries in private hatcheries is seriously constrained by non-availability of brood stock. There is no provision of brood stock collection on commercial basis and hatcheries rely mainly on the government source (research vessel) for collection of brood stock from the deep sea.

III. Shrimp feed mills

Supplemental feeding is an important practice of present day shrimp culture. There is a huge shortage of shrimp feed in the country. In addition to the BFDC's fish meal plant, there is only one large scale fish feed mill currently in operation in the Mymensingh region. Besides, there are a few small scale local manufacturer of fish feed. At present only about 6,000 metric tons of fish are locally produced against the total requirement of 100,000 metric tons. Consequently most of the fish and shrimp feeds are imported from abroad. Shrimp farmers also use feeds collected from natural source such as snails and other homemade feeds.

IV. Shrimp processing plants

One interesting feature of the shrimp industry of Bangladesh is the disproportionate growth of the shrimp processing plants in relation to the volume of shrimp produced in the country. By the year 1993/94, there were already 115 processing plants with daily processing capacity of 800 metric tons of shrimp. In 1994, while total production of shrimp was 20,000 metric tons, the processing capacity of plants was 156,000 metric tons of shrimp. As a result, only 13 percent capacity utilization was ensured and most of the plants remained idle because of shortage of raw materials. Hossain (1994) pointed out that unplanned credit system, over enthusiasm of investors for earning quick return were mainly responsible for such disproportionate growth of the processing plants.

In addition to the processing plants, there has been spectacular development of small scale ice plants and cold storage facilities which have contributed to increased production and export of shrimp to a great extent. Besides, a number of ancillary activities such as specialised transportation system for shrimp fry and harvested shrimp, supply of raw materials for construction and maintenance of shrimp farms/ghers, collection and marketing of shrimp by-products have developed with the advent of commercial shrimp farming in the coastal areas of Bangladesh.

3.5.6 Income and employment implications for the shrimp industry

Commercial shrimp culture has created a substantial economic and social transformation in the shrimp belt of Bangladesh (Hamid and Alauddin, 1996). A large number of big gher owners, urban and semi urban stakeholders have made a quick fortune by producing and trading shrimps. Commercial shrimp farming has made a significant departure of the production system from small scale rice production and open water fishing to large scale pond/gher based aquaculture in the coastal regions of Bangladesh. This departure has created a setback for the small/marginal farmers and the fisherman who used to make their cropping plans independently and were engaged in open water fishing. Thus the gains of the big farmers and traders are alleged to have been achieved at the expense of the small/marginal

farmers and the fishermen community. Alauddin and Tisdell (1996) reported an uneven distribution of gains from shrimp culture between big 'gher' owners and the small land owners who lease out lands to the gher owners for shrimp cultivation.

However, the net impact of modern shrimp culture pattern on income distribution and employment generation may not be negative as it apparently appears to be. Although shrimp farming itself is less labour intensive than rice cultivation, the overall labour requirement centering shrimp production and processing is likely to be higher. Thus shrimp industry has the potential for absorbing the surplus labour force of the coastal areas. In fact, the departure from the traditional employment pattern associated with the predominantly rice based farming system to the one with commercial shrimp culture has created a new employment structure involving focus of rural labour flow within rural areas and between rural and urban areas (Hamid and Alauddin 1996). According to MPO (1986) estimate, shrimp culture generated 10.2 million person days of employment on-and off-farm from 51,000 hectares of shrimp area in 1983. With the projected increases in shrimp area, the volume of employment was projected to increase to 22.7 million person days in 1990 and 59.5 million person days in 2005 respectively (Table 3.16).

Table 3.16: Estimated labour requirement of the shrimp industry

<i>Category of employment</i>	<i>Labour requirement ('000' person days)</i>		
	<i>1983</i>	<i>1990</i>	<i>2005</i>
	<i>(51,000/ha.)</i>	<i>(108,000/ha.)</i>	<i>(135,000/ha.)</i>
On-farm works	4,096	8,143	12,062
Shrimp fry collection	5,606	11,664	40,155
Transportation of shrimp post-larvae	126	420	894
Beheading	303	1,296	3,037
Processing for export	91	1,161	3,302
Total	10,222	22,684	59,450

Source: DOF (1994), MPO (1986), Hamid and Alauddin (1996)

Shrimp culture has also opened up the avenues of new employment pattern for rural woman. Before the commencement of commercial shrimp farming, the rural women used to perform various household-based agricultural activities such as threshing, winnowing and drying crops, grading, processing and storing agricultural produce, feeding and caring livestock and poultry. These were in addition to the normal household duties such as cooking family meals, cleaning utensils and looking after children. The emergence of commercial shrimp farming and the related backward and forward linkage activities has opened up new dimension for women's involvement in many of the activities. Shrimp depots are the largest source of employment for women. Karim and Aftabuzzaman (1995) reported that women represented 73 per cent of depot workers, They also estimated that 65 per cent of workers in the shrimp processing plants were women. Shrimp fry collection is also an important source of employment for rural women. Collection of shrimp fry by women in knee-to shoulder-deep water in the coastal belt is a familiar scene. Karim and Aftabuzzaman (1995) estimated that about 55,000 rural women were engaged in fry collection, constituting 36 per cent of the fry collectors. Besides, a large number of rural women are engaged in collection of shrimp feed (e.g., snail) and artisanal production of fish trapping and packing materials.

Although shrimp cultivation and ancillary activities have provided employment and income gains to a large section of people, these have been achieved at considerable cost to the environment and society at large. Some of the negative impacts of shrimp farming include destruction of mangrove forest and hence bio-diversity, reduced paddy production, loss of green vegetation, decline in production of livestock and poultry, and incidence of various types of social conflicts. All these aspects need to be taken into account in the formulation of policies with respect to sustainable development of the shrimp industry in Bangladesh.

3.6 Forest Development Programmes and their Impacts

The Forest Department is primarily responsible for development and management of forest resources in Bangladesh. A number of projects are being implemented for developing and

maintaining forest resources in the country. A list of such on-going projects together with their planned execution period is presented in Table 3.17. One of the objectives of the Forest Resource Management Project is to establish 32,000 hectare of mangrove plantation in the coastal lands. The project will also contribute to employment and income generation of rural community through production of raw materials for wood based cottage industries. The Thana Afforestation and Nursery Development Project is playing an important role in expanding social, community,

Table 3.17: Area under forests and production of selected forest products of reserve forests

Years	Area (‘000’ acre)	Production					
		Timber		Fuel wood		Bamboo	
		Total (‘000’ cft)	Per capita (cft)	Total (‘000’ cft)	Per capita (cft)	Total (‘000’ nos)	Per capita (cft)
1980/81	5416	15306	0.17	24007	0.26	74028	0.83
1981/82	5298	17336	0.19	26282	0.28	77865	0.86
1982/83	5296	15453	0.16	30448	0.32	92335	0.99
1983/84	5205	19569	0.20	31903	0.33	92061	0.96
1984/85	5297	17423	0.17	31368	0.31	76989	0.79
1985/86	5237	19799	0.19	34951	0.34	92616	0.75
1986/87	4909	12764	0.12	23662	0.22	105050	0.90
1987/88	4703	14072	0.13	26111	0.24	140636	0.99
1988/89	4584	12357	0.11	27819	0.25	140636	1.28
1989/90	4584	6751	0.06	13309	0.12	119131	1.06
1990/91	4584	4819	0.07	35241	0.31	84240	0.73
1991/92	4584	6600	0.06	13000	0.11	80000	0.68
1992/93	4584	8122	0.07	6663	0.06	119206	0.99
1993/94	4584	6766	0.06	9481	0.08	90466	0.74

Source: CPD 1997

cropland and homestead agroforestry. Besides these government efforts, a number of NGOs such as BRAC, PROSHIKA, ASA, CARE and RDRS have undertaken successful programmes for developing social, community and homestead agroforestry by organizing, motivating and training the landless rural people on different aspects of tree husbandry.

These government and non-government initiatives have contributed substantially to expansion of forest coverage in the country. It is estimated that an area of 0.3 million hectare have already been planted with various forms of forest cover over the last 20 years from 1974/75. The average annual plantation under such programmes is estimated to be around 15,000 hectare (CPD 1997). The results of these programmes are amply visible in the form of greenery looks along the highways, embankments and many khas lands.

One important gesture in the propagation of forestry in the rural areas is the action programme named Village and Farm Forestry Programme (VFFP) jointly being implemented by Swiss Development Cooperation (SDC) and Bangladesh Agricultural University (BAU), Mymensingh. The programme is being implemented in 21 agricultural blocks covering 118 villages in Bangladesh since 1991. The aim of the project is to expand plantation of timber and fruit trees in homesteads and crop fields through motivation and technical assistance to farmers. The salient feature of the programme is to select and train one ‘core farmer’(CF) from each block in the technical aspects of nursery management and tree husbandry. The core farmers would raise nurseries of their own, sell seedlings to neighbouring farmers, train and motivate them in different aspects of tree husbandry both in homesteads and in the crop fields. By the year 1993, the project completed its two years of operation. According to latest progress report, a total of 2367 and 2354 farm families have been served through the project in the years 1991/92 and 1992/93 respectively (Rahman *et. al.* 1994). It is also reported that the project has been able to bring about significant changes in the attitudes of the village farmers towards plantation of timber and fruit trees in their homesteads and crop fields.

Table 3.18: An inventory of projects being implemented by Forestry Department

<i>Name of projects</i>	<i>Planned period of execution</i>
Forest Resource Management Project	1993-1998
Integrated Development of National Botanical Garden, Baldha Garden and National Herbarium Project	1989-1994
Development of Bamboo, Cane and Musta Plantation Project	1990-1995
Thana Afforestation and Nursery Development Project	1987-1995
Afforestation and Settlement in the Unclassed State Forest of Chittagong Hilltracts	1990-1995
Nagar Banayan Prokalpa	1993-1998

Source: Forest Department records

Chapter IV

Micro Level Diversity and Linkage Effects

4.1 Introduction

This chapter examines the pattern of diversification of enterprises of different classes of farm households and their impacts on selected variables such as income, employment and consumption pattern. A typical farm household practises a variety of crop and non-crop enterprises within the given agricultural and socio-economic environment, and in accordance with the goals, expectations and preferences of the household. Thus the farmers in fact practise farming system in which crop and non-crop enterprises are combined in a unique and synergistic way to yield relatively higher level of composite output.

The micro level diversity has been examined in four locations (thanas) of the four old divisions namely Dhaka, Chittagong, Rajshahi and Khulna. The four thanas covered were Trishal of Mymensingh district, Chandina of Comilla district, Birganj of Dinajpur district and Bagherpara of Jessore district. The four thanas represented four distinct agro-ecological zones (AEZ) of the country. While Trishal fell in the Old Brahmaputra Floodplain (AEZ 9), Chandina represented Old Meghna Estuarine Floodplain (AEZ 19), Birganj was in the Teesta Meander Floodplain (AEZ 3) and Bagherpara fell in the High Ganges Riverine Floodplain (AEZ 11).

4.2 Cropping Pattern and Cropping Intensity

Cropping pattern in a given location is determined by physical, biological and socio-economic factors. In Bangladesh, the physical determinants of cropping pattern includes topography, soil type, climate, length of the growing season, seasonal availability of moisture etc. Biological factors influencing cropping pattern are the food habit of the people, types or varieties of seeds available, incidence of pests and diseases. Among the socioeconomic factors, size of farm, availability of labour, financial resources, tastes and preference of the farmers are the important ones.

Cropping intensity is defined as the ratio of total cropped area to net cultivated area. It indicates the extent to which the same area of land is used for crop production within a cropping year. It appears from Table 4.1 that cropping intensity was the highest in Comilla and the lowest in Mymensingh area. If rice area as a proportion of total cropped area is used

as an index of crop diversity, Table 4.1 shows that Jessore area had the lowest proportion of rice area (57 per cent) in the total cropped area and hence could be considered as having more crop diversity compared to the Dinajpur area where the proportion of rice area in the total cropped area was the highest (64 per cent). However, an apparent look at Table 4.1 also shows that numbers of non-rice crops grown in Comilla and Dinajpur areas were more than those in Jessore and Mymensingh areas. It can also be noted that the proportion of rice area in the total cropped area did not vary much across regions. Based on these indicators it may be said that there is not enough variation in crop diversity across regions of Bangladesh.

Table 4.1: Cropping patterns and cropping intensities by farm size groups

Farm size group	Crops and cropping intensities																						NCA	CI			
	Boro		Aus		Aman		All Rice		Wheat		Jute		Oilseeds		Potato		Sugar-cane		Winter vegetable		Summer Vegetable				All crops		
	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%			Area (ha)	%	
<i>Mymensingh</i>																											
Landless	0.07	28	0.07	28	0.07	28	0.21	84	0.04	16	-	-	-	-	-	-	-	-	-	-	-	-	-	0.25	100	0.11	227
Small	0.33	22	0.23	16	0.35	24	0.91	62	0.13	9	0.13	9	0.21	14	-	-	-	-	0.04	3	0.04	3	1.46	100	0.45	324	
Medium	0.64	21	0.53	17	0.99	33	2.16	71	0.20	7	0.10	3	0.29	10	-	-	-	-	0.07	2	0.21	7	3.03	100	1.35	224	
Large	0.69	18	0.93	25	1.14	31	2.76	74	0.09	2	0.13	3	0.68	18	-	-	-	-	0.05	1	0.09	2	3.80	100	2.15	177	
All	0.43	19	0.44	19	0.64	28	1.51	66	0.12	5	0.12	5	0.39	16	-	-	-	-	0.05	2	0.11	5	2.14	100	1.02	209	
<i>Comilla</i>																											
Landless	0.10	14	0.19	27	0.17	24	0.46	65	0.08	11	-	-	-	-	0.17	24	-	-	-	-	-	-	-	0.71	100	0.19	374
Small	0.85	34	0.67	27	0.63	25	2.15	86	0.16	7	-	-	-	-	0.18	7	-	-	-	-	-	-	-	2.49	100	1.01	246
Medium	0.68	19	0.90	25	1.03	29	2.61	73	0.23	6	0.12	3	0.20	5	0.35	10	-	-	0.04	1	0.06	2	3.61	100	1.25	289	
Large	1.70	25	0.98	13	2.13	31	4.81	69	0.32	5	0.46	7	0.33	5	0.40	6	-	-	0.20	3	0.35	5	6.87	100	2.72	253	
All	0.83	22	0.69	18	0.99	25	2.51	65	0.20	5	0.29	8	0.27	7	0.28	7	-	-	0.12	3	0.21	5	3.80	100	1.29	295	
<i>Dinajpur</i>																											
Landless	0.15	38	-	-	0.14	36	0.29	74	-	-	-	-	-	-	0.10	26	-	-	-	-	-	-	-	0.39	100	0.24	163
Small	0.97	38	-	-	1.03	40	2.00	78	0.32	12	0.12	5	-	-	-	-	-	-	0.06	2	0.08	3	2.58	100	1.17	221	
Medium	1.13	28	0.20	5	1.60	39	2.93	72	0.42	10	0.17	4	-	-	0.45	11	-	-	0.05	1	0.07	2	4.09	100	1.86	220	
Large	1.68	22	-	-	4.07	54	5.75	76	0.81	10	0.20	3	-	-	0.35	4	0.20	3	0.13	2	0.14	2	7.51	100	4.04	186	
All	0.98	23	0.20	5	1.61	40	2.79	68	0.52	12	0.16	4	-	-	0.30	7	0.20	5	0.09	2	0.09	2	3.85	100	1.79	215	
<i>Jessore</i>																											
Landless	0.07	10	-	-	0.20	30	0.29	40	-	-	0.12	17	-	-	-	-	-	-	0.30	43	-	-	0.69	100	0.30	230	
Small	0.42	15	0.39	14	0.54	19	1.35	48	0.39	14	0.63	3	0.26	9	-	-	-	-	0.05	2	0.12	4	2.80	100	0.92	304	
Medium	0.82	26	0.25	8	0.92	29	1.99	63	0.17	5	0.21	7	0.24	8	-	-	-	-	0.05	2	0.05	2	3.11	100	1.38	225	
Large	1.73	29	0.56	9	1.89	32	4.18	70	0.21	3	0.38	6	0.57	10	-	-	-	-	0.15	3	0.15	3	5.94	100	2.97	200	
All	0.76	21	0.40	11	0.89	25	2.05	57	0.26	7	0.34	9	0.36	10	-	-	-	-	0.14	4	0.10	3	3.60	100	1.39	258	

NCA = Net Cropped Area, CI = Cropping Intensity

* All crop does not include all rice

Source: Field Survey 1998

4.3 Numbers of Crop, Non-Crop and Non-Agricultural Enterprises

An attempt was made to identify the numbers of crop, non-crop and non-agricultural enterprises practised by different categories of farms in the four regions of Bangladesh. As would be evident from Table 4.2, total numbers of enterprises

Table 4.2: Number of crop, non-crop and non-agricultural enterprises practised by farm size groups

<i>Farm size Groups</i>	<i>No. of farms</i>	<i>Number of average enterprises per farm</i>			
		<i>Crops</i>	<i>Non-crop</i>	<i>Non-agricultural</i>	<i>Total</i>
<i>Mymensingh</i>					
Landless	20	4	5	2	11
Small	40	8	6	3	17
Medium	33	8	6	2	16
Large	12	8	6	2	16
All	105	7	6	2	15
<i>Comilla</i>					
Landless	16	5	3	3	11
Small	60	5	4	3	12
Medium	26	9	6	3	18
Large	10	9	6	2	17
All	112	7	5	3	15
<i>Dinajpur</i>					
Landless	20	3	3	2	8
Small	40	6	5	3	14
Medium	32	8	6	4	18
Large	28	8	6	2	16
All	120	6	5	3	14
<i>Jessore</i>					
Landless	18	4	3	2	9
Small	39	8	5	2	15
Medium	41	9	6	2	17
Large	20	9	6	2	17
All	118	8	5	2	15

Source: Field Survey 1998

practised by all farms were 15 each in Mymensingh, Comilla and Jessore, and 14 in Dinajpur region. The numbers of crop enterprises practised by all farms were highest in Jessore and lowest in Dinajpur district. The numbers of non-crop and non-agricultural enterprises practised by all farms did not vary appreciably across regions. Within enterprise category, however, the numbers of enterprises practised varied significantly across farm size groups. In the crop category, for example, numbers of enterprises practised were higher for medium and

large farms in all regions. The numbers of non-crop agricultural enterprises were also higher for medium and large farms in all regions. Table 4.2 shows that a relatively higher numbers of non-agricultural enterprises were practised by small and landless farms in all regions. The overall distribution patterns of crop, non-crop and non-agricultural enterprises according to farm size groups did not vary much across regions of Bangladesh.

4.4 Combination of Crop, Non-crop and Non-agricultural Enterprises

Table 4.3 shows the different combinations of crop, non-crop and non-agricultural enterprises practised by different farm size groups in the four regions of Bangladesh. It appears that apart from crop and non-crop enterprises, rickshaw pulling was the common practice for landless households in all the regions. Among the non-crop agricultural enterprises, livestock and poultry raising were common for all categories of households in all the regions. Trading was more common across farm size groups in Jessore than in any other region.

4.5 Contribution to Household Income by Crop, Non-crop and Non-agricultural Enterprises

The pattern of contribution of crop, non-crop and non-agricultural enterprises to total household income is presented in Table 4.4. The contribution of crop enterprises was the highest in Dinajpur (47 per cent) and lowest in Mymensingh (23 per cent) region. A large part of this contribution came from rice enterprises which represented 37 per cent of total household income in Dinajpur area, compared to only 16 per cent in Mymensingh area.

The contribution of non-rice crop to total household income was the highest in Comilla and the lowest in Mymensingh area. However, the contribution of non-crop agricultural enterprises to total household income was the highest in Mymensingh (38 per cent) and lowest in Comilla (13 per cent). Non-agricultural enterprises had the highest contribution to total household income in Comilla area (57 per cent) compared to the lowest contribution of 36 per cent in Dinajpur area.

For landless farms the highest contribution to household income came from non-agricultural enterprises in all the areas studied. For small farms, the picture was the same except in Dinajpur region. For large farms, on the other hand, crop enterprises had the highest contribution to total household income in all the regions studied. Thus in terms of contribution of non rice enterprises to total household income, relatively smaller farmers could be considered as more diversified than larger farms.

Table 4.3: Combination of crop, non-crop and non-agricultural enterprises by farm size groups

<i>Farm size groups</i>	<i>Combination of crop, non-crop and non-agricultural enterprises</i>
<i>Mymensingh</i>	
Landless	Crop + Fruit + Bamboo + Livestock + Poultry + Rickshaw
Small	Crop + Fruit + Wood + Bamboo + Livestock + Poultry + Fisheries + Rickshaw + Handicraft
Medium	Crop + Fruit + Wood + Bamboo + Livestock + Poultry + Fisheries + Trading
Large	Crop + Fruit + Wood + Bamboo + Livestock + Poultry + Fisheries + Rickshaw
All	Crop + Fruit + Wood + Bamboo + Livestock + Poultry + Fisheries + Trading + Rickshaw + handicraft
<i>Comilla</i>	
Landless	Crop + Fruit + Bamboo + Livestock + Poultry + Driving + Rickshaw
Small	Crop + Fruit + Wood + Livestock + Poultry + Trading + Mechanical work
Medium	Crop + Fruit + Wood + Bamboo + Livestock + Poultry + Fisheries + Trading + Handicraft
Large	Crop + Fruit + Wood + Bamboo + Livestock + Poultry + Fisheries + Trading
All	Crop + Fruit + Wood + Bamboo + Livestock + Poultry + Fisheries + Trading + Driving + Rickshaw + Handicraft
<i>Dinajpur</i>	
Landless	Crop + Fruit + Livestock + Poultry + Rickshaw
Small	Crop + Fruit + Wood + Livestock + Poultry + Fisheries + Driving + Rickshaw
Medium	Crop + Fruit + Wood + Bamboo + Livestock + Poultry + Fisheries + Trading + Mechanical work + Handicraft
Large	Crop + Fruit + Wood + Bamboo + Livestock + Poultry + Fisheries + Trading
All	Crop + Fruit + Wood + Bamboo + Livestock + Poultry + Fisheries + Trading + Driving + Rickshaw + Handicraft + Mechanical work
<i>Jessore</i>	
Landless	Crop + Fruit + Livestock + Poultry + Rickshaw + Handicraft
Small	Crop + Fruit + Bamboo + Livestock + Poultry + Fisheries + Trading
Medium	Crop + Fruit + Wood + Bamboo + Livestock + Poultry + Fisheries + Trading
Large	Crop + Fruit + Wood + Bamboo + Livestock + Poultry + Fisheries + Trading
All	Crop + Fruit + Wood + Bamboo + Livestock + Poultry + Fisheries + Trading + Rickshaw + Handicraft

Note: Frequency of enterprises varied across enterprises in a group of farms. The combination of enterprises in each size group was chosen on such a basis that at least one farm in the group practised one enterprise

Source: Field Survey 1998

Table 4.4: Contribution of crop, non-crop and non-agricultural enterprises in total household income (1997)

Farm size group	Total annual Household Income (Tk.)	Contribution of enterprises to total household income (%)					
		Crop			Non-crop	Non-agri. enterprises	Total
		Rice	Non-rice	Total			
<i>Mymensingh</i>							
Landless	19,886	5	0	5	26	69	100
Small	44,370	9	4	13	40	47	100
Medium	78,711	11	9	20	54	26	100
Large	135,394	37	16	53	32	15	100
All/Average	72,575	16	7	23	38	39	100
<i>Comilla</i>							
Landless	22,410	7	2	9	3	88	100
Small	54,583	17	11	28	25	47	100
Medium	89,080	26	13	39	17	44	100
Large	140,378	39	12	51	10	39	100
All/Average	78,201	21	29	30	13	57	100
<i>Dinajpur</i>							
Landless	28,175	10	4	14	12	74	100
Small	70,244	42	15	57	25	18	100
Medium	103,548	46	9	55	23	22	100
Large	165,828	60	16	76	9	15	100
All/Average	94,378	37	10	47	17	36	100
<i>Jessore</i>							
Landless	25,635	8	3	11	28	61	100
Small	59,829	23	12	35	18	47	100
Medium	92,425	32	15	47	19	34	100
Large	150,581	41	21	62	14	24	100
All/Average	84,833	24	12	36	20	44	100

Source: Field Survey 1998

4.6 Household Expenditure Pattern by Farm Size Groups

The patterns of expenditure on different food items, expenditure on food and non-food items and percentage distribution of expenditure on food and non-food items are presented in Tables 4.5, 4.6 and 4.7 respectively. As is expected, rice accounted for major portion of food expenditure ranging from 35 per cent to 49 per cent of total expenditure on food. Table 4.6 shows the absolute magnitude of food and non-food expenditures for which percentage distributions are presented in Table 4.7. As is expected, food expenditure represented an overwhelmingly larger proportion of total expenditure for all income classes in all regions.

Table 4.5: Shows***

Table 4.5: Annual household expenditure on different food items

<i>Farm size group</i>	<i>Average annual expenditure on different food items per household (in Tk)</i>														
	<i>Rice</i>	<i>Wheat</i>	<i>Edible Oil</i>	<i>Pulses</i>	<i>Mustard</i>	<i>Vege.</i>	<i>Fruits</i>	<i>Milk</i>	<i>Egg</i>	<i>Fish</i>	<i>Meat</i>	<i>Sugar</i>	<i>Spices</i>	<i>Others</i>	<i>Total</i>
<i>Mymensingh</i>															
Landless	13821	640	120	790	480	300	400	380	180	528	814	360	100	290	19203
Small	15192	1103	1211	926	620	1200	613	1706	770	1585	1430	560	300	415	27631
Medium	20120	440	1455	1285	1270	2500	1420	3422	1200	4005	2925	960	480	700	42182
Large	26495	423	1633	1408	1424	3648	4165	7599	3000	7654	5000	1094	500	1205	65248
All	18907	652	1105	1102	949	1912	1650	3277	1288	3443	2542	744	345	653	38566
<i>Comilla</i>															
Landless	11490	1782	816	1028	187	2366	723	733	441	1438	714	609	356	324	23007
Small	12238	4641	1716	1322	490	2567	1132	1857	602	2332	1359	701	1191	641	32789
Medium	17098	6428	2268	2051	609	3712	2319	4058	1515	5306	3436	1079	2669	1025	53573
Large	20155	6052	2338	1768	1722	4727	1842	4727	1582	10510	4640	1304	4141	1594	67102
All	15245	4726	1784	1542	652	3343	1504	2744	1035	4897	2537	923	2089	896	44118
<i>Dinajpur</i>															
Landless	7307	708	851	657	308	2046	750	448	365	926	721	311	364	159	15921
Small	13037	1350	1262	904	749	3673	1646	1873	443	2702	2185	577	1250	928	32579
Medium	16770	1722	2012	1119	1295	4117	2745	3250	736	3670	3270	897	1523	1080	44206
Large	30607	3138	2796	2150	2194	5573	4714	4950	954	6961	6633	1567	3461	1967	77665
All	16930	1729	1730	1207	1137	3852	2464	2630	625	3565	3202	838	1649	1033	42593
<i>Jessore</i>															
Landless	10993	780	633	859	188	2483	125	620	113	1075	973	360	352	403	19957
Small	14065	630	1200	837	775	3424	328	1355	565	4811	1780	612	1554	694	32630
Medium	15360	825	1546	1323	1250	3950	514	2170	835	6836	2722	853	2037	1041	41262
Large	20170	600	2328	1106	1672	4573	930	3596	1676	8438	3668	1134	3629	1410	54930
All	15147	709	1427	1031	971	3608	474	1935	820	5290	2286	740	1893	887	37195

Source: Field Survey, 1998

Table 4.6: Annual household expenditure on food and non-food items

Farm size Group	Annual expenditure on different food and non-food items per household (in Tk)									Total
	Food	Non-food								
		Cloth ing	Foot- wear	Travel	Educa tion	Medi- cine	Fuel	Recrea -tion	Others	
<i>Mymensingh</i>										
Landless	19203	2000	200	200	600	1000	1000	135	263	24601
Small	27631	4000	710	1964	1862	1392	1729	720	685	40693
Medium	42182	6000	1610	2000	12000	3200	3400	924	1214	72530
Large	65248	9000	3500	4230	14840	5400	5500	1200	2025	110943
All	38566	5250	1505	2099	7351	2748	2907	745	1047	62192
<i>Comilla</i>										
Landless	23007	2606	949	824	221	1666	1693	268	520	31754
Small	32789	3760	1172	1211	1195	2816	1801	907	830	46481
Medium	53573	8438	1664	1791	4650	3938	2231	2318	1145	79748
Large	67102	9165	2480	2416	6793	5900	2929	2543	1625	100953
All	44118	5992	1566	1561	3214	3580	2164	1509	1030	64734
<i>Dinajpur</i>										
Landless	15921	1550	375	290	742	558	1161	268	441	21306
Small	32579	3215	977	683	1862	946	1535	592	1029	43418
Medium	44206	5425	1850	1143	6300	1990	2630	885	1473	65902
Large	77665	11056	3561	2094	16778	3028	3619	2206	2061	122068
All	42593	5511	1691	1027	6345	1606	2236	968	1141	63174
<i>Jessore</i>										
Landless	19957	1740	523	248	525	484	1314	171	365	25327
Small	32630	4338	1019	1183	1462	1162	2791	766	703	46054
Medium	41262	5947	1277	1500	2846	2431	3267	1118	920	60568
Large	54930	7875	2055	1921	7210	4005	4440	1870	1235	85541
All	37195	4975	1219	1213	3011	2020	2953	981	806	54373

Source: Field Survey, 1998

Food expenditure as proportion of total expenditure did not vary much across income groups within regions and for all income groups across regions. Among the non-food items the highest proportion of expenditure was incurred on clothing for all classes of households in all the regions. Expenditure on clothing as per cent of total expenditure ranged from 8 per cent in Mymensingh region to 10 per cent in Comilla region. Recreation accounted for the lowest proportion of total household expenditure for all income classes in all the regions studied.

Table 4.7: Percentage distribution of annual household expenditure on food and non-food items

Farm Size Group	Percentage of average annual expenditure per household									Total
	Food	Non-food								
		Cloth ing	Foot-wear	Travel	Educa tion	Medi cine	Fuel	Recre ation	Others	
<i>Mymensingh</i>										
Landless	78	8	1	1	2	4	4	1	1	100
Small	71	10	2	2	5	4	4	1	1	100
Medium	58	8	2	3	17	4	5	1	2	100
Large	57	9	3	4	14	5	5	1	2	100
All	61	8	3	3	12	5	5	1	2	100
<i>Comilla</i>										
Landless	72	8	3	3	1	5	5	1	2	100
Small	71	8	2	3	2	6	4	2	2	100
Medium	67	11	2	2	6	5	3	3	1	100
Large	66	9	2	2	7	6	3	3	2	100
All	68	10	2	2	5	6	3	2	2	100
<i>Dinajpur</i>										
Landless	75	7	2	1	3	3	5	1	2	100
Small	75	8	2	2	4	2	4	1	2	100
Medium	67	8	3	2	10	3	4	1	2	100
Large	63	9	3	2	14	2	3	2	2	100
All	66	9	3	2	10	2	4	2	2	100
<i>Jessore</i>										
Landless	78	7	2	1	2	2	5	1	2	100
Small	70	9	2	3	3	3	6	2	2	100
Medium	68	10	2	2	5	4	5	2	2	100
Large	64	9	2	2	9	5	6	2	1	100
All	68	9	2	2	6	4	5	2	2	100

Source: Field Survey, 1998

4.7 Labour Employment in Agricultural and Non-agricultural Activities

Table 4.8 shows the total number of mandays of employment according to agricultural and non-agricultural enterprises. The corresponding percentage distribution of days of employment is presented in Table 4.9. It is interesting to note that trading accounted for substantial proportion of employment in all the classes of households in all the regions. Wage earning and rickshaw pulling constituted the major source of employment for landless households in all the regions.

Table 4.8: Total man-days of employment in agricultural and non-agricultural enterprises, 1997

Farm Size Group	Total man-days of employment per annum per household		Total
	Agriculture	Non-agriculture	

	<i>Crop</i>	<i>Non crop</i>	<i>Wage earning</i>	<i>Trad- ing</i>	<i>Rickshaw/ van pulling</i>	<i>Handi- crafts</i>	<i>Driving</i>	<i>Mechani- cal work</i>	
<i>Mymensingh</i>									
Landless	56	50	300	-	280	-	-	-	686
Small	136	66	244	-	122	94	-	-	662
Medium	106	124	-	330	-	30	-	-	590
Large	74	106	-	280	-	-	-	-	560
All	78	86	150	178	100	32	-	-	624
<i>Comilla</i>									
Landless	-	70	312	-	208	-	100	-	690
Small	140	86	214	150	-	-	-	80	670
Medium	124	76	-	288	-	120	-	-	608
Large	92	84	-	414	-	-	-	-	590
All	88	80	132	214	52	30	24	20	640
<i>Dinajpur</i>									
Landless	70	100	310	-	190	-	-	-	670
Small	156	70	226	-	86	-	114	-	652
Medium	128	92	-	204	-	104	-	70	598
Large	106	110	-	350	-	-	-	-	566
All	98	94	152	138	68	26	28	18	622
<i>Jessore</i>									
Landless	36	62	220	-	230	130	-	-	678
Small	124	76	194	144	102	-	-	-	640
Medium	96	124	-	264	-	90	-	-	574
Large	74	110	-	374	-	-	-	-	558
All	74	92	112	196	82	56	-	-	612

Source: Field Survey, 1998

Table 4.9: Percentage distribution of man-days of employment in agricultural and non-agricultural enterprises, 1997

<i>Farm size</i>	<i>Percent of total man-days of employment per annum per household</i>
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Group	Agriculture		Non-agriculture					Total	
	Crop	Non-crop	Wage earning	Trading	Rickshaw/ Van pulling	Handicrafts	Driving		Mechanical work
<i>Mymensingh</i>									
Landless	8	7	44	-	41	-	-	-	100
Small	21	10	37	-	18	14	-	-	100
Medium	18	21	-	56	-	5	-	-	100
Large	13	19	-	68	-	-	-	-	100
All	13	14	22	31	15	5	-	-	100
<i>Comilla</i>									
Landless	-	10	45	-	30	-	15	-	100
Small	21	13	32	22	-	-	-	12	100
Medium	20	13	-	47	-	20	-	-	100
Large	16	14	-	70	-	-	-	-	100
All	14	12	19	35	8	5	4	3	100
<i>Dinajpur</i>									
Landless	10	15	47	-	28	-	-	-	100
Small	24	11	35	-	13	-	17	-	100
Medium	21	15	-	35	-	17	-	12	100
Large	19	19	-	62	-	-	-	-	100
All	16	15	23	24	11	4	4	3	100
<i>Jessore</i>									
Landless	5	9	32	-	34	20	-	-	100
Small	19	12	30	23	16	-	-	-	100
Medium	17	22	-	46	-	15	-	-	100
Large	13	20	-	67	-	-	-	-	100
All	12	16	17	34	13	8	-	-	100

Source: Field Survey, 1998

An attempt was made to assess the change in employment opportunities in different sectors through farmers' response. The results are presented in Table 4.10. Except for livestock enterprises in Dinajpur, fish enterprises in Comilla and Dinajpur of landless farms, all the categories of farms in all the regions reported that employment opportunities in crop, livestock, fish and non-agricultural enterprises increased over the past years. Eightyfive per cent farms in Mymensingh, 76 per cent in Comilla, 77 per cent in Dinajpur and 65 per cent in Jessore reported that employment opportunities in the crop sector increased over the recent past years (Table 4.10).

Table 4.10: Farmers' opinion about change in employment opportunities in different sectors, 1997

Farm size	Farmers' response about changes in employment opportunities during 1997 (%)			
	Crop	Livestock	Fisheries	Non-agriculture

	<i>Increase</i>	<i>Decrease</i>	<i>Increase</i>	<i>Decrease</i>	<i>Increase</i>	<i>Decrease</i>	<i>Increase</i>	<i>Decrease</i>
<i>Mymensingh</i>								
Landless	73	27	62	38	64	36	76	24
Small	79	21	57	43	57	43	68	32
Medium	87	13	71	29	69	31	79	21
Large	67	33	66	34	73	27	83	17
All	85	15	64	36	66	34	77	23
<i>Comilla</i>								
Landless	83	17	55	45	46	54	72	28
Small	77	23	64	36	58	42	81	19
Medium	69	31	76	24	67	33	74	26
Large	73	27	67	33	61	39	86	14
All	76	24	66	34	58	42	78	22
<i>Dinajpur</i>								
Landless	70	30	40	60	35	65	80	20
Small	78	22	47	53	56	44	75	25
Medium	86	14	63	37	68	32	83	17
Large	73	27	78	22	61	39	77	23
All	77	23	57	43	55	45	79	21
<i>Jessore</i>								
Landless	63	37	47	53	58	42	67	33
Small	56	44	59	41	71	29	73	27
Medium	72	28	67	33	62	38	64	36
Large	68	22	52	48	68	32	78	22
All	65	35	56	44	65	35	71	29

Source: Field Survey, 1998

An overwhelming majority of all farmers in all the regions reported that employment opportunities in livestock and fishery sectors increased over the past years. A good majority of farmers in all the regions also reported that employment opportunities in non-agricultural activities increased during the recent past years.

A variety of responses were put forward by farmers as reason for increase in employment opportunities in different sectors. In the crop sector the important reasons mentioned were diversification of crop, adoption of new technology and bringing fallow land under cultivation. Seventy five per cent farmers in Mymensingh and 72 per cent in Dinajpur mentioned crop diversification as the major cause of increase in employment opportunities in the crop sector (Table 4.11). Seventy two per cent farmers in Comilla mentioned that adoption of labour intensive technologies was the major cause of increase in employment opportunities in the crop sector. In the livestock sector, the important reasons for increase in employment opportunities, as perceived by the farmers, were increased credit facilities, participation in various rural development programmes and profitability of the enterprise. Sixty one per cent farmers in Comilla and 53 per cent in Mymensingh reported that employment opportunities in the livestock sector increased because of increased credit facilities (Table 4.11). Modern fish culture technology, increased credit facilities,

participation in rural development programmes and profitability of the enterprises were reported to be the important causes of increased employment opportunities in the fishery sub-sector. In the case of expansion of employment opportunities in the non-agricultural sector, the important reasons mentioned were easy availability of credit, expansion of small scale enterprise and increased employment opportunities in the NGO sector. Sixty eight per cent of Mymensingh farmers, 72 per cent of Comilla farmers and 70 per cent of Dinajpur farmers mentioned that easy availability of credit contributed to expansion of non-agricultural activities (Table 4.11). On the other hand, 65 per cent of Comilla farmers and 74 per cent of Dinajpur farmers reported that development and expansion of small scale enterprises contributed highly to expansion of non-agricultural employment in their areas.

Table 4.11: Reasons for increase in employment opportunities in different sectors

<i>Reasons of increase</i>	<i>Percent of farmers</i>			
	<i>Mymensingh</i>	<i>Comilla</i>	<i>Dinajpur</i>	<i>Jessore</i>
<i>Crop</i>				
Diversification of crop/cropping intensity	75	64	72	57
Adoption of new technology	67	72	63	60
Cultivation of fallow land	58	61	54	52
<i>Livestock</i>				
Increased credit facility	53	61	46	42
Participation of various organization	48	56	41	50
Profitable business	42	39	52	46
Increasing awareness	36	49	38	32
<i>Fisheries</i>				
Modern fish culture	64	53	49	51
Increased credit facility	57	42	53	60
Participation in various organizations	47	38	42	46
Profitable business	52	48	37	42
<i>Non-agriculture</i>				
Easy availability of credit	68	72	70	64
Expansion of small scale enterprises	57	65	74	58
Scope of employment in NGOs	70	67	64	71

Source: Field Survey, 1998

4.8 Relation of Diversification with Household Income and Employment

An attempt was made to link the extent of diversification of enterprises with the level of household income and level of employment of the farm households. For this purpose, the households of each region were categorised according to the number of enterprises practised.

The corresponding number and percentage distribution of households, average household income and level of employment are presented in Table 4.12. It is evident from the table that average household income persistently increased with increase in the number of enterprises

practised in all the regions. However, the level of employment varied directly with the number of enterprises practised only upto certain level and employment level generally decreased with further increase in the number of enterprises, particularly when the number of enterprises practised exceeded 10-12. Thus in the extensive margin of the number of enterprises, farm households may have been deriving higher income not by extensive use of labour, but by improving labour productivity.

Table 4.12: Relation of number of enterprises with gross household income and level of employment

<i>Number of Enterprises</i>	<i>Households</i>		<i>Average income (Taka)</i>	<i>Level of employment (man-days)</i>
	<i>No</i>	<i>%</i>		
<i>Mymensingh</i>				
1-3	8	7.62	30882.70	758.00
4-6	17	16.19	40043.35	792.71
7-9	47	44.76	61566.88	840.82
10-12	29	27.61	701477.17	761.34
13-15	4	3.82	118346.50	673.00
<i>Comilla</i>				
1-3	11	9.82	33765.00	747.00
4-6	19	16.96	54238.25	779.00
7-9	44	39.29	78935.75	815.00
10-12	32	28.57	88625.50	736.00
13-15	6	5.36	126750.00	684.00
<i>Dinajpur</i>				
1-3	13	10.83	35945.55	768.00
4-6	21	17.50	53264.95	805.00
7-9	48	40.00	82437.64	835.00
10-12	31	25.83	87210.00	727.00
13-15	7	5.84	138635.00	692.00
<i>Jessore</i>				
1-3	9	7.63	31270.00	747.00
4-6	22	18.64	49780.00	786.00
7-9	52	44.07	73725.00	845.00
10-12	30	25.42	82465.00	742.00
13-15	5	4.24	106324.00	653.00

Source: Field Survey, 1998

Chapter V

Summary Conclusions and Policy Implications

5.1 Introduction

This chapter presents the major findings and conclusions of the study and draws implications for policy with respect to promotion of diversification of the agricultural sector of Bangladesh. A summary of major findings and conclusions is presented at the beginning. Implications of the findings for policy are identified and some policy recommendations are suggested for sustainable growth of the agricultural sector through diversification of crop and non-crop agricultural activities.

5.2 Summary of Findings and Conclusions of the Study

Bangladesh agriculture has undergone substantial structural changes over the past years. While the share of crop agriculture to GDP declined from about 30 per cent in 1990/91 to about 23 per cent in 1997/98, the contribution of livestock and fishery sub-sector to GDP increased from 2.14 per cent and 2.70 per cent in 1990/91 to 3.20 per cent and 3.27 per cent respectively in 1997/98. The share of forestry sub-sector, however, remained almost static at around 2.5 per cent during the period. As regards growth rates of different sub-sectors, crop sector growth rate marginally increased from 1.20 per cent in 1990/91 to 1.62 per cent in 1996/97, with a lot of fluctuation in the growth rate during the period. The growth rates of livestock, fishery and forestry sub-sectors, however, steadily increased from 2.15 per cent, 5.82 per cent and 2.25 per cent in 1990/91 to 8.00 per cent, 8.80 per cent and 4.30 per cent respectively in 1997/98.

An examination of crop sector diversity in terms of crop share index revealed that while area under foodgrain crop as percent of net cropped area increased from 111 per cent in 1973/74 -1977/78 to 137 per cent in 1991/92 -1995/96, per cent of net cropped area under non-foodgrain crops decreased from 38 per cent to 35 per cent during the period. As regards gross value share of individual crops in the crop sector's gross value of output, it was observed that in value share of foodgrain (mainly rice) increased from 68 per cent in 1973/74 -1977/78 to 75 per cent in 1991/92-1995/96. On the other hand, gross value share of the non-foodgrain crops decreased from about 32 per cent to 25 per cent during the period. Thus if diversification is measured in terms of shifts of acreage or production away from rice/cereals, crop agriculture of Bangladesh cannot be considered to have moved along the path of diversification.

An examination of crop diversity in terms of cropping intensity and rice share index across farm size groups revealed that cropping intensity decreased remarkably with increase in the farm size. This was due to the fact that more lands were kept fallow by large landholders. The rice share index suggested that crop diversity declined with increasing farm size, although the number of total and non-rice crop increased with increase in the farm size. One explanation of this behavior is that large farmers are more likely to grow some crops for market because they are less constrained by subsistence needs. This goes in line with the agreement that commercial agriculture requires specialization of production at farm level rather than diversification so that marketable surplus can be generated. There are a number of factors which affect farmer's decision to diversify or produce the combination of crop enterprises. These factors are agronomic suitability, financial and economic returns, technological changes, marketing infrastructures and macro level price and trade policies. The results of financial and economic analysis have shown that a number of crops such as potato, vegetables, onion and cotton have financial and economic returns larger than those of rice. Yet farmers are not found enthusiastic about expanding areas along these crops, particularly by replacing rice. In a subsistence economy like Bangladesh, it is not unlikely that farmers, instead of maximizing financial or economic returns, will tend to produce the staple cereals upto certain threshold limit, given the stress on household food security. However, the reasons for lesser preference for non-rice crops lie in a combination of technical and economic factors. There are high price risks associated with marketing of most of the non-rice crops. Besides, producers are not assured of reliable access to modern inputs, technology, credit and improved commercial facilities.

Diversification along the line of production of non-rice crops also have implications for labour employment. Some crops like oilseeds and pulses are less labour intensive and hence will have negative impact on employment generation. Since potatoes, vegetables and spices are highly labour intensive, expansion of area and production of these crops will have positive impact on labour employment, However, with fluctuation of price and lack of storage, transportation and processing facilities may constrain any large scale expansion of area under these crops.

A well developed agro-processing sector provides a vital link in the stimulation of agricultural diversification. Bangladesh has a number of agro-industrial enterprises which process a wide range of agricultural commodities. These enterprises are grain milling, sugarcane crushing, oilseeds crushing, jute processing, cotton ginning,, processing tobacco leaves and leather tanning. Besides, there are freezing, canning and some other processing activities which are limited to a few products.

In the areas of non-crop agriculture, tremendous potentialities exist for diversification, particularly among the livestock and fisheries activities. Records maintained by the DLS

revealed that for most of the species of animals/birds, the number of new farms established increased from 1990/91 to 1994/95. Although total production of milk increased from 1987/88 to 1994/95, per capita production slightly decreased during the period. Total as well as pre capita production of meat and eggs, however, increased during the period. The government initiated incentive schemes were found to have made significant positive impact on production and per capita consumption of milk at household level. Some achievements were also made in the area of egg and meat production and related activities through the Smallholder Livestock Development Project (SLDP) implemented by the DLS in 80 thanas of Bangladesh. Egg production increased from 8 million units in 1993/94 to 90 million units in 1995/96. Monthly income per beneficiary also increased during the period.

In the area of fishery sub-sector, total fish production in the country increased from 754 thousand metric tons in 1983/84 to 1200 thousand metric tons in 1994/95. While contribution of inland open water capture fishery to total fish production decreased during the above period, production from inland culture fishery increased substantially. Overall inland fish production increased from 589 thousand metric tons in 1983/84 to 922 thousand metric tons in 1994/95. The improvements in fish production, particularly inland production, are attributed to different intervention measures taken by the government and non-government organizations in the areas of fishery research, extension and credit.

The last two decades have witnessed a phenomenal growth in commercial shrimp culture in Bangladesh. In 1979/80, slightly more than 20,000 hectares were under shrimp cultivation. According to Master Plan Organization (MPO,1986) estimate, total area under shrimp is expected to increase from 96,048 hectares in 1990 to 135,000 hectares in the year 2005. As a primary export item, shrimp grew from next to nothing in the early 1970s to contribute about 11 per cent of total export in the mid 1990s. The share of shrimp export in the total primary export increased from only 1.97 per cent in 1972/73 to as high as 52 per cent in 1997/98.

Commercial shrimp culture has created a substantial economic and social transformation in the shrimp belt of Bangladesh. A large number of big 'gher' owners, urban and semi urban stakeholders have made a quick fortune by producing and trading shrimp. It is, however, alleged that the gain of big 'gher' owners have occurred at the expense of small land owners who lease out land to the 'gher' owners and have to forego rice production and other activities for leasing out land to the 'gher' owners for shrimp cultivation. The net impact of modern shrimp culture pattern on employment generation is, however, considered to be positive. Although shrimp farming itself is less labour intensive than rice cultivation, the overall labour requirement centering shrimp production and processing is likely to be higher. Thus shrimp industry is believed to have the potential for absorbing surplus labour force of the coastal areas.

The forestry sub-sector is playing an important role by providing income earning and employment opportunities through a number of afforestation programmes by government and non-government organisations. The results of these programmes are amply visible in the form of greeny looks along the high ways, embankments and many khas lands.

The micro analysis of diversification and the linkage effects revealed important relationships between the extent of diversification and the level of household income, employment and consumption of different classes of households. An examination of numbers of crop, non-crop and non-agricultural enterprises practised by different size groups of farms in different locations revealed that the total numbers of enterprises practised by the landless households were the lowest in all the locations. The highest numbers of enterprises were practised by medium farms followed by large and small farms, except in Mymensingh where small farms were found to practise the highest number of enterprises. As regards composition of enterprises practised, landless farms obviously had the least number of crop enterprises. The numbers of non-crop and non-agricultural enterprises were also one of the lowest for the landless farms in all the locations studied. Among the non-agricultural enterprises, rickshaw pulling was common for landless and trading was common for small, medium and large farms in all the locations.

Non-agricultural enterprises contributed the highest proportion of household income for the landless households. Crop enterprises had the highest contribution to household income for large farms in all the locations. Total expenditures on food and non-food items were lowest for landless and highest for large farm households in all the locations studied.

It was observed that the number of enterprises practised was positively related with gross household income in all the locations. However, the level of employment varied directly with the number of enterprises practised only upto certain level and employment level generally decreased with further increase in the number of enterprises, particularly when the number of enterprises practised exceeded 10-12. Thus in the extensive margin of the number of enterprises, farm households may have been deriving higher income not by extensive use of labour, but by improving labour productivity.

5.3 Policy Implications

The results obtained from the study have a number of policy implications with respect to agricultural diversification and its linkage effects. In the context of crop agriculture it has been observed that inspite of the crop diversification programme pursued by the government, there has not been any remarkable change in the composition of crop enterprise, particularly in terms of expansion of area and production of non-cereal crops. This is inspite of the fact that many non-cereal crops such as potato, vegetables, cotton and spices have higher

financial and economic returns than HYV rice. This behaviour can be attributed to a combination of economic and physical factors. There are very high price risks associated with marketing of these crops. Storage and transportation facilities are not adequately available for many of these crops. Again, the existing on-farm water management systems are not conducive to production of rice and non-rice crops in the same service units. Modern irrigation facilities are almost exclusively devoted to foodgrain production, leaving the high-value non-cereal crops to be grown under traditional irrigation or rainfed condition. This leads to lower than potential yield of these crops.

These problems can be solved by a number of ways, such as by : (i) improving storage and transportation infrastructures and thereby reducing price risks; (ii) designing on-farm water management system conducive to production of rice and non-rice crops in the same service units; and (iii) improving yield and hence profitability of the non-rice crops through technological development. These goals can be achieved by introducing necessary price, marketing and structural policy adjustments.

A sustainable diversification strategy will not only have linkage with the domestic market, but also with the export outlets, particularly for the high-value non-conventional crops including some fruits and vegetables. The domestic markets for some of these crops are limited because of the generally low living standard of the people. Successful exploitation of the export market of these crops will require high degree of sophistication in processing, packaging and handling of these products. This will also require some public investment in building marketing infrastructure and also in promotional activities in the export market.

In the livestock sub-sector, expansion of economic activities is constrained by inadequate availability of medicare and artificial insemination services, high price of cattle and poultry feed and also lack of marketing facilities of milk and other livestock products. The incentive bonus scheme which was introduced in the early 1990s had some positive impact on establishment of new dairy farms, production and consumption of livestock products and also employment generation. However, the impact was short lived because of lack of proper monitoring of the programme and supporting intervention in the pricing of inputs and outputs, and development of marketing infrastructure. These aspects need to be incorporated in the public policy agenda.

The fisheries sub-sector has undergone substantial changes, particularly in the form of popularization and the consequent increased production of the inland pond fish culture. Expansion of pond fish culture has not only compensated for the decline in the inland capture fishery, it has significantly contributed to income and employment generation and household nutrition. Another dimension of the fishery sub-sector is the phenomenal growth of shrimp culture which has been significantly contributing to income, employment generation and foreign exchange earning. However, shrimp culture is alleged to be making negative impact

on income distribution and environment. These aspects have important implications for policy and efforts should be directed to quantify and measure the negative impacts so that the results can be incorporated in the pricing mechanism for sustainable development of the shrimp industry in Bangladesh.

In the forestry sub-sector, the important dimensions of diversification are expansion of homestead forestry, agroforestry and social forestry. These activities offer excellent opportunities of household income and employment generation on the one hand and protection of environment on the other. The forestry sub-sector provides fuel, food, fodder and timber. In the case of social and agroforestry, participants have excellent opportunities of earning short and long run returns, depending on the stipulated benefit sharing agreements and costs involved. However, there seems to be lack of effective awareness about the nature and magnitude of benefits involved. Public policy should therefore address the issue of motivation and training of the prospective clientele groups for sustainable development of the forestry sub-sector as an effective linkage of agricultural diversification in the country.

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