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**Livestock based livelihoods and pathways out of poverty: the case of  
smallholder farmers in Bangladesh**

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**Abstract**

This paper evaluates livelihoods of smallholder livestock farmers who were beneficiaries of a poverty alleviation programme involving longer term intervention towards building the strength of stakeholders such as government department, NGOs, village organisations and women beneficiaries. Data are drawn from a survey of 400 women farmers in 2006 and 2008. These farmers have been the members of BRAC, a well known NGO in Bangladesh. Poverty profiles, transition matrices and regression analysis drawn from asset-base framework are used to analyze data. A number of key questions related to poverty transition through livestock based activities, heterogeneity in livelihood choice and its impact on household welfare, extent of poverty reduction using different strategies etc. are addressed.

**Key words: Poverty, Women and livestock, Livelihood Strategies, Asset-base Framework, Bangladesh**

**JEL classifications: O1; O3; Q13, Q55**

## **Livestock based livelihoods and pathways out of poverty: the case of smallholder farmers in Bangladesh**

### **1. Introduction/Background**

Many countries in the world have made great strides over the past two decades in tackling poverty and hunger, but much remains to be done. Poverty still remains pervasive; for example in Bangladesh almost half the population is identified as poor (Kotikula et al. 2007). Fighting poverty and hunger implies a greater degree of attention to agriculture, which is still employing 50% of the labour force in many developing countries. Smallholder and mixed systems demand particular attention because they dominate farm area in developing countries that depend heavily on agriculture (World Bank 2007). Livestock provides not only traction but also extra income and nutrition in this system. As a matter of fact, most livestock products in developing countries come from this type of mixed system. Livestock sector is valued as one of the main global drivers of agriculture as well as one of the sectors having enormous potential for poverty reduction (FAO 2006; Holmann et al. 2005). Smallholder farmers, particularly invisible women are a major owner of the contribution of livestock and agriculture. Women are the main carers of livestock in the mixed system.

Livestock production in developing countries has been rising in response to income growth accompanied by changing dietary preferences and human population growth. Annual growth rates in the last 10 years in livestock have been 3.77% compared to 2.71% in crops and 1.18% in non-food commodities. In Bangladesh, more than 60% people depend on agriculture, about 25% people are directly and 50% are partly engaged in livestock sector. The contribution of livestock to GDP is around 3 percent, its share to agriculture GDP is more than 17 percent. Recent growth of the livestock in GDP is more than 7 percent. Total meat consumption increased by 54% from 305,400 tonnes in 1990 to 469,100 tonnes in 2005 and egg consumption increased by 132% from 67,300 tonnes to 156 thousand tonnes in the same period, but per capita consumption of meat increased slightly from 7.4 grams per day in 1990 to 8.4 grams per day in 2005, and per capita consumption of eggs increased by 75% from 1.6 to 2.8 grams per day (Jabber et al. 2007). Meat, milk and egg consumption in Bangladesh is very low by international standards. There is no denying the fact that the recent food price soaring would hit the people badly who are already living with low level of consumption and the case of Bangladesh would be a part. Researchers and policy makers are now considering agricultural growth that includes livestock as the most important development agenda.

A large number of income generating/poverty reduction initiatives in developing countries have been using livestock as an intervention domain, among other strategies, to reach the poor

farmers. Livestock is often valued for its positive role to consumption smoothing, buffer stock, pro-poor growth and nutrient status of land (Fafchamps et al. 1998, Lekasi et al. 2001, Deshingkar et al. 2008). In particular, poultry is a common enterprise of poor households in many developing countries and targeting this enterprise is considered an innovative inclusive means to reach the poor (Kristjanson *et al.* 2004, Dolberg 2001). It requires low investment, short life cycle and so quick turnover, occupies little space, and women farmers who are the primary carer of poultry can raise them along with their regular household responsibilities. Most relevant for this study, a smallholder poultry project is expected to have greater impact on poverty reduction, because smallholder poultry is an enterprise of poor farmers, particularly women.

A widely discussed initiative known as ‘Bangladesh Poultry Model’ is probably the pioneer in taking forward poultry based poverty alleviation tools (DARUDEC 2003, Policy and Planning Support Unit, 2003, Dolberg 2003). This is an innovative capacity development programme through multi-strategic approaches being adapted widely in a number of developing countries such as Burkina Faso, Benin, Ghana, Eritrea, Malawi, Mozambique, Tanzania, Zimbabwe, Kenya, Senegal, Vietnam, Cambodia, Indonesia, Nepal and Nicaragua with supports from donors and GO-NGO partnerships (Akter and Farrington 2011). Ad hoc experimentation generated the basic dimensions of the model, and these were then reinforced over two decades by research and learning-by-doing experiences. Impact studies identified the program successful in terms of gender mainstreaming and empowerment, higher income, consumption and nutrition; but independent review expressed the view that the results from the weak impact studies should be used with a high degree of caution (Islam and Jabber 2005). The following issues, pertinent to poverty reduction, are not yet fully answered. Impact studies, usually evaluate the impact, whilst a development project is on-going or immediately after the completion. Follow-up after the project period is not realistically possible, because project funding is not ear-marked to do so. Independent evaluation can come forward to compare the actual situation with what had been predicted during the project period. This study does not aim to measure the impact of an intervention but it aims to compare the livelihood and welfare situation at almost the end of a longer term intervention (the Bangladesh poultry model) with the situation two years later. The participants and support services were given opportunities to build capacity to improve welfare by improving poultry production, other strategies were open choices. We investigate the following issues for policy recommendation.

- Firstly, were participants able to raise income or opportunities adequately to quit poverty? It is important to identify strategies leading them out of poverty along with challenges to incorporate in the capacity development programmes.

- Secondly, there is a possibility that some of the participants are successfully combining the opportunities generated by the intervention with exogenous opportunities and moving out of poverty, while the others either have no other opportunities or are failures. It is important to identify such heterogeneities and suggest measures to improve opportunities in pathways out of poverty.

The paper addresses these issues using a two-period panel data and rigorous statistical/econometric analyses. Section 2 discusses methodology and data, section 3 presents results and discussions on poverty transitions, livelihood strategies and determinants of household welfare. The paper concludes in section 4.

## **2. Methodology**

### **2.1 Framework for analysis:**

Dynamic process that lead households to fall into and escape poverty are analysed using poverty transitions (Baulch and McCulloch 1998). In this paper, transition matrix based on quantitative (income based) measurement of poverty was used to compare poverty situation between two periods – 2006 and 2008. There were still some supports from the longer term intervention until 2006 and thereafter no direct support was available. After the project period the decision of farmers are influenced by market and non market factors along with enabling environment and capacities created by the longer term intervention. This comparison allows us to find the changes in poverty situation between the conclusion of a development project and the situation after. Put it differently, we would expect the impact of a development project to sustain if the project benefit continues after the project period. The poverty transition matrix would explain whether the benefit continues and if so in what form.

It is often argued that income/consumption-based definition of poverty has the advantage of clearly dividing a population into mutually exclusive categories (Lipton and Ravallion 1995). In this study we also assessed qualitative poverty as assessed by the farmers themselves. Farmers were asked to assess their poverty status in both periods; whether they were poor or not. The results were presented in transition matrix.

Asset based approach was used to assess livelihood strategies used by the farmers in both periods (Siegel 2005). This framework assumes that household welfare results from its livelihood strategies determined by its access to assets in the given institutional, policy and vulnerability environment. Some of the assets affect welfare indirectly through livelihood strategies. The relation in a particular year may be expressed as follows:

$$(1) \quad L_t = f(X_t, Y_t)$$

$$(2) \quad W = f(X_t, L_t)$$

Where,  $L$  represents the vector of livelihood strategy pursued by households,  $X$  is the matrix of assets that affect welfare directly and indirectly,  $Y$  is the matrix of assets that affect welfare only directly and  $W$  is a vector of welfare measure, and  $t$  represents time. We used multinomial logistic regression to explain livestock based livelihood strategies in equation 1. Household welfare is measured by income per person and the equation 2 is estimated using two-stage regression. Statistical properties were taken care of using appropriate test statistics.

## **2.2 Data and collection method:**

In two weeks in August 2006, we conducted a single visit survey with a structured questionnaire from 400 women farmers located in the Manikgonj district of Bangladesh. The selected women farmers were the beneficiary of the poultry enterprise based poverty alleviation programme, known as Bangladesh Poultry Model as mentioned above. The same farmers were re-interviewed two years later in 2008, when we were able to trace 398 farmers. This constitutes a two-period panel data set. The questionnaire was revised slightly in the second period. In both surveys the same data collection methodology was being employed. Manikgonj is situated immediately to the west of Dhaka, chosen purposively because this is the location where the initial experiment to develop a model under the programme was being done. The geographical coordinates of the Manikgonj District of Bangladesh are 23° 51' 19" North, 90° 0' 45" East.

The sample size was pre-determined by financial constraint and so survey coverage was kept limited to the population under two area offices of Bangladesh Rural Advancement Committee (BRAC), a well known NGO in Bangladesh. BRAC was one of the implementing organisations of the programme. The two selected area offices covered five Unions (45 villages) of Manikgonj Sadar Upazilla and one Union of Saturia Upazilla (5 villages)<sup>1</sup>. The sample beneficiaries were selected randomly from the list of members farmers under the programme. The list was collected from the area offices of BRAC. Data were collected with a structured questionnaire in two weeks during August, 2006 by eight local interviewers who were selected with the help of DLS officers in Dhaka and Manikgonj and was given training using a mock interview session. Questionnaires were translated into the local language and pre-testing was done in the mock session, before being made final. The interviewers were intensively supervised and data were checked regularly during field data collection. Any error identified was corrected either by discussing with the interviewers or

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<sup>1</sup> Upazillas are sub-districts and Unions are sub-Upazillas. They are administrative units in Bangladesh. The sample sizes are includes in Table A1 in the appendix.

sending the interviewers back to the farmers if it becomes pertinent to improve the quality of data. In spite of all these attempts usual errors should be admitted because farmers do not keep any record. Errors may arise from two sources: first, farmers do not know what would be the accurate answer, second in some cases they are not willing to give accurate information. For example, in absence of birth records age information is inaccurately given. Also, some farmers are reluctant to give time to interviewers. The interviewers said, 'we had to rely on their responses'. Farmers want direct benefit from any sort of participation; it is difficult to extract more accurate information without giving them any resource. It may be possible to collect more accurate information from an action research project where researchers are able to provide some direct benefits to respondents.

### **3. Results and discussions**

#### **3.1 Livestock and livelihoods:**

Under the capacity development programme, 'the Bangladesh Poultry Model', poultry production was being supported for a long period of time; more than two decades. In spite of the support, production levels and income shares attributable to poultry were low. Income share from poultry was below 5% in 2006 (Table 1). Livestock income share increased from around 15% in 2006 to more than 18% in 2008. In 2008 there was no external support but the income share of poultry was higher than in 2006. This indicates that the smallholder farmers consider poultry as an additional, albeit not a principal, source of income. The increased income indicates some sustained gain due to intervention.

Table 1 here

Agriculture, business, salaried occupations and international migration are major sources of income. The income share from these sources are lower in 2008 indicates reduced concentration these occupations. During the first survey in 2006, there were 26 international migrants, this year we have recorded an increased number of 66. Thus international migration increased significantly but per person remittances reduced.

There are some differences in the income sources between the regions, Manikgonj and Saturia. They are neighbouring Upazillas but Manikgonj is more developed as it is a district town, where business and salaried job are two most dominant occupations. In Saturia, agriculture, international migration and cow rearing are major occupations. The farm households having international migrants have dropped out from active participation before

the end of the project. In other words these households enjoyed the opportunity to consider international migration as a route to exit poverty.

Rickshaw is a laborious job that increased in the recent year, may be partly due to lack of other jobs and partly due to increased population and demand for rickshaw. Infrastructure is also improving and in some villages Rickshaws are accessible in 2008, unlike in 2006.

Table 2 presents the changes in farming as well as herd size of all livestock species kept by the farmers over the 12 years period beginning 1996. A great deal of increase is noted in the farming of all species, except that poultry farming reduced in 2008 from the 2006 level. The increasing trend until 2006, in part, indicates a positive impact of the intervention. In 2008, number of poultry farms (chicken and duck) reduced remarkably but the average flock size increased. Particularly for chicken, average flock size increased from 15 in 2006 to 39 in 2008; almost three times bigger. This indicates that the some small farms exit from farming.

There was very little change in poultry flock size until 2006. This may be due to the fact that the intervention pursued and supported only poultry but farmers are more interested in other strategies.

(Table 2 here)

### **3.2 Poverty transitions:**

Transition matrix in Table 3 indicates that 110 farmers (more than 66% of the poor) escaped poverty in this two years time. At the same time 76 farmers (33% of the non-poor) fell into poverty. Head count poverty was 41.8% in 2006 and it reduced to 33.2% in 2008. Thus the poverty situation was improved at around 4.5% per annum. Off-diagonal entries add up 46.8% with 27.7% moving up and 19.1% moving down in two years. Thus the transient poverty is very high. Studies in developing countries also found high transient poverty (Baulch and Hoddinot 2000).

(Table 3 here)

There are differences between income poverty and the self-assessed poverty. According to self-assessment, poverty was 25.3% in 2006 and it became 36.2% in 2008 (Table A2 in the appendix). Thus poverty situation was worsened as per farmers' assessment. Transient poverty in this case was 40.1%, with 14.6% moving up and 25.5% moving down.



It is not possible to compare income poverty before the intervention and after, because per-intervention income is not available. Instead we compare before-after situation using self-assessment. The farmers were asked to assess their poverty situation prior to their entry into the programme with the situation at the time of interview in August, 2006. The transition matrix in Table A3 in the appendix indicates that 67 participants (more than 40% of the poor) escaped poverty and only 3 out of 234 non-poor households fell into poverty. Thus the risk of entering poverty is only around 1% in presence of a programme. This impact is not due entirely to the intervention, although it partly plays an important role.

### **3.3 Livelihood strategies and welfare:**

In total annual income from 28 activities were recorded in the both surveys using memory recall. We have identified 5 dominant strategies on the basis of income share as follows (Akter and Farrington 2011):

- #1. Either 50% of household income is derived from livestock or 60% of income is derived from agriculture plus livestock,
- #2. Either 60% of income is derived from livestock plus business or 60% of income is derived from livestock plus skilled services,
- #3. 60% of income is from livestock plus regular job,
- #4. 60% of income is derived from livestock plus wage labour, and
- #5. 60% of income is derived from multifarious non-farm activities include 26 international migrants contributing from a minimum of 48% of family income share.

In this setting it is investigated whether poverty reduction strategies need to incorporate opportunities for the poor to enter into specialised farm or non-farm activities. Although poultry enterprise alone was being promoted under the programme, households were free to pursue other livelihood strategies. Only 10% of the households considered livestock (includes all species such as poultry, goat and cow) as a major source of income (50% or more of income share) in 2006. Table 4 presents income and poverty status.

(Table 4 here)

Wage income strategy was the worst in 2006, but agriculture became the worst strategy in 2008. Farmers gained through all strategies but agriculture. In terms of annual per person income in 2006, international migration combined with other non-farm activities (#5) appeared the most remunerative, followed by salaried job (#3). Agriculture (#1) is in the third position among the five categories and business is the least remunerative option, where most people was crowded. The crude probability of access to international migration was 6.5% and

that of regular job was 23.5%. In 2008, the situation of business became better, because some people failing to do good business entered into international migration. Thus, strategies that could ease international migration, could create regular jobs, could enhance productivity in the business and agriculture would help poverty reduction.

### **3.4 Determinants of income:**

The determinants of income were estimated using Equation (1) and Equation (2). In Equation (2), livelihood strategies (L) are endogenous. So, in the first stage, we applied multinomial logistic regression to estimate L and then the predicted values of L were used as independent variables in the welfare function, Equation (2). Asset variables included in the models are human capital such as education, household size and composition, age and training; natural capital such as land and its quality; financial capital such as credit; physical capital such as business assets, agricultural machineries; and social capital such as membership in the programme and other organisations, etc. Market access and location variables are also included in the models. The results are presented in Table 5. Statistically, model fit is acceptable. Most of the results appear plausible. Definition of the variables along with their mean and standard deviation are reported in Table A4 and the results of the first stage regressions are reported in Tables A5 and A6 in the appendix.

(Table 5 here)

Dependent variable used in Table 5 is the log of per person annual income as a measure of household welfare. Strategy variables are not highly significant. Strategy #2 is significant at 10% and strategy #5 is significant at 5%, but they were insignificant in 2008 model. Within each broad strategy, some jobs were better than others. So we introduced some dummy variables in the model. Whether earning a major income or not, those who are engaged in regular salaried jobs are significantly better than strategy #1 and strategy #3, consistently in both periods. Strategy #5, livestock plus other non-farm activities (other than international migration) produces lower welfare than agriculture along with livestock, but this is not borne in 2008. Business was worse than agriculture in 2006 but better than agriculture in 2008. The relationship between strategies and income is complex but diversification through regular job and international migration are two robust sources of higher welfare to smallholder livestock farmers.

An additional year of schooling leads to 2.8% increase in welfare in 2006 but education effect is not significant in 2008. Households with an extra adult male are better off, but not significant in 2008. An additional member in the household causes a decrease in welfare by

22.3% in 2006, also not significant in 2008. The effect of age is significant at 5% in 2008 and significant at 10% in 2006. Effect of productivity is consistent in both years. Thus there are many differences in farmers' behaviour between years.

#### **4. Conclusions**

This study is based on primary data collected with a structured questionnaire from a sample of 400 smallholder poultry farmers who were the beneficiaries of a poverty alleviation programme that was promoting poultry production. The survey was carried out almost at the end of decades of intervention. The sample was re-surveyed two years later in 2008 using a slightly modified questionnaire. Poverty was assessed using transition matrix with income and self-assessed measurements. Asset-base approach was used to explain impact of livelihood strategies on household welfare. Household welfare measured by income per person was estimated using two-step regression. At the first step, multinomial logistic regression was used to estimate livelihood strategies and at the second step household welfare was regressed on the estimated values of the livelihood strategies and other variables. The important conclusions are:

Livelihood strategies are heterogeneous and complex. Attempts to reduce poverty by promoting a single strategy appear self-defeating. Instead, capacity development programmes should target creating environment so that farmers are able to make their own choice without great difficulty. Creation of more jobs, enabling environment for business and international migration, education and training opportunities are different options for better coping with poverty. More than 21% of the farmers earn 60% or more of the household income from agriculture with the lowest per person income and very low productivity. This situation should be improved.

Counterintuitively, farmers' rating showed that poverty increased at a high rate in the 2006-2008 periods, contrary to income measurement. However, both measures showed that transient poverty is extremely high. This indicates that poverty reduction strategies should consider the risk factors adequately in order to fight long term poverty reduction, pursuing a single strategy would not help much.

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Table 1. Income share (% of gross income of the group) of the sample households by Upazilla, 2006 & 2008.

Occupation	2006			2008		
	Manikgonj	Saturia	Total	Manikgonj	Saturia	Total
Agriculture	11.6	28.0	14.6	9.7	17.0	10.7
Poultry Rearing	4.8	2.4	4.3	7.2	6.5	7.1
Cow Rearing	8.5	16.1	9.9	8.9	7.9	8.7
Goat Rearing	1.0	0.8	1.0	2.4	4.0	2.6
Business	20.9	3.2	17.7	15.3	7.5	14.3
Salaried Job	19.0	8.0	17.0	16.2	4.8	14.7
Sewing/tailoring	3.8	1.2	3.4	2.1	2.5	2.2
Carpentry/electrician	6.8	3.1	6.1	7.0	5.3	6.8
Day labourer	7.4	6.0	7.2	7.1	8.6	7.3
Rickshaw pulling	2.2	5.7	2.9	6.1	12.7	7.0
International migration	11.6	24.3	13.9	9.6	21.3	11.2
Seschashebi/poultry worker	0.2	0.3	0.2	1.7	1.9	1.8
Others*	2.0	0.9	1.8	6.6	0.0	5.7
Total	100	100	100	100	100	100

\*Others include traditional occupations, craft work, fishing and boating.

Data source: Field survey, 2006 & 2008.

Table 2. Changes in the herd size by species, 2008.

Species name	12 years ago		7 years ago		2 years ago		Now in 2008	
	No. Farm	Av size (Number)	No. Farm	Av size (Number)	No. Farm	Av size (Number)	No. Farm	Av size (Number)
Chicken	276	13.1	319	13.3	380	14.6	342	39.3
Duck	18	6.6	25	6.5	52	5.8	41	6.2
Cow	44	2.8	51	2.1	133	2.7	199	1.6
Goat	45	3.5	49	2.7	132	2.9	139	2.8
Total*	292	13.8	332	15.6	390	15.3	368	39.5

\* One farm keeps more than one species.

Data source: Field survey, 2006 & 2008.

Table 3: Movement in and out of poverty (assessed by income poverty).

		Status 2008			Total
		Poor	Non-poor		
Status 2006	Poor	Count	56	110	166
	% of Total		14.1	27.7	41.8
	Non-poor	Count	76	155	231
	% of Total		19.1	39.1	58.2
Total		Count	132	265	397
		% of Total	33.2	66.8	100

Table 4: Poverty status by main source of livelihood.

Livelihood strategies combined with livestock*	2006					2008				
	N	% N	Annual income per person (Tk)	Income poverty upper ** %	Income poverty lower ** %	N	% N	Annual income per person (Tk)	Income poverty upper ** %	Income poverty lower ** %
#1. Agriculture	85	21.3	14888	35.3	30.6	82	20.7	10996	63.4	53.7
#2. Business, skilled service	125	31.3	11483	56.8	47.2	102	25.7	15696	32.4	26.5
#3. Salaried/ Regular job	62	15.5	17933	21.0	12.9	60	15.1	22952	11.7	6.7
#4. Wage labour	39	9.8	9587	66.7	51.3	30	7.6	12948	53.3	43.3
#5. Non-farm (include international migration)	89	22.3	21434	31.5	22.5	123	31.0	22491	19.5	17.1
Total	400	100.0	15204	42.0	33.3	397	100.0	17719	33.2	27.5

\* Definitions are indented at the beginning of section 4.

\*\*Upper poverty line is Tk 893 per person per month, and lower poverty line is Tk 772 per person per month, Tk is Bangladesh currency Taka. They are based on the Report of the Households Income and Expenditure Survey 2005 (pages 160 and 161) data on Dhaka rural poverty lines upper and lower (cost of basic needs approach), composite price index and food price index respectively (BBS 2007). Poverty lines were adjusted for CPI inflation rate of 6%.

Table 6. Determinants of income of beneficiary households, Bangladesh, 2006 & 2008.

Variables: Dependent Variable: log of annual income per person	2006				2008			
	Co- efficien t	Std error	z statisti c	Sig.	Co- efficie nt	Std error	z statisti c	Sig.
(Constant)	9.251	.243	38.079	.000	9.917	0.314	31.613	0.000
#2 Business	-.158	.091	-1.740	.083	0.157	0.144	1.090	0.276
#3 Salaried job	-.199	.146	-1.360	.175	-0.010	0.190	-0.052	0.959
D10 (regular job = 1)	.433	.124	3.481	.001	0.382	0.091	4.211	0.000
#4 Wage labour nonagID (non-farm wage labour)	-.063	.156	-.401	.689	0.268	0.227	1.181	0.238
#5 Other sources	-.224	.109	-2.050	.041	0.088	0.141	0.622	0.534
D3 (have international migrant = 1)	1.067	.110	9.665	.000	0.873	0.108	8.093	0.000
ed1 (med. Yrs of schooling)	.028	.011	2.652	.008	0.004	0.022	0.209	0.835
deprat (dependency ratio)	.023	.147	.155	.877	-0.317	0.167	-1.902	0.058
Adult member	.176	.081	2.174	.030	0.004	0.067	0.054	0.957
famS (family size)	-.223	.064	-3.461	.001	-0.106	0.057	-1.837	0.067
Age_median of working members	-.005	.003	-1.848	.065	-0.009	0.004	-2.196	0.029
fhead (female head)	-.014	.107	-.131	.896	0.072	0.136	0.529	0.597
Farm size (own land acres)	.160	.077	2.067	.039	-0.108	0.077	-1.394	0.164
lnYield (productivity of land log)	.276	.077	3.570	.000	0.020	0.011	1.826	0.069
Credit (access to credit=1)	.155	.068	2.284	.023	0.086	0.115	0.746	0.456
lnBasset (business asset value log)	.020	.008	2.584	.010	0.006	0.017	0.336	0.737
lnDurab (durable asset value log)	.015	.007	2.259	.024	0.021	0.009	2.436	0.015
lnlstk (productivity of livestock asset log)	.010	.014	.722	.471	0.114	0.031	3.704	0.000
Distance from market (km)	.054	.045	1.202	.230	-0.013	0.062	-0.215	0.830
Distance from metallic road (km)	-.001	.034	-.039	.969	-0.007	0.056	-0.133	0.894
Distance from hospital (km)	-.003	.007	-.393	.695	-0.004	0.028	-0.135	0.893
Length of residency (yrs)	-.007	.005	-1.506	.133	-.007	0.003	0.963	0.336
Active = 1	.047	.059	.795	.427	-0.061	0.072	-0.847	0.398
Location 2	.368	.084	4.388	.000	-0.154	0.106	-1.445	0.149
Location 3	.281	.107	2.623	.009	0.083	0.246	0.335	0.738
Location 4	.046	.142	.322	.748	0.059	0.180	0.325	0.745
Location 5	.103	.118	.875	.382	0.187	0.158	1.185	0.237
Location 6	-.238	.110	-2.166	.031	0.199	0.152	1.309	0.191
R <sup>2</sup>	0.544				0.318			



## Appendix

Table A1. Distribution of sample women farmers by Upazilla and Unions/Post Offices

Upazilla	Union	Sample size (N), 2006	Sample size (N), 2008
Manikgonj	Manikgonj	134	133
	Gorpara	141	141
	Jagir	18	18
	Nobogram	27	27
	Dighi	27	26
Shaturia	Tilli	53	53
	Total	400	398

Table A2: Movement in and out of poverty (according to self-assessed poverty).

		Status 2008		Total	
		Poor	Non-poor		
Status 2006	Poor	Count	38	52	90
		% of Total	10.7	14.6	25.3
	Non-poor	Count	91	175	266
		% of Total	25.5	49.2	74.7
Total		Count	129	227	356
		% of Total	36.2	63.8	100

Table A3: Movement in and out of poverty (self-assessed poverty; comparison of before intervention and 2006).

		Status 2006		Total	
		Poor	Non-poor		
Status before	Poor	Count	99	67	166
		% of Total	24.8	16.8	41.5
	Non-poor	Count	3	231	234
		% of Total	0.8	57.8	58.5
Total		Count	102	298	400
		% of Total	25.5	74.5	100.0

**Table A4: Description of the variables with mean, median and standard deviation**

Variable description	2006		2008	
	Mean	Std Dev	Mean	Std Dev
ed1, Median years of schooling of household members > 7 yrs of age	5.70	2.52	5.70	2.52
edu, Education of beneficiary women (yrs of schooling)	4.17	3.04	4.17	3.04
depart , dependency ratio = no of persons (below 15 and above 60)/no of persons (15-60 years of age)	0.55	0.28	0.55	0.28
adult , no of persons 15+ years	3.22	1.18	3.22	1.18
adultm, no of males 15+ years	1.74	0.86	1.74	0.86
adultf, no of females 15+ years	1.48	0.66	1.48	0.66
famS, family size	4.08	1.17	4.08	1.17
Age_median, median age of workers in the family	36.07	9.43	36.07	9.43
fhead, beneficiary female who is also head of the family	0.09	0.28	0.09	0.28
D11, beneficiary gained from training, accessed to information/knowledge	0.05	0.22	0.05	0.22
Farm size (own land acres)	0.42	0.50	0.42	0.50
lnyield, productivity of land (revenue per acre in Tk) in log	2.74	4.74	2.74	4.74
credit, access to micro credit = 1	0.87	0.34	0.87	0.34
lnBasset, value of business assets (Tk) in log	8.27	2.23	8.27	2.23
lnlstk, value of livestock asset (Tk) in log	8.48	2.86	8.48	2.86
Distance from market (km)	1.57	1.54	1.57	1.54
Distance from metallic road (km)	1.24	1.42	1.24	1.42
D1, marital status of beneficiary women (single=1)	0.09	0.29	0.09	0.29
D3 , households having international migrant member	0.16	0.36	0.16	0.36
D10 , households having member with regular job	0.23	0.42	0.23	0.42
D8, households sold livestock due to shock reasons	0.22	0.41	0.22	0.41
Length of time (yrs) in the programme	11.74	6.23	11.74	6.23
nonagID, households having non-farm wage labour	0.04	0.20	0.04	0.20
infoS, households having membership with more than one organisations	1.10	0.39	1.10	0.39
Active = 1, who were still active in project in 2006	0.49	0.50	0.49	0.50
D12, households who fulfil targeting criteria of land<=0.5 acres	0.78	0.42	0.78	0.42
Gpara, location 2 dummy	0.35	0.48	0.35	0.48
Tilli, location 3 dummy	0.13	0.34	0.13	0.34
Jagir, location 4 dummy	0.05	0.21	0.05	0.21
Nobo, location 5 dummy	0.07	0.25	0.07	0.25
Dighi, location 6 dummy	0.07	0.25	0.07	0.25







Table A5. Multinomial logit model (Livelihood strategy #1 Agriculture includes livestock as comparison group), 2008.

	#2 Livestock plus business/ skilled service				#3 Livestock plus regular job				#4 Livestock plus wage labour				#5 Livestock plus other non-farm (with international migration) jobs			
	Co- efficient	Std. Error	Sig.	Odds ratio	Co- efficient	Std. Error	Sig.	Odds ratio	Co- efficient	Std. Error	Sig.	Odds ratio	Co- efficient	Std. Error	Sig.	Odds ratio
Intercept	1.257	1.817	0.489		-1.616	2.371	0.495		1.809	2.355	0.442		1.405	1.758	0.424	
ed1	0.112	0.105	0.287	1.119	0.372	0.128	0.004	1.451	-0.360	0.155	0.020	0.697	0.077	0.104	0.459	1.080
Edu	0.017	0.089	0.848	1.017	0.076	0.100	0.446	1.079	0.008	0.140	0.956	1.008	0.083	0.086	0.337	1.086
Depart	-1.082	0.837	0.196	0.339	-1.969	1.019	0.053	0.140	-0.142	1.216	0.907	0.868	-1.983	0.830	0.017	0.138
Adult	0.057	0.344	0.869	1.059	-0.214	0.401	0.594	0.808	0.988	0.521	0.058	2.686	0.386	0.330	0.241	1.472
famS	0.481	0.281	0.087	1.617	0.690	0.336	0.040	1.994	-0.086	0.424	0.839	0.918	0.162	0.276	0.557	1.176
Age	0.008	0.021	0.706	1.008	-0.032	0.028	0.256	0.968	0.003	0.028	0.915	1.003	0.004	0.020	0.833	1.004
Fhead	-0.492	1.014	0.627	0.611	-1.633	1.303	0.210	0.195	-1.767	1.598	0.269	0.171	-1.266	1.019	0.214	0.282
D11	-0.273	0.812	0.737	0.761	-0.815	1.062	0.443	0.443	0.265	1.080	0.806	1.304	-0.246	0.768	0.749	0.782
Farm	-0.233	0.368	0.527	0.792	-0.344	0.502	0.493	0.709	-0.572	0.760	0.452	0.564	-0.383	0.341	0.262	0.682
Lnyield	-0.222	0.040	0.000	0.801	-0.199	0.049	0.000	0.819	-0.378	0.092	0.000	0.685	-0.181	0.037	0.000	0.834
Credit	0.639	0.516	0.216	1.895	2.396	0.849	0.005	10.983	0.822	0.792	0.299	2.274	1.514	0.539	0.005	4.545
lnBasset	0.116	0.091	0.202	1.123	0.219	0.144	0.128	1.244	-0.074	0.104	0.472	0.928	0.083	0.076	0.275	1.086
Lnlstk	-0.322	0.106	0.002	0.725	-0.361	0.114	0.002	0.697	-0.278	0.126	0.027	0.757	-0.358	0.104	0.001	0.699
Distmkt	-0.095	0.281	0.736	0.910	-0.164	0.388	0.672	0.849	0.122	0.363	0.737	1.130	0.101	0.231	0.663	1.106
Distroad	-0.240	0.216	0.268	0.787	-0.190	0.266	0.474	0.827	0.047	0.222	0.834	1.048	-0.009	0.149	0.952	0.991
D1	-0.825	1.081	0.445	0.438	0.856	1.224	0.484	2.354	0.501	1.426	0.725	1.650	0.941	0.956	0.325	2.564
Tlength	-0.023	0.034	0.501	0.977	-0.019	0.041	0.644	0.981	-0.057	0.047	0.229	0.945	-0.053	0.032	0.101	0.949
Member	0.001	0.465	0.998	1.001	-1.182	0.641	0.065	0.307	-0.003	0.718	0.997	0.997	-0.123	0.458	0.788	0.884
Active	-0.359	0.393	0.361	0.699	0.713	0.466	0.126	2.041	0.490	0.566	0.387	1.632	-0.278	0.370	0.452	0.757
Model fit	Mean pred. prob.=0.270		% of correct pred.= 49.0		Mean pred. prob.=0.126		% of correct pred.= 43.3		Mean pred. prob.=0.054		% of correct pred.= 30.0		Mean pred. prob.=0.348		% of correct pred.= 59.3	

Pseudo R square (Cox and Snell) = 0.488, Likelihood ratio Chi Square = 266.10 (sig = 0.00).

Table A6. Multinomial logit model (Livelihood strategy #1 Agriculture includes livestock as comparison group, 2006).

	#2 Livestock plus business/ skilled service				#3 Livestock plus regular job				#4 Livestock plus wage labour				#5 Livestock plus other non-farm (with international migration) jobs			
	Co- efficient	Std. Error	Sig.	Odds ratio	Co- efficient	Std. Error	Sig.	Odds ratio	Co- efficient	Std. Error	Sig.	Odds ratio	Co- efficient	Std. Error	Sig.	Odds ratio
Intercept	6.177	1.702	.00		2.207	2.882	.44		2.065	2.440	.40		5.418	1.749	.00	
ed1	-.019	.106	.85	.98	.263	.147	.07	1.30	-.137	.166	.41	.87	.022	.103	.83	1.02
Edu	.072	.101	.47	1.07	-.164	.146	.26	.85	.021	.163	.90	1.02	-.070	.101	.49	.93
Depart	-1.466	1.212	.23	.23	2.968	2.178	.17	19.45	-3.742	1.884	.05	.02	-2.110	1.277	.10	.12
Adult	-.150	.659	.82	.86	1.689	1.008	.09	5.42	-1.990	1.072	.06	.14	-.052	.668	.94	.95
famS	.943	.523	.07	2.57	-1.222	.858	.15	.29	2.224	.833	.01	9.24	.894	.537	.10	2.44
Age	-.034	.022	.12	.97	-.017	.035	.62	.98	-.027	.036	.47	.97	-.027	.023	.24	.97
Fhead	-1.097	1.403	.43	.33	-2.576	1.840	.16	.08	-2.210	1.793	.22	.11	-1.802	1.384	.19	.16
D11	-1.453	.767	.06	.23	-1.618	1.595	.31	.20	-1.481	1.223	.23	.23	-2.119	.906	.02	.12
Farm	-.404	.361	.26	.67	-.771	.560	.17	.46	-.771	.649	.23	.46	-.610	.343	.08	.54
Lnyield	-.260	.051	.00	.77	-.020	.085	.82	.98	-.308	.099	.00	.73	-.137	.048	.00	.87
Credit	.087	.518	.87	1.09	-.868	.940	.36	.42	1.757	.987	.08	5.79	.195	.534	.71	1.22
lnBasset	-.059	.056	.30	.94	.005	.093	.95	1.01	-.013	.077	.86	.99	.069	.054	.20	1.07
Lnlstk	-.730	.127	.00	.48	-.654	.173	.00	.52	-.466	.167	.01	.63	-.675	.131	.00	.51
Distmkt	-.135	.309	.66	.87	-.736	.497	.14	.48	-.071	.396	.86	.93	.097	.313	.76	1.10
Distroad	.135	.223	.55	1.14	-.451	.429	.29	.64	.374	.292	.20	1.45	-.036	.240	.88	.96
D1	1.582	1.356	.24	4.86	4.062	1.709	.02	58.07	2.883	1.534	.06	17.86	2.828	1.334	.03	16.91
Tlength	.004	.036	.91	1.00	-.114	.064	.07	.89	-.002	.050	.97	1.00	-.062	.037	.10	.94
infoS	.254	.443	.57	1.29	-.618	.728	.40	.54	.320	.610	.60	1.38	.130	.456	.78	1.14
Model fit	Mean pred. prob.=0.313			% of correct pred.=76.8	Mean pred. prob.=0.154			% of correct pred.=88.7	Mean pred. prob.=0.098			% of correct pred.=51.3	Mean pred. prob.=0.221			% of correct pred.=35.2

Pseudo R square (Cox and Snell) = 0.748, Likelihood ratio Chi Square = 549.38 (sig = 0.00).





