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# A Structural Perspective of Farm and Non-farm Households in Bangladesh

by

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The paper attempts to trace the process of growth of non-farm and transition of farm households and population with identification of those who would depend primarily on labour markets for a living. This is achieved through examination of intercensal changes. A projection is then made to portray the picture of distribution of population and households by the year 2006 in categories like rural, urban, farm, non-farm labour, and non-labour households. A particular focus on the process of disintegration of farms is included as a basis for growth of non-farm households. Some speculative implications of the projection are indicated in the concluding part of the paper.

## I. INTRODUCTION

Bangladesh is an extremely densely populated country with widespread poverty. Agriculture and services sectors provide about 85 percent of national income and more than 90 percent of employment. Per capita income was only about US\$ 170 in 1983/84 (BBS 1985). About 100 million people are compressed in a landmass of about 55 thousand square miles. Development issues of this country have often puzzled many local and expatriate experts. While some experts have lamented on the pessimistic future of Bangladesh, others have emphasized on the progression in landlessness in the countryside (Januzi & Peach 1977 ; Cain 1981).

But the realization that generation of non-farm employment is a critical factor for holding together the political and social fabric of the nation has yet to emerge in full force among policy makers. Projection of the gap between supply of and demand for agricultural employment, based on historical trends of population, sectoral products, and employment coefficients is the customary route for high-lighting the issue. Such an approach, important as it is for certain purposes, is not always effective in arousing necessary seriousness among policy makers in changing priorities. It is believed that a projection of

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some measure of labour force by socially significant household groups would produce a stronger impact on politicians and policy makers. This faith is founded on the fact that past studies on increased incidence of landlessness provoked so much interest and debate whereas projections of gaps between employment and labour force continue to remain as cold statistics.

The present paper is addressed to unfold the process of growth of non-farm and transition of farm households and population with identification of those who would depend primarily on labour markets for a living. This is achieved through examination of intercensal changes. A projection is then made to portray the picture of distribution of population and households by the year 2006 in categories like rural, urban, farm, non-farm, labour, and non-labour households. A particular focus on the process of disintegration of farms is included as a basis for growth of non-farm households. Some speculative implications of the projection are indicated in the concluding part of the paper.

## II. DATA, DEFINITIONS AND METHOD OF ANALYSIS

The study on changes in the structural attributes of households and population is based on the Agricultural Censuses of 1960, 1977, and 1983 and the Population Censuses of 1961, 1974 and 1981. These census statistics provide most of the necessary ingredients for making a comprehensive evaluation of the process of change in various types of households over a period of 23 years. However, in order to do this in a consistent manner, the comparability of data among these censuses has to be ensured carefully. The first and the obvious comparability question arises from the fact that the agricultural and population censuses were conducted at different points in time. Therefore, pooling of agricultural census with population census can be done only after they are adjusted for the difference in time factor. This adjustment is performed by upgrading the population and household data in 1981 population census to the 1983 level for pooling with 1983 Agricultural census using the average growth rates between 1974 and 1981. Similarly the 1961 population census was adjusted backward to the 1960 level using the average growth rates between 1961-74. The 1974 population statistics were likewise upgraded to the 1977 level using the 1974-81 average growth rates before pooling with 1977 agricultural census. Generally, the population statistics in the population census were adjusted upwards by the Bureau of Statistics for under-counting. These adjusted figures are used in this analysis instead of the original estimates.

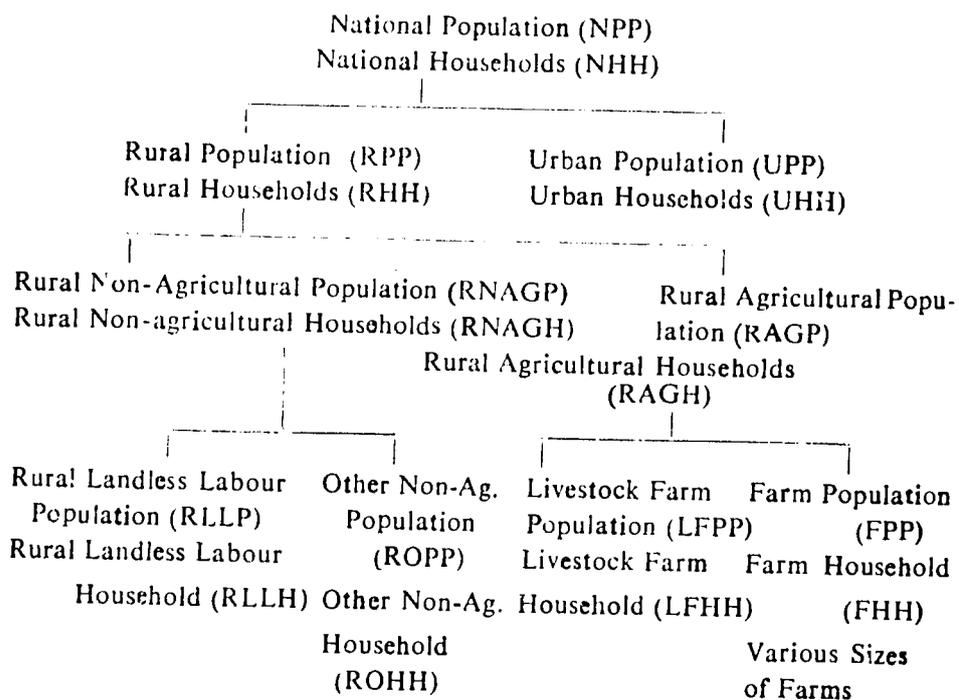
The other aspects of comparability of data between agricultural and population censuses are the sample coverage and definitions. Definitions, for

example of urban and rural areas, can make considerable divergences and are carefully taken into consideration as clarified below. The difference in sample sizes do not appear to be a serious problem as it appears from the remarkable consistency in estimates of agricultural population and agricultural labour force as obtained in population and agricultural censuses of 1960, and 1983. The fact that all the censuses have been conducted by the same agency has contributed considerably towards the consistency between population and agricultural censuses.

**Definitions**

Definitions of the following terms, arranged according to the order of aggregations, are important in the paper.

National Population and Household are the sums of urban and rural population and households. A household is defined in the same way both in the population census and agricultural census, although definition of household matters less in population census than in agricultural census. It is defined as a "group of persons normally living together maintaining a family or family like relations and eating from a common arrangement of cooking." A household may be a one-person or a multi-person unit. Total population is a simple product of household numbers and household size.



*Rural and Urban Areas.* Urban areas are defined to include those population settlements which have municipalities or exceed a population of 6,000. Both the agricultural and population censuses follow this definition. The 1983 agricultural census covered both urban and rural areas but the report of agricultural census was based on rural households alone. The number of rural households in the 1983/84 agricultural census was found to be 13.818 million. The comparable figure in the 1981 population census was 13.407 million. Adjusting for the time gap between the two censuses, it appears that the two figures are remarkably consistent.

Rural non-agricultural population and households include those who are not in agriculture but included in rural statistics. Agricultural households include farm households and livestock households. Farm households are those that operate (not necessarily own) land for cultivation. Livestock households operate no land but manage a given size of livestock (cow, poultry, etc.). Therefore, non-agricultural rural households operate no land. This category is further subdivided into landless labour households and other rural households. The first sub-category is called landless in the sense that they operate no land. They are not only landless but depend on the sale of their labour as primary source of income. The second sub-category also does not operate any land but sale of labour is not their primary source of income. Their primary source of income include various types of rural industries, trades, and services and rents. They represent the residual category in the framework of this paper.

The farm households are subdivided into classes according to the farm sizes measured in acres. These are (1) under 0.5 acres, (2) 0.5 to under 1.0 acres, (3) 1.0 to under 2.5 acres, (4) 2.5 to under 5.0 acres, (5) 5.0 to under 7.5 acres, (6) 7.5 to under 25.0 acres and (7) 25.0 acres and above.

The method of projection is based on natural growth in population<sup>1</sup> and internal migration. First total population (NPP) is projected on the basis of some growth rate, explained in appropriate places. This total population is then allocated to urban (UPP) and rural (RPP) on the basis of estimated share of urban population in the total. Suppose the total urban population thus estimated is  $UPP_{2005}$  and the estimated urban population on the basis of natural growth is  $UP_{2006}$ , then the number of persons migrated to urban from rural areas ( $M_{2006}$ ) is

$$M_{2006} = (UPP_{2006} - UP_{2006}).$$

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<sup>1</sup>The natural growth rate of total population is the weighted average natural growth rates of urban and rural population.

The estimate of projected rural population is obtained by deducting projected urban population ( $UPP_{2006}$ ) from the projected total population ( $NPP_{2006}$ ). This rural population is then allocated to various sub-categories on the basis of assumptions elaborated later but briefly mentioned here.

Rural non-agricultural population ( $RNAGP_{2006}$ ) is obtained by deducting rural agricultural population ( $RAGP_{2006}$ ) from total rural population ( $RPP_{2006}$ ). Rural agriculture population consists of population in farm households (FHH) and livestock households (LFHH). A Markov chain framework is employed to project the farm households and population for the year 2006. The transition probability matrix for this purpose is based on 1960 and 1983 agricultural census data. The rationale for employing Markov chain is explained in the relevant section. Livestock households and population are projected on the basis of linear growth trend for this sub-category as indicated by 1960 and 1983 census data with a slight acceleration of this rate on consideration of increasing income effect. However, livestock households produce only a small part of the total livestock production. Farm households that combine livestock and crop production as mixed and complementary enterprises in the agriculture of Bangladesh produce bulk of the livestock products. The livestock households are mostly rural landless who are forced out of farming due to disintegration of farms and undertake livestock raising as a mode of living.

The rural non-agricultural population consists of purely labour households (RLLH) and other non-agricultural households (ROHH) doing miscellaneous non-agricultural jobs. The projection for this ROHH is based on linear trend with a slight acceleration in the rate on consideration of increasing commercialization in the rural sector. The projection for the RLLH is made as residuals, deducting  $ROPP_{2006}$  from  $RNAGP_{2006}$ . It is clear that this procedure of allocation among sub-categories under rural non-agricultural households is somewhat arbitrary. This arbitrariness may make the projections of various sub-categories under  $RNAGP$  somewhat tenuous. But most of these sub-categories consist of households that are landless and depend on non-agricultural activities as a means of livelihood. They constitute the rural poor of Bangladesh along with small farmers and livestock households.

The estimates of households are derived from the population estimates, dividing population by family size. Family size of farm households are based on the relation between farmsize (measured by land area) and family size as reflected in census data. Other family size estimates are also based on census data and inter-censal changes in family size.

### III. INTERCENSAL CHANGES IN POPULATION AND HOUSEHOLDS Annual Growth Rates in Households and Population

The changes in the number of various categories of households and population are shown in Tables I and II. In Table I, the annual growth rates are shown while shares of each category in the total are presented in Table II.

TABLE I  
ANNUAL GROWTH RATES OF POPULATION AND VARIOUS TYPES OF  
HOUSEHOLDS DURING INTERCENSAL YEARS, BANGLADESH

Items	1960-77 (%)	1977-83 (%)	1960-83 (%)
1. Total Household numbers	2.80	2.68	2.77
2. Total Population	2.49	2.25	2.43
3. Urban Household numbers	4.85	15.42	7.61
4. Urban Population	6.01	11.30	7.39
5. Rural Household numbers	2.66	1.12	2.26
6. Rural Population	2.24	1.02	1.92
7. Rural Non-Agric. Households	7.31	-13.71	1.82
8. Rural Non-Agric. Population	9.28	-19.29	1.83
a) Rural Landless Labour Households	7.08	-13.71	1.65
b) Rural Landless Labour Population	9.20	-19.74	1.65
c) Other Rural Households	10.16	-15.10	3.57
d) Population in Other Rural Households	10.16	-15.10	3.57
9. Agricultural Households	0.34	8.12	2.37
10. Agricultural Population	0.10	7.13	1.93
a) Livestock Households	3.56	10.36	5.33
b) Population in Livestock Households	3.56	10.32	5.32
c) Farm Households	0.11	7.89	2.14
d) Farm Population	-0.07	6.89	1.75

Source : Computed from Census data.

The most glaring feature of the growth rates in Table I is the very unlikely negative rates of growth of households and population in the rural non-agriculture and its sub-categories between 1977 and 1983 but high positive growth rates between 1960 and 1977 for the same classes. In case of farm households and population, a negative growth rate in population (-0.07) and a small growth rate in household members (0.11) between 1960 and 1977, contrast oddly with a high positive growth rates between 1977 and 1983. This oddity raises doubt about the reliability of 1977 data. This odd feature is also reflected in the low share of farm households and population and very high share of rural non-agricultural households and population in 1977 (Table II). The growth rates in all categories of households and population between 1960 and 1983, however, show a normal pattern.

TABLE II  
**CHANGING SHARES OF VARIOUS SUB-GROUPS IN THE TOTAL  
 POPULATION AND HOUSEHOLDS, (%)**

Items	1960	1977	1983
1. Share of urban in total households	5.10	7.24	15.54
2. Share of urban in total population	4.92	8.94	15.39
3. Share of rural in total households	94.90	92.76	34.46
4. Share of rural in total population	95.08	91.06	84.61
5. Share of non-ag. in rural households	21.32	46.96	19.29
6. Share of non-ag. in rural population	11.65	38.58	11.41
7. Share of landless labour households in non-agric. households	92.77	89.19	89.19
8. Share of landless labour in non-ag. population	92.58	91.38	88.92
9. Share of other non-ag. household in total non-ag.	7.23	10.81	10.80
10. Share of other non-ag. population in total non-ag. population	7.42	8.62	11.08
11. Share of agricultural households in rural households	78.68	53.04	80.71
12. Share of agricultural population in rural population	88.35	61.42	88.59
13. Share of farm households in rural households	74.72	48.42	72.70
14. Share of farm population in rural population	85.30	57.61	81.94

Source : Computed from Census data.

One of the principal reasons for this odd phenomenon is definitional. As would be shown soon, the farm group operating an area under 0.5 acres represent households that are difficult to distinguish from labour households. Most of the farms under this group were counted out of farm households in 1977 agricultural census but not in others. This happened because of the introduction of a more rigorous definition of farms under 0.5 acres in the 1977 Agricultural Census, see (BBS 1986). The appendix table will show that the number of farms under 0.5 acres was 803 thousand in 1960 and only 342 thousand in 1977 but 2,417 thousand in 1983. This obviously is an unlikely trend.

The growth rates in various categories of population and households, shifting the farm size group under 0.5 acres to rural non-agricultural category and under the sub-category of landless labour households, are shown in

Table III. It will be seen from this table that by treating farms under 0.5 acres as rural non-agricultural (i. e., landless labour households), the negative growth rates of these categories for the period 1977-83 and similarly large positive rates for 1960-77 become much smaller than in Table I, but nevertheless the negative rates persist. There are reasons to believe that the concentration of landless labour households in rural areas increased sharply in mid seventies which gradually tapered off later. During the 1974 famine, large scale transfer of land small and marginal farms is a recorded fact (Alamgir 1976). Moreover, after the 1971 civil war and the 1974 famine, the urban sector did not yet develop the resilience to absorb the landless mass from the rural areas. As a result the growth in urbanization is found to be slower in 1960-77 compared to the accelerated growth rate during 1977-83, thus reducing rural concentration.

TABLE III  
ALTERNATE<sup>2</sup> ESTIMATES OF ANNUAL GROWTH RATES OF HOUSEHOLD  
AND POPULATION DURING INTERCENSAL YEARS

Categories	1960-77 (%)	1977-83 (%)	1960-83 (%)
1. Total households	2.80	2.68	2.77
2. Total population	2.49	2.25	2.43
3. Urban households	4.85	15.42	7.61
4. Urban population	6.01	11.30	7.39
5. Rural households	2.66	1.12	2.26
6. Rural population	2.24	1.02	1.92
7. Rural non-agric. households	5.41	-3.87	2.99
8. Rural non-agric. population	7.30	-8.30	3.23
a) Rural landless labour household	5.08	-3.04	2.96
b) Rural landless labour population	7.10	-7.91	3.21
c) Other rural households	9.67	-13.71	3.57
d) Other rural population	10.16	-15.10	3.57
9. Agricultural households	0.32	5.23	1.60
10. Agricultural population	0.32	5.23	1.60
a) Livestock households	3.56	10.36	5.33
b) Population in livestock household	3.56	10.32	5.32
c) Farm households	0.61	4.24	1.55
d) Farm population	0.15	4.82	1.37

Source : Computed from Census data.

<sup>2</sup>The alternate estimates are based on shifting the farm size group 0.5 acres to non-agricultural rural and under it to landless labour sub-category found in all agricultural censuses.

The growth rates in households and population between 1960 and 1983 show the normal trend. Based on Table III, it appears that even though the overall growth rates in households (population) between 1960 and 1983 has been 2.77 (2.43) percent, farm households (population) has been increasing at 1.55 (1.37) percent per annum. However, urban households (population) has increased faster—at 7.61 (7.39) percent per annum. Similarly, rural non-agricultural households (population), most of them being landless labours, have also been increasing fast—at about 2.99 (3.23) percent annually.

The difference between growth rates in population and household represents the rate of change in family size (i.e., persons in a family). Looking at Tables I and III, it is clear that family size has declined for farm households, but urban households do not show any significant change between 1960 and 1983. The decline in the family size of rural households and agricultural households over the period is a reflection of the decline of farm households.

#### Farm Households and Population

Agriculture in rural areas, particularly the farm sector, is the principal source of the accelerated growth in non-farm households and population. This non-farm population may have a strong or a weak tendency to remain in the countryside or migrate out to urban areas depending on the relative incentives involved. The scope of this paper does not include any analysis of such determinants of rural-urban migration. However, what is important is the unfolding of the process and measuring of the speed of transition of farms into non-farm households.

The rates of change in number of farm households and the area of land under various farm size-groups are shown in Table IV. This table shows

TABLE IV  
AVERAGE FARM SIZE AND ITS CHANGE OVER TIME

Size Group	Average Size 1960	Average Size 1977	Average Size 1943	Percentage Change in Size <sup>a</sup>		
				1960-77	1977-83	1960-83
				(acres)		
Under 0.5 acres	0.255	0.319	0.257	25.1	-19.4	0.78
0.5 to under 1.0	0.724	0.728	0.701	0.5	-3.7	-3.2
1.0 to under 2.5	1.685	1.667	1.597	-1.06	-4.20	-5.2
2.5 to under 5.0	3.551	3.498	3.447	-1.49	-1.46	-2.93
5.0 to under 7.5	6.003	5.973	5.908	-0.50	-1.09	-1.58
7.5 to under 25.0	11.466	11.237	10.994	-2.00	-2.16	-4.11
25.0 and above	40.152	31.042	36.059	-22.69	16.16	-10.19
All Farms	3.539	3.510	2.258	-0.83	-35.67	-36.20

Note: <sup>a</sup>Note that these are changes over a number of years and not annual rates of change.

that both households and farm area under size groups 5.0 to 7.5, 7.5 to 25.0 and 25 acres and above have declined absolutely (showing a negative growth rate). In contrast all size groups below 5.0 acres show an absolute increase in households as well as farm area. Looking at the change between 1960 and 1983, it seems that the national average farm size has declined very rapidly (by about 36 percent) compared to size-specific average sizes (Table IV). The average size for the smallest size group has changed little. This is because of the fact that a farm below an average area of 0.25 to 0.30 acre is not economically sustainable for a family of 5 members. Of course, the threshold of a viable size depends on farm productivity (i. e., technology) as well as availability of non-farm income opportunities for under-employed family members to supplement farm income. Technological progress in agriculture has been quite impressive during the last two decades. Similarly aggregate income from non-farm, particularly the non-formal sector, has also increased fast during the last decade. But these developments have not resulted in any change in the threshold of a viable farm size as is evident from 1960 and 1983 census data.

Beyond this smallest group of farmers, both households and farm areas have moved *pari-passu* in downward direction so that the average farm size in each group have declined less rapidly. In fact, average farm sizes in each group would appear to be relatively stable if annual growth rates were the indicators. The difference between the annual growth rates in farm areas and household numbers would provide the growth rates in average farm size in each group. For example, for the 7.5 to 25.0 size group, the households declined at 2.29 percent annually and the farm area declined at 1.38 percent. Therefore, the farm size in this group has declined by only 0.19 percent annually.

The shares of size-groups in the number of total households and farm acreage at the three census years are shown in Table V. Small farms constituted 52 percent of all households operating only 16 percent of total farm area in 1960. By 1983 the proportion of small farms went up to 70 percent. But their share of farm area also went up from 16 to 29 percent. In case of medium farms, it appears that this proportion in the total farm households declined from 38 to 25 percent between 1960 and 1983. But the share of medium farms in total farm area did not change significantly. Again, large farms suffered a loss both in these shares of households and farm areas. The entire pattern is represented by gradual downward movements of farms which seems to have been caused by population growth and splitting of families along with sharing of farm land among split families. The almost perfect

TABLE V  
SHARES OF SIZE-GROUPS IN TOTAL HOUSEHOLDS AND AREAS (%)

Size Groups	Households			Areas		
	1960	1977	1983	1960	1977	1983
Under 0.5 acres	13.07	5.47	24.06	0.94	0.50	2.74
0.5 to under 1.0	11.24	10.36	16.37	2.30	2.15	5.08
1.0 to under 2.5	27.32	33.90	29.92	13.01	16.10	21.16
2.5 to under 5.0	26.31	29.25	17.98	26.40	29.15	27.45
5.0 to under 7.5	11.38	11.60	6.74	19.30	19.74	17.64
7.5 to under 25.0	10.26	9.05	4.77	33.26	28.96	23.22
25 and above	0.42	0.38	0.17	4.80	3.39	2.70
All Farms	100.0	100.0	100.0	100.0	100.0	100.0
Small Farms	51.63	—	70.35	16.25	—	28.90
Medium Farms	37.69	—	24.72	45.70	—	45.09
Large Farms	10.68	—	4.94	38.06	—	25.92

Source : Computed from Agricultural Censuses.

inverse relation between farm sizes and growth rates of households under size groups is a strong evidence of the process of disintegration of farms under population pressure.

#### IV. A PERSPECTIVE OF HOUSEHOLDS BY THE YEAR 2006

Changes in population and households occur due to natural growth rates and migration. For the national picture, natural growth rate, which is a function of natural birth rates and mortality rates, is the single most factor. But for various categories like urban, rural, farm, non-farm etc. migration from one to the other is important. We have shown that the main source of such internal migration is the farm sector, i. e., from farm to non-farm rural to urban.<sup>3</sup> This process seems to have a substantial generality as a part of economic transition (Mellor 1974). We therefore begin with the projection of the structural facets of farm sector and then incorporate the natural growth in population to arrive at the figures of households in other sectors.

<sup>3</sup> It is true that there may be some migration from the upper end of farm to urban sector directly, particularly persons from well-to-do families getting education and then migrating to urban areas. This process generally reduces family size (i. e., one or two sons going out alone to urban areas) with little effect on household numbers. The cases of an entire farm family leaving farming for urban life would constitute an insignificant proportion of farm population and households.

It is assumed that the total population will grow annually at 2.35 percent and urban population will grow at 1.856 percent during 1983-2006. These are growth rates in recent years as estimated by the Bureau of Statistics (BBS 1986). Population growth rate in Bangladesh has slowed down. The third five-year plan assumes that the population growth rate in 1990 will come down to 1.8 percent. Some microstudies lend credence to this direction if not the absolute rate (Rabbani & Hossain 1983). But the assumption we hold to in the context of this paper is valid on two grounds. First, the emphasis in the paper is the concern for labour identified with the attributes related to household categories. Even though the population growth rate may decline in the future the labour population is not likely to be so. The bulk of persons who would join the labour force during the next 23 years are already born. In fact an increase in the participation rate in the labour force may accelerate the growth in labour force.<sup>4</sup> Second, we are emphasizing relatively more on households than on population. A decline in the growth rate in population will generally imply smaller proportion of children per family and it is the increase in adult members that cause a split in household. The changes in family size will of course imply a larger per capita income from a given growth of average income than would be the case with a higher population growth rate.

#### Method of Projection for Farm Sector

Two sets of forces—demographic and economic—largely determine the number of people that a static land base can provide sustenance in the farm sector of Bangladesh. Growth of population, particularly the work force, in farm families accelerates the process of disintegration of farm family holding. Economic forces exert pressure on those farm holdings that reach the threshold of subsistence to migrate out of farming. This subsistence threshold is determined by the dynamism of agricultural technology and degree of access of such small farms to non-farm sources of income without disruption of farm work. It is hard to predict the future course of development in these two sets of forces and, more so, to measure the effect of such changes on the structure of farm. As most past studies on such issues have revealed, it is assumed in this paper that farm structure in Bangladesh will continue to evolve during 1983-2006 as it has undergone during 1960-83. This leads to the technique of Markov chain framework for projecting the transition of farm number and area under various sizes for 1983 to 2006.

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<sup>4</sup> The participation rate in labour force, as conventionally measured, is quite low (about 35 percent), because of low participation rate of female labour force due to cultural, economic, religious factors. This is not an unambiguous measure; female unemployment in activities within the house is not believed to be less than the male unemployment outside the house.

Let us assume 4 categories of farms (measure by acre size) starting from the lowest to the highest ( $n = 1, \dots, 4$ ). Let us also assume the following distribution of areas under each category at times  $t_1$  and  $t_2$ .

$n$	$t_1$	$t_2$
	(Land Area)	(Land Area)
1	10	30
2	30	25
3	30	25
4	30	20
<b>Total Acres</b>	<b>100</b>	<b>100</b>

At  $t_1$ , the category 1 had 10 acres which went up to 30 acres at  $t_2$ . Therefore, 20 acres must have moved out from the next higher category. It is assumed that no land can move out from category 1 to non-agricultural sector. If 20 acres moved out from category 2, then, in the absence of any area moving out from category 3 to 2, the area in category 2 would have been 10 at  $t_2$ . But we observe 25 acres in  $n_2$  at  $t_2$ . Therefore, 15 acres must have moved out from 3 to 2. In this way, we can find out the acreage that moves out from  $n$  to  $n-1$  category. This provides a basis for constructing a matrix of probabilities of moving out and staying in a category. For example, the probability of moving out is zero and staying is 100 in category 1, in our example. Similarly the probability of moving out is  $(20/30)100 = 66.6$  and staying-in is  $100 - 66.6 = 33.4$  in category 2. We estimate these probabilities for all categories following this procedure. Once we develop this probability matrix based on the inter-category area movements between 1960 and 1983, we can project the distribution of acreage in  $n$  categories in the year 2006 by multiplying this probability matrix with the vector of land distribution in the same categories in the year 1983.

The above example with 7 size groups is presented in algebraic form as follows. For further information on the methodology, see (Judge & Swanson 1961).

$$A = (A_1 A_2 A_3 A_4 A_5 A_6 A_7) \text{ \{the initial row vector\}}$$

$$P = \begin{pmatrix} PS_{11} & 0 & 0 & 0 & 0 & 0 & 0 \\ PO_{21} & PS_{22} & 0 & 0 & 0 & 0 & 0 \\ 0 & PO_{32} & PS_{33} & 0 & 0 & 0 & 0 \\ 0 & 0 & PO_{43} & PS_{44} & 0 & 0 & 0 \\ 0 & 0 & 0 & PO_{54} & PS_{55} & 0 & 0 \\ 0 & 0 & 0 & 0 & PO_{65} & PS_{66} & 0 \\ 0 & 0 & 0 & 0 & 0 & PO_{76} & PS_{77} \end{pmatrix} \text{ \{ the transition probability matrix \}}$$

(Note that there is no moving out from 1—the lowest size group)

$$A^* = (A^*_1 \ A^*_2 \ A^*_3 \ A^*_4 \ A^*_5 \ A^*_6 \ A^*_7) \ \{\text{the final row vector}\}$$

$$A^* = A \times P$$

where  $A$  = the initial distribution of land area in 7 size groups

$P$  = the matrix of probabilities for staying-in (PS) and moving out (PO) from  $n$ th class.

$A^*$  = the projected distribution of land in 7 size groups.

The assumption of moving out from  $n$  to  $n-1$  category may appear to be restrictive, because area can move from  $n$  as well as from  $n+1$  to  $n$  category. We do not have detailed information on movement among various categories. Therefore some sensitivity analysis is done with various assumptions, e. g., 80 percent of total out-migration coming from  $n$ , and 20 percent from  $n+1$  categories to  $n-1$  category. The result indicates that changes in this assumption do not make any substantial difference.

The total land area under farming in the country is assumed to remain constant in the projection. This is an assumption not required technically but considered to be a reality in Bangladesh. Between 1960 and 1983 total farm area has increased slightly mainly due to drawing all culturable waste under cultivation. Little scope exists for further expansion of land base in the future. Whatever expansion may seem possible would be counter-balanced by land taken out of farming due to infrastructural development and growth of homesteads with the increase of population.

Once we have projected the farm areas by size categories, we can estimate the number of households in each category by dividing the area in a category by the average farm size in that category. As mentioned earlier, the average farm sizes in lower categories are more stable than those in higher categories. In general, group specific farm sizes are more stable than national average size. Such results obtain because of increasing proportion of farm households and land in small size categories at the expense of large ones. Our projections include a scenario with decreasing group-specific farm sizes consistent with the trend between 1960 and 1983.

#### **Farm Households in 2006**

The projected pattern of households in the farming sector is shown in Table VI. In this table only the shares of different size groups in the total are presented; the absolute numbers are given in Table A 2.

It will appear that the difference among various projections is quite small. By 2006, the proportion of small farms (under 2.5 acres) would increase to 83 percent compared to 70 percent in 1983. This small farm group will

TABLE VI  
PROJECTED SHARES OF SIZE GROUPS OF TOTAL HOUSEHOLDS AND  
FARM AREAS YEAR 2006(%)

Size Groups	Projection 1		Projection 1a		Projection 2		Projection 2a	
	House-holds	area	House-holds	area	House-holds	area	House-holds	area
Under 0.5 acres	39.14	6.73	38.00	6.73	38.55	6.52	37.42	6.52
0.5 to under 1.0	18.28	8.55	18.48	8.55	17.97	8.27	18.15	8.27
1.0 to under 2.5	25.27	26.95	26.09	25.95	25.88	27.15	26.71	27.15
2.5 to under 5.0	11.65	26.81	11.74	26.81	11.76	26.62	11.85	26.26
5.0 to under 7.5	3.42	13.50	3.40	13.50	3.54	13.73	3.52	13.73
7.5 to under 25.0	2.17	15.93	2.21	15.93	2.24	16.20	2.20	16.20
25.0 and above	0.07	1.53	0.08	1.53	0.06	1.51	0.06	1.51
All Farms	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Small Farms	82.69	42.23	82.57	42.23	82.40	41.94	82.28	41.94
Medium Farms	15.07	40.31	15.13	40.31	15.30	40.35	15.37	40.35
Large Farms	2.24	17.46	2.29	17.46	2.30	17.71	2.35	17.71

**Note :**

Projection 1 : Constants group specific farm size, and movement only from upper to next lower class.

Projection 1a : Decreasing group specific farm size and movement as in 1.

Projection 2 : Constant group specific farm size and movement from class n (80%) and class n+1 (20%) to class n-1.

Projection 2a : Decreasing group specific farm size and movement as in 2.

operate about 42 percent of farm area. Medium farm group (2.5 to 7.5 acres) would constitute about 15 percent of farm households and 40 percent of the farm area. Proportion of large farms (25 acres and above) would be reduced to 2 percent but operating about 18 percent of the farm area. The national average farm size will come down to 1.46 from 2.26 acres in 1983. The number of total farm households will increase from 10.045 million in 1983 to about 15.4 million including farms under 0.5 acres in size.

**Projection for Non-Farm Households**

Projection for non-farm households is made on the basis of migration from farm households and natural growth of population and households in non-farm sectors. There are more than one categories of non-farm households as elaborated in previous sections. Inter-migration among these categories is a matter of relative growth in job opportunities. Assumptions relating to this inter-migration among non-farm categories of households would be clarified in each case as we proceed with the analysis.

**Migration from Farm Households**

The migration from farm sector is estimated on the basis of natural growth rate of population and households and deducting the number of households retained on farm from such an estimate.

The natural growth rate of population in farming sector is assumed to be the same as that in the rural sector. The studies by the Bureau of Statistics show that the average annual natural growth rate (crude birth rate minus crude death rate) of population in rural area was 2.44 percent and in urban area 1.86 percent during the period from 1980 through 1984 (BBS 1985). To convert the natural growth in population into that for households, the estimate of family size (or household size) as reflected in Table VII is used.

TABLE VII

**PROJECTED AVERAGE FAMILY SIZE IN 2006 FOR FARM GROUP**

Size Group	Family Size (1983) (persons)	Number of Farms (1983) (thousands)	Family Size (2006) (persons)	Number of Farms (2006) (thousands)
Upper 0.5 acre	5.0	2.41	5.0	5.881
0.5 to under 1.0	5.5	1.644	5.3	2.860
1.0 to under 2.5	6.5	3.005	6.2	4.037
2.5 to under 5.0	7.5	1.806	7.3	1.817
5.0 to under 7.5	8.2	677	8.1	527
7.5 to under 25.0	11.0	479	10.5	343
25.0 and above	16.0	17	14.4	11
Average	6.5	10,045	5.87	15,475

In the table, the group specific family sizes for 1983 are obtained from Agricultural Census. For 2006, these family sizes are adjusted for the change in group specific average farm size. The overall family size in farms was 6.5 in 1983 which comes down to 5.87 in 2006. This reduction in overall family size in the farm sector results primarily from the increasing proportion of smaller farms in 2006 compared to 1983. The changes in group specific family sizes are quite small.

On the basis of natural growth rate of farm population, the total farm population in the year 2006 would be 114,443 thousand, before migration. But 15,475 thousand farm families (i.e., 90,839 thousand persons) remain on farming. Therefore, 23,604 thousand migrate to non-farming sector. Assuming that livestock households (population) would grow at 4 percent per annum, about the rate between 1960 and 1983, and given the family size for this category, we can find out how many persons and households of the surplus from

farms would be absorbed in this category, in addition to absorbing pressure arising from natural growth in this category. Once we have estimated this, the net transfer from agriculture to other sectors are automatically determined.

#### **Projection for Urban Sector**

The share of urban population is assumed to be between 21 to 23 percent of total population in 2006. This share is the result of natural growth in urban population of 1.86 percent per annum and migration from rural areas. It is true that urban growth rate was more than 7 percent during 1960-83. But such growth in the next two decades is unlikely. The basis of the growth in the share of urban population is as follows.

Comparison of inter-censal changes show that urban population grew at 6.01 percent annually during 1960-77, at 11.30 percent annually during 1977-83, and at 7.39 percent annually during 1960-83. Clearly, the growth during 1977-83 was faster than either 1960-77 or 1960-83. This is considered to be due to an unusual decline in urbanization in the mid-seventies, during and just after the civil war, because of the civil war related disruption in non-agricultural activities. During the years from 1972-74, the share of non-agricultural sector declined from about 47 percent in 1968-70 to about 41 percent and the share of agriculture increased from 53 to 59 percent. This happened in the course of falling production of both agriculture and non-agriculture sectors, the latter experiencing a much sharper fall than the former.

As a matter of fact, it can be argued that urbanization under normal circumstances can be seen as a function of growth in non-agricultural production including services. In terms of growth rate, urbanization is, however, likely to grow at an increasingly slower rate as the share of urban population in the total expands. Since most, if not all, non-agricultural activities are generally located in urban areas including rural towns, and people migrate to urban areas through involvement in urban related jobs, the prospect of growth in non-agricultural production is a primary basis for projecting the future dimension of urban population in the total. This is what is done here for arriving at a reasonable estimate of urbanization.

Assume that the economy is divided into two sectors—agriculture and non-agriculture ; all services are included in the non-agriculture. The share of agriculture in GDP was 48.5 percent and that of non-agriculture 51.5 percent in 1983. Further, it is assumed that agriculture may grow at either 2.5 percent or 3.0 percent annually during 1983-2006. Similarly, growth rate of

non-agricultural sector is assumed as 4.5 or 6.0 percent per annum for the same period. These assumptions compare with the actual growth rates of 3.2 percent for agriculture and 5.5 percent for non-agriculture during 1972/73 through 1983/84. For a longer period like 1960/61 through 1983/84, such growth rates of trend production are likely to be even smaller. Calculation of growth rates with first half of the seventies as the base of trend tends to overstate the growth rate because of the fall in production during these years of turmoil in Bangladesh. The production of agriculture and non-agriculture sectors in 2006, with these growth rates, can be calculated as follows :

$$Xa_{2006} = Xa_{83}(1 + \gamma'a)^{23} \quad (1)$$

$$Xn_{2006} = Xn_{83}(1 + \gamma'n)^{23} \quad (2)$$

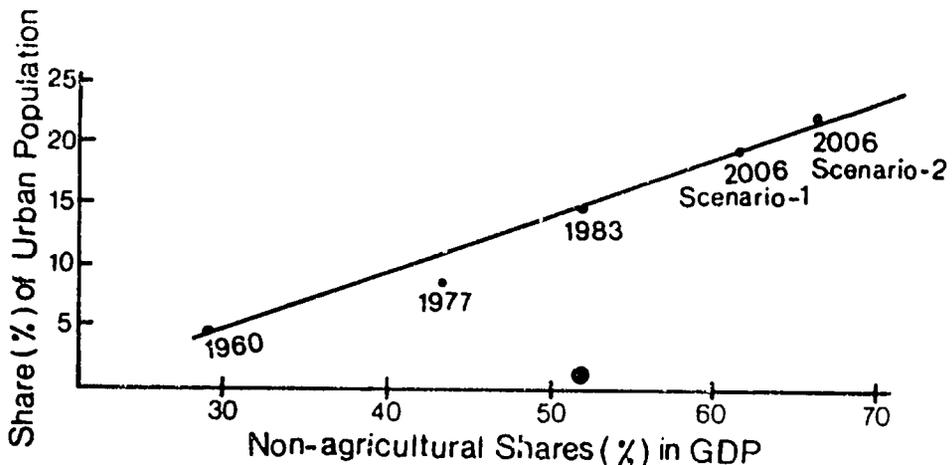
where  $Xa$  = agricultural production

$Xn$  = non-agricultural production

$\gamma'a$  = agricultural growth rate

$\gamma'n$  = non-agricultural growth rate

On this basis, the sectoral shares of GDP in 2006 can be estimated. Next, it seems logically right to extrapolate the share of urban in the total population on the basis of the historical relation between shares of non-agricultural sectors in GDP and the shares of urban in total population. This is shown in the following graph.



The graph represents the estimates of the shares of non-agriculture in GDP and the shares of urban in total population for 1960, 1977 and 1983, and extrapolations of the same for the two scenarios with different growth rates in GDP. The results are shown in Table VIII.

TABLE VIII  
ACTUAL AND PROJECTED SHARES OF NON-AGRICULTURAL GDP  
AND URBAN POPULATION

Shares (%)	1960	1977	1983	2006 Scenario 1	2006 Scenario 2
Share of Agriculture in GDP	70.5	53.4	48.5	38.7	33.4
Share of Non-agricul- ture in GDP	29.5	46.6	51.5	61.3	66.6
Share of urban in total population	5.0	9.9	15.4	20.65	23.3

**Source :** GDP Shares for 1960 are taken from Planning Department, *An Examination of Sectoral Allocations between East and West Pakistan* (mimeo), Dhaka, 1963. GDP shares for other years from Bangladesh Bureau of Statistics, *Statistical Year Books 1979, 1985*, Dhaka.

This exercise indicates if Bangladesh can sustain its best historical records of long term growth in non-agricultural production, it is likely that the share of urban in total population will reach a figure between 21 and 23 percent in 2006. This will imply an annual growth rate in urbanization of about 3.5 percent. Of course, the tempo of non-agricultural production may be heightened during the next two decades. Moreover, to see the implication, of such production and the associated acceleration in urbanization, a hypothetical exercise assuming 5 percent rate of growth in urban population is also presented.

#### Projection for Rural Non-Agricultural Households

First, rural non-agricultural population is projected on the basis of a natural growth rate of 2.44 percent per annum. To this is then added the migration from farm population. Then the migration to urban sector is subtracted from this to arrive at the population projection for the rural non-agricultural sector. Of the two sub-categories under rural non-agricultural sector, the projection for the "other rural non-agricultural" population is made on the basis of a natural growth in population of 2.44 percent annual and a migration rate such that population in this sub-category increases at an overall rate of 3 percent per annum. The projection for the second sub-category is made as a residual of the projected non-agricultural population after deducting the projected population in the second sub-category. The household members are derived by dividing the population with the group specific family size.

The results of the exercise on projection are shown in Tables IX and X. Table IX reflects the assumption of urban population growth rate of 3.7 percent while Table X reflects the assumption of 5 percent annual growth rate in urban population.

TABLE IX

**PROJECTED POPULATION AND HOUSEHOLDS IN DIFFERENT  
FARM AND NON-FARM CATEGORIES, 2006\***

Categories	Number in Thousands		Annual Growth Rate (%)	Shares of Total	
	1983	2006		1983 (%)	2006 (%)
1. Urban Population	14,495	33,946	3.7	15.39	20.97
2. Urban Households	2,543	5,955	3.7	15.54	19.90
3. Rural Population	79,688	127,951	2.06	84.61	79.03
4. Rural Households	13,818	25,237	2.62	84.46	80.91
5. Rural Non-Agric. Population	9,089	23,798	4.19	9.65	14.70
6. Rural Non-Agric. Households	2,665	6,982	4.19	16.29	22.38
a) Landless Labour Population	8,082	21,790	4.31	8.58	13.46
b) Landless Labour Households	2,377	6,408	4.31	14.53	20.54
c) Other Non-Agric. Rural Population	1,007	2,008	3.00	1.07	1.24
d) Other Non-Agric. Rural Households	288	574	3.00	1.76	1.84
7. Agricultural Population	70,598	104,153	1.69	74.96	64.33
8. Agricultural Households	11,153	18,255	2.14	68.17	58.52
a) Population in Livestock Households	5,306	13,314	4.00	5.63	8.22
b) Number of Livestock Households	1,108	2,779	4.00	6.77	8.91
c) Farm Population	65,293	90,839	1.44	69.33	56.11
d) Farm Households	10,045	15,475	1.88	61.40	49.61
9. Total Population	94,182	161,897	2.35	100.00	100.00
10. Total Households	16,361	31,192	2.80	100.00	100.00
11. Total Non-Farm Population	28,889	71,058	3.91	30.67	43.89
12. Total Non-farm Households	6,316	15,717	3.96	38.60	50.38

**Note :**

\*This table assumes a growth in urban population of 3.7 percent per annum (1.858 percent natural and the rest migration from rural).

TABLE X  
PROJECTED POPULATION AND HOUSEHOLDS IN DIFFERENT  
FARM AND NON-FARM CATEGORIES 2006\*

Categories	Number in Thousands		Annual Growth Rate (%)	Shares of Total	
	1983	2006		1983 (%)	2006(%)
1. Urban Population	14,496	45,777	5.0	15.39	28.28
2. Urban Households	2,543	8,031	5.0	15.54	26.96
3. Rural Population	79,688	116,120	1.64	84.61	71.72
4. Rural Households	13,818	21,758	1.97	84.46	73.04
5. Rural Non-Agric. Population	9,089	11,967	1.20	9.65	7.39
6. Rural Non-Agric. Households	2,665	3,503	1.19	16.29	11.76
a) Landless Labour Population	8,082	9,959	0.91	8.58	6.15
b) Landless Labour Households	2,377	2,929	0.91	14.53	9.83
c) Other Non-Agric. Rural Population	1,007	2,008	3.0	1.07	1.24
d) Other Non-Agric. Rural Households	228	574	3.0	1.76	1.93
7. Agricultural Population	70,598	104,153	1.69	74.96	64.33
8. Agricultural Households	11,153	18,255	2.14	68.17	61.28
a) Population in Livestock Households	5,306	13,314	4.00	5.63	8.22
b) Number of Livestock Households	1,108	2,779	4.030	6.77	9.33
c) Farm Population	65,293	90,839	1.44	69.33	56.11
d) Farm Households	10,045	15,475	1.88	61.40	51.95
9. Total Population	94,182	161,897	2.35	100.00	100.00
10. Total Households	16,361	29,789	2.61	100.00	100.00
11. Total Non-farm Population	28,889	71,058	3.91	30.67	43.89
12. Total Non-farm Households	6,316	14,314	3.56	38.60	48.05

**Note :**

\*This table assumes a growth in urban population of 5.0 percent per annum (1.858 percent natural and the rest migration from rural).

Comparing the two tables, it becomes obvious that the higher rural-urban migration (Table X) reduces the population of rural landless labour household rather drastically. With a growth rate of urban population by 5 percent, landless rural labour population and households increase only by 0.91 percent annually between 1983 and 2006. But with the lower rate of urbanization (Table IX), the rural landless labour population and households grow at about 4.2 percent annually. It is clear that the emphasis on the growth of landless households, measured as a percent of all rural households, can change drastically depending on rural urban migration. The basic concern should therefore be the increasing rate of surplus population and household from over-crowded farming sector, and the need for their gainful employment in non-farm sectors. The debate on rural landlessness that heated up the scene after the surveys in mid-seventies (Januzi & Peach & 1977) is a genuine concern, but its solution lies more in non-farm than farm sector. Out-migration from farming could be a healthy sign if this happens in response to better job opportunities in non-farm sectors. In the context of Bangladesh, non-farm incentives have not been the major inducement for the out-migration from farming. The challenge is then the creation of non-farm job opportunities that could match the outflow of surplus population from the farming sector.

Non farm population and households are expected to grow at about 3.5 to 4.0 percent annually compared to 1.44 percent growth rate in farm population and 1.83 percent for farm households. About half of the households in Bangladesh would be in the non-farm category by 2006. If job opportunities do not keep pace with this rate of growth of non-farm population and households, the principal urban centres of the country may look like a few spots of well-to-dos in an ocean of *bustees*.

The magnitude of the challenge for creation of wage employment is not perhaps fully reflected in the extent of growth in non-farm population and households. Because the farming sector would change its structure so that small farms would constitute about 83 percent of farm households, it may affect demand for hired labour in farming. The 1983 agricultural census shows that about 39.0 percent of all rural households are agricultural labour households.<sup>5</sup> Of the total agricultural labour households, 57 percent are again operators of farms as the secondary sources of income. Most small and a significant proportion of medium farms are in fact labour households, with farms providing a secondary source of income. Similarly, more than half of the landless labour households derive their income working as agricultural labour.

<sup>5</sup>Agricultural labour household is defined as the household whose main source of income is wage income from working on some farms as hired workers.

A significant proportion of the "livestock households" may also derive a part of their income by working as labours on farms. The distinction between labour households in non-farm category and farm category is important in that the mobility of labour under farm category is more restrictive than that under non-farm category, mainly because of the seasonal nature of the demand for farm labour.

Because farming sector has been so important for providing employment, the question arises whether this would remain to be true in the future. The data in Table XI show that the intensity of hired labour in larger farm classes much higher than smaller ones. As the proportion of small farms would be increasing faster in the future, this would generate a declining effect on demand for hired labour in the farming sector, unless compensated by labour intensive technological progress.

TABLE XI  
THE PATTERN OF LABOUR USE BY SIZE OF FARMS, 1982

Size Group (acres)	Labour Days per Household			Labour Days per Acre of Cropped Land			Use of Hired Labour ( percent )
	Family Labour	Hired Labour	Total Labour	Family Labour	Hired Labour	Total Labour	
Small owner (up to 2.0)	68.7	33.7	102.4	37.6	18.5	56.1	32.9
Medium owner (2.01-5.0)	114.0	82.3	196.3	29.5	21.3	50.8	41.9
Large owner (5.01 and above)	159.4	218.3	377.7	20.3	27.8	48.1	57.8
All Farm Households	96.6	76.2	172.8	28.7	22.6	51.3	44.1

Source : IFPRI/BIDS. *The In-depth Study on the Development Impact of Food for Works Program, Bangladesh* (Washington, D. C. : 1985).

## V. POLICY IMPLICATIONS

Two policy thrusts emerge quite clearly from the analysis presented in the paper. The first relates to measures that will slow-down the process of out-migration from farming and the second relates to measures that will expand the scope of absorption of surplus farm population in the non-farm sector.

Policies to accelerate the pace of generation and diffusion of agricultural technology can slow-down the rate of out-migration from farming. If a given subsistence can be harvested from a smaller land area by application of technology, the threshold farm size that represents the point of out-migration from farming will slide down. However, with an increasing preponderance of tiny farms in the farming system, the task of diffusion of technology will also be

increasingly harder. Transfer of modern technology (e.g., irrigation based new seeds, fertilizers, etc.), distribution of credit, and delivery of extension service are known to be difficult in a small farm system. Therefore, even though an increasing emphasis on agricultural technology is desirable, this thrust alone will not be a sufficient solution.

Development of non-agricultural income and employment opportunities appears to be the critical requirement for matching the emerging problems. How to create more non-agricultural employment and income with the given resources is, therefore, a question of strategic importance. Direct actions by government in the form of public sector industrialization have not generally been an effective solution. Price policies designed to make capital dearer relative to price of labour have also not been a feasible and effective solution. It will be argued here, although the empirical underpinnings of the arguments are left to a number of on-going research projects at the International Food Policy Research Institute (IFPRI), that infrastructural development, particularly rural infrastructure, is the key factor in the creation of non-agricultural income and employment at an accelerated pace. Preliminary results of country studies at IFPRI indicate very substantial effects, hitherto unrecognized, of infrastructural development, transfer of technology, and market development including factor markets. A comparative study of Korea and Taiwan, which had the same growth paths and historical background but achieved vastly different levels of rural non-farm employment and income, shows different degrees of infrastructural development. In Taiwan, about 80 percent of rural income is received from non-farm sources, compared to less than 48 percent in Korea. Seventy percent of farm households in Taiwan had access to electricity even in 1980 compared to only 13 percent in Korea. Density of paved roads in Taiwan was 76 kilometers per 1000 square kilometers in 1962 and 215 in 1972, while in Korea it was less than 10 in 1966 and still below 50 in 1975 (Saith 1986).

Of course, effect of infrastructural development does not consummate to its full potential without supplementary actions in policies that not only remove the constraints for widespread participation of individuals in economic activities, but also encourage such initiatives. Price policies meant for promoting labour-intensive techniques in production do not work effectively mainly because of numerous constraints related to infrastructural under-development.

Infrastructural development in rural areas stimulates dispersion of urban centres and industrial units in rural areas. When location of job opportunities are brought closer to farm communities, small farm families get easy access to jobs reducing their extent of under-employment. This is particularly

crucial for Bangladesh, and the current *Upazila* programme bears the potential of stemming the influx of landless population from rural to large urban centres like Dhaka, Chittagong and Khulna.

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Appendix

TABLE A.1  
DISTRIBUTION OF FARM HOLDING AND AREA BY SIZE GROUPS,  
1960, 1977 AND 1983

Farm-Size Class (acres)	1960		1977		1983	
	Farm Number	Area (acres)	Farm Number	Area (acres)	Farm Number	Area (acres)
<0.5 acres	803	205	342	109	2,417	622
0.5-<1.0	690	499	648	472	1,644	1,152
1.0-<2.5	1,677	2,826	2,121	3,536	3,005	4,799
2.5-<5.0	1,615	5,735	1,830	6,402	1,806	6,226
5.0-<7.5	698	4,193	726	4,336	677	4,000
7.5-<25.0	630	7,225	566	636	479	5,266
25.0 and above	26	1,043	24	745	17	613
All Farms	6,139	21,726	6,257	21,960	10,045	22,678

Source : Agricultural Censuses, 1960, 1977, and 1983.

TABLE A.2  
PROJECTED DISTRIBUTION OF FARM HOUSEHOLDS AND AREA  
BY SIZE GROUPS, 2006

Size Groups in Acres	Farm Numbers in Thousands	Area in Thousand Acres	Average Size in Acres
<0.5 acres	5,981	1,525	0.259
0.5-<1.0	2,860	1,940	0.678
1.0-<2.5	4,037	6,112	1.514
2.5-<5.0	1,817	6,081	3.346
5.0 <7.5	527	3,062	5.315
7.5-<25.0	343	3,613	10.542
25.0 and above	11	345	32.384
All Farms	15,476	22,678	1.465

Source : Projected as in Ia in text.