Scavenging Poultry for Poverty Alleviation:

A review of experiences with a focus on Bangladesh

S M Fakhrul Islam and M A Jabbar

Prepared for

International Livestock Research Institute
PO Box 5689, Addis Ababa, Ethiopia

June 2003

List of Acronyms

ADB – Asian Development Bank
BRAC- Bangladesh Rural Advancement Committee
BLRI- Bangladesh Livestock Research Institute
DLS- Department of Livestock Services
DANIDA- Danish International Development Agency
DOC- Day Old Chick
EU – European Union
FAO- Food And Agricultural Organization of the United Nations
IFAD- International Fund for Agricultural Development
MSPPM- Malawi Smallholder Poultry Production Model
NGO- Non-Government Organization
PKSF - Palli Karma-Sahayak Foundation
PLDP- Participatory Livestock Development Project
RIR- Rhode Island Red
SLDP- Smallholder Livestock Development Project
UNDP- United Nations Development Programme

Acknowledgements

The authors are grateful to Frands Dolberg, Hans Jensen and William Thorpe for comments on an earlier draft and to ILRI for providing funding to undertake the study. However, the authors alone are responsible for the content.

Table of Contents

Executive summary

Smallholder poultry as a tool for poverty alleviation has been developed and widely applied in Bangladesh. Parallel development of the concept has taken place in a number of countries and adaptation of Bangladesh model is also underway in a number of other countries with donor support from DANIDA, ADB, IFAD, the World Bank. Scavenging poultry is common in the rural areas of most developing countries and in some countries there are efforts to support its development though such efforts have not been structured into formal models as in Bangladesh. The concept is appealing because through poultry many more people, especially poor and women, can be reached unlike any other species of livestock, and there is good donor interest as there is a dire shortage at project or programme levels for effective interventions to address poverty.

A review of literature was conducted to summarize the evolution of the semi-scavenging poultry model and its application, especially in Bangladesh, to review the evidence on the effectiveness and impact of the poultry model on poverty alleviation and food security, to identify the limitations of the previous assessments in terms of methodology, geographical and subject area coverage, findings and conclusions and to determine knowledge gaps, and outline the principles and methods for a broad, systematic impact study.

The semi-scavenging poultry model of Bangladesh has a long history of development. The Department of Livestock Services (DLS) and the Bangladesh Rural Advancement Committee (BRAC), an NGO, had developed this model for poverty alleviation through a series of field trials. The basic model consists of a supply chain of 7 enterprises - Model Breeders, Mini Hatchery, Chick Rearers, Key Rearers, Poultry Workers, Feed Sellers and Egg Collectors. The development process got momentum through implementation of three large national smallholder poultry development projects in partnership with the DLS and a number of NGOs. The projects are known as SLDP I (1992-98), PLDP (1998-2002) and SLDP II (1999-2003) supported by DANIDA, IFAD, ADB, the Government of Bangladesh and several NGOs, though not all of them were involved in all the projects. Some changes were introduced in the pure scavenging poultry model in PLDP and SLDP II including the use of Sonali crossbreed instead of only local breeds, the hatching and rearing of Sonali chicks by the Key Rearers instead of government hatcheries alone, and de-emphasise the role of Mini-Hatchery in the model as it did not appear to be competitive in the market.

The development projects were supposed to establish rigorous monitoring and impact assessment mechanisms but the DLS was not successful in establishing an effective monitoring and impact assessment system in any of the projects. Most of the results reported on the progress of implementation of the model came from participating NGOs as a part of their routine programme report without detail analysis and donot evaluation mission reports. A few small and large studies have been conducted to assess the impacts of the poultry model in Bangladesh and in some other countries where the model or its principles have been adapted and replicated. These studies show positive results in terms

of the number of beneficiaries reached, and their increased income, consumption and nutrition, expenditure and savings and empowerment of women. They also indicate varying degree of performance of the supply and delivery services including credit, day old chick, research, training and capacity building. However, these findings need to be interpreted with a high degree of caution because most studies suffer from one or more of the following methodological deficiencies: size, distribution and stratification of the samples; approaches used in attributing benefits to the projects and their beneficiaries. Two of these limitations are illustrated further.

Most studies were based on fairly small samples in relation to the population drawn from observed high performing areas, thus creating a bias. Systematic sampling frame has been rarely used if at all. Some studies included dropouts in the sample while others did not and in most cases the depth of analysis remain low. Empirical studies on agricultural technology adoption generally divide a population into adopters and non-adopters, and analyse the reasons for adoption or non-adoption at a point in time and then the impact of adoption may also be measured. In reality, technology adoption is not a one-off static decision rather it involves a dynamic process in which information gathering, learning and experience play pivotal roles particularly in the early stages of adoption. The adoption pathway may involve a process in which farmers move from learning to adoption to continuous or discontinuous use over time. Inclusion of drop outs in the sample and analysis of their profiles are very important where high drop out rates, permanent or temporary, are observed, as apparently the situation in all three poultry projects in Bangladesh and in other countries.

All the impact studies under review except one used simple before-after comparison to assess the impact of the project. In reality the projects operated under a dynamic socio-economic environment where poor peoples' conditions might have changed to some degree without the poultry projects. Therefore, to assess the net effect of the projects at household, community or national levels, both before-after (for participants) and with-without (including both participants and non-participants or control group) comparisons should have been done. Either before-after or with-without comparison on its own may generate biased estimates of the effects of the project if there were initial differences between participants and non-participants and /or there were changes in peoples' conditions (positive or negative) without the project. The before-after comparison also should address the time path of adoption (as not all participants joined the project in the beginning or at the same time), and the problem of using constant or current prices in valuing products and inputs. If the number of participants joining the project has an unequal (skewed) distribution over the life of the project, the sample should also reflect that distribution in order to obtain an unbiased estimate of the impact of the project.

More objective, inclusive and systematic impact studies are required to assess the characteristics of the actual beneficiaries reached by the projects, the impacts made (where, how and why), the indicators of success or failure and sustainability of the model. Such knowledge is essential to guide the intended adaptation or replication underway in several countries or to guide further efforts in using poultry as a tool for poverty alleviation. Three major issues need to be considered in future studies. First, the

concept of smallholder poultry for poverty alleviation, its feasibility and limitations. Second, the choice of impact indicators, their measurement and attribution. Third, policy and research needs to support smallholder poultry development for poverty alleviation.

The mechanism by which a poultry model affects poverty suggests multiple dimensions through which poverty impact need to be measured and assessed. These include: effectiveness of delivery of services by public, private and NGO sectors to the target groups; whether different component of the poultry model are functioning well as per the model design and why; how the benefits of the model are distributed among the different levels of the food system chain including farmers, traders and consumers, and how supply changes affect prices; some measures of individual and community capacity including impacts on individual capacity for decision making and at the community level, enhanced capacity for taking collective action. Capturing these dimensions will require adoption of an appropriate sampling and survey design.

Research is required to solve technical problems and constraints and also to facilitate decision making at household, community and higher levels. Given the current status of scavenging poultry as a development tool and its problems in developing countries, the following research areas appear to be important:

Nutrition and management

- Nutrition, especially micronutrient, and disease, e.g. Newcastle Disease, interaction in chicks. Malnutrition of chicks may make vaccination less effective and also increase mortality. Potential gains from nutrition and health interaction may justify additional investment in this enterprise.
- Feeding and management of young chicks to reduce mortality and its effect on economic returns.
- Assessment of feed resource base and optimal flock size as the size of the flock is likely to be constrained by the physical area covered by the flock as well its ecosystem that generates food supply. Often the feed supply range may be a local common resource, so flock size and options for management of the local common feed resource need to be determined.
- Role of supplementation with alternative resources from within the production system where birds scavenge, basically looking at the prospect of cycling resources within the farm household system.
- Supplementation from outside the household system, collected or purchased, their prospects, impacts, and economics.
- Brooding productivity (different options for management may be found).
- Chick mortality in systems where day old chicks may be supplied from organized stock multiplication farms: role of chick production and delivery systems, extension and health services.
- Breed x location (ecosystem or production system) interactions.

Economic and institutional issues

- Economics of scavenging poultry enterprise including optimal flock size.

- Institutional mechanism, policy and support services for promotion of semi-scavenging poultry, especially the role of NGOs, health and extension services, credit and marketing opportunities, local organizations, role of the private sector.
- Measuring household level impact of interventions using simple indicators to capture changes. Where food security is a severe problem, the indicators may include number of meals by season and gender, quality of food consumed, anthropometric measures (height for age, weight for age) and Body Mass Index of the mother (BMI). Also overall impact of investment is required to guide policy and investment options.
- Work with farmers to find how they diversify out of poultry to get out of poverty. Some may scale up poultry (larger flock, better breed and management), some may scale up by acquiring larger species (asset ladder through acquiring goats, cattle), some may add new activities, farm or non-farm, some may leave poultry to do other things. What factors facilitate or constrain these alternative pathways out of poverty.

1. Background and Objectives

Scavenging poultry is a common enterprise in the rural areas of developing countries. In the 1960s and 70s, several unsuccessful attempts were made by donor and national agencies to develop the system through backyard poultry projects and cockerel exchange programmes. These initiatives did not produce sustainable technical and institutional mechanisms to support scavenging poultry development. Since many of the poor, especially ultra poor throughout the world either do not have any livestock or have a few chicken, poverty reduction programmes continued to search for ways in which chicken or other small animals could be used as a vehicle to assist them get out of poverty and ensure food security. Other reasons for the appeal of the concept are: (a) there is a dire shortage at donor project or programme levels for effective interventions to address poverty, (b) gender is a major focus in development and poultry is an obvious starting point to reach poor women, and (c) it is appealing to livestock extension and research workers as using this concept they can reach out (complying a and b above) to a much larger population than when they confine themselves to cattle or practically any other animal (Ashley et al.,1999; Dolberg, 2001).

The concept has been tested and applied in Bangladesh, one of the poorest countries in the world with over 40% of the population lying below the poverty line. In Bangladesh, poultry is kept by 70-90% of the households, while goats and cattle are kept by lesser proportion of households. Households owning less than 0.5 acre of land keep more than 50% of the total poultry population. Poultry is sometimes used as the first investment for a livestock ladder (in the sense that one can move from poultry to goat/sheep to cattle etc) to increase income and get out of poverty.

These considerations gave rise to the development of the semi-scavenging poultry model in Bangladesh by the Directorate of Livestock Service (DLS) and the Bangladesh Rural Advancement Committee (BRAC), a large national NGO. The semi-scavenging poultry-rearing model, especially targeted to poor and landless women, as implemented through a number of projects in phases in different parts of Bangladesh required several years to develop. Initially in the 1970s, there was no model or design or any systematic conceptual or theoretical basis for the poultry related activities being implemented, they were chosen or designed on an ad hoc basis to answer immediate problems at hand. Over time through practical experience and learning, various complementary activities or enterprises were gradually put together into a structured relationship or a model in the 1980s, and the process is still ongoing. The model has been implemented and validated extensively in the First Smallholder Livestock Development Project (SLDP I: 1992-1998) supported by DANIDA, IFAD, the Government of Bangladesh and 3 NGOs, and the Participatory Livestock Development Project (PLDP: 1998-2002) implemented through 10 NGOs and financed by DANIDA and the Asian Development Bank (Table 1). The SLDP II (1999-2003) – the second phase of SLDP I- financed by DANIDA and implemented in five districts in the southern part of the country through 10 Ngos is still on-going (Saleque, 2000; DARUDEC, 2003).

The model has been extensively described in several publications (e.g. Jensen, 1996 and 2000, Saleque and Mustafa, 1997; Saleque 2000; Fattah 2000; Ahmed 2000; Dolberg 2001; DARUDEC 2002). A number of rapid or extensive survey based assessment of the Bangladesh project at different stages of its evolution and a desk study of the performance of the projects in the other countries indicated that the project participants have benefited positively in terms of income, nutrition and employment. Various other publications also reported positive achievements mainly on the basis of the above studies as well as field visits of donor missions and internal progress reports or project documents of the implementing and donor agencies.

Table 1. Target thanas and beneficiaries in various Smallholder Livestock Development projects in Bangladesh

Period	Project	Donor	Thanas covered	Target beneficiaries
1992-1998	SLDP I**:** Smallholder Livestock Development Project	Danida,IFAD, GOB, 3 NGOs	80	400,000
1998-2002	PLDP**:** Participatory Livestock Development Project	Danida, ADB	89	364,000
1999-2003	SLDP II**:** Smallholder Livestock Development. Project	Danida	26	109,000

Source: Fattah, 2000.

However, the real extent of benefits and the degree of success of the model under various projects in Bangladesh and elsewhere remain very fuzzy. For example, BRAC, the principal executing NGO in Bangladesh, reported in 2000 that the semi-scavenging poultry model was being practiced in 380 of the 460 thanas (sub-district or police station) of Bangladesh and that by 1997 1.27 million women were involved in small-scale poultry production under BRAC's poultry programme alone ; BRAC was supplying one million day old chicks per month, representing 60% of the total day old chick production in the country (Saleque, 2000). These figures are much larger than the number of thanas (195) and number of beneficiary women (873,000) targeted under SLDP I and II and PLDP combined. On the other hand, an IFAD Project Completion Review of PLDP and Evaluation of SLDP in 2002 expressed concern about sustainability of the semi-scavenging poultry production system as the mission found that 35-40% of the PLDP beneficiaries dropped out even before the project was completed, and about 50% of SLDP beneficiaries seemed to have dropped out after the project ended (Anonymous, 2002). Moreover, the original idea of using scavenging poultry has been significantly modified in the process of development of the model and what is in practice is no longer purely scavenging rather semi-scavenging or semi-intensive systems requiring better breeds, feeds, health and other technical services to support it. [1] Depending on the proportion of feed derived from scavenging vs supplementation, the system may require different levels of support services and accompanying costs.

[1] Jansen (1996) defines a semi-scavenging poultry model as an integrated system to provide supplies and services to establish and maintain a semi-scavenging poultry sector.

Therefore, an objective and systematic analysis and synthesis of the available evidence need to be done in order to identify knowledge gaps and lay the foundation for a detailed critical study on the impact of the model and how well it functions under different conditions. Whether scavenging or semi-scavenging systems are appropriate and viable strategies for the poor also need to be examined. Both farm and project level or higher level impact assessment may be required to analyse the effectiveness of the technology package (the model) and the institutional arrangement for delivery and implementation in order to draw lessons for further replication elsewhere in and out of Bangladesh.

The objectives of this review of the literature are:

- To summarise the evolution of the semi-scavenging poultry model and its application, especially in Bangladesh
- To review the effectiveness and impact of the poultry model on poverty alleviation and food security and identify the limitations of the previous assessments in terms of methodology, geographical and subject area coverage, and findings and conclusions
- To determine knowledge gaps and outline the need for a broad, systematic impact study.

The remainder of this document is organized as follows. In section 2, a brief summary of the evolution of the semi-scavenging model is given. In section 3, the impact studies conducted in Bangladesh are reviewed and their findings and limitations summarised. In section 4, experience of application of the model in selected other countries is briefly summarised. In section 5, knowledge gaps in the area are identified and the principles for conducting a broad based impact study are outlined.

2. The Evolution of the Semi-scavenging Poultry Model in Bangladesh

2.1 The background

In Bangladesh, poultry is the most widely held livestock species by rural households, especially poor and landless households. In many cases, poultry serve as the first of a 'livestock asset ladder' in that a family may start with a few chicken and gradually acquire a goat, then a cow through accumulated income and savings. Until the late 1980s, such traditional rural smallholder producers were the only source of poultry and eggs in both rural and urban markets. A few government poultry farms supplied a tiny share of the urban market. However, because of population and income growth and urbanization, demand for livestock products increased rapidly, which the scavenging sector could not satisfy. Income elasticity of demand for meat and eggs was estimated to be 1.19 in 1995-96, and this was projected to be 0.63 in 2020. Meat and egg production in the country would need to grow by 4.7-5.9 percent per annum to meet increased demand (Hossian and Bose, 2000). In response to this market opportunity, beginning from the early 1990s a commercial poultry (broiler and layer) sector has emerged using intensive production techniques (exotic and crossbred birds, concentrate feeds and drugs) and with technical and policy support from the government in the form of subsidized credit, local production and import of day old chicks, drugs etc. Yet scavenging poultry remains the principal supplier of poultry meat and eggs in the country and an important source of protein and income for many poor rural households.

Attempt to improve the scavenging system goes back to 1935 when the then provincial government introduced improved breeds of birds in government poultry farms for multiplication and distribution to village farmers. In 1947, six poultry farms were established in different places in this country for supplying eggs and chicks to the villagers. During the late 1950s, several small poultry farms were also established under the village aid programme for rural development. In 1962-63, the Directorate of Livestock Services also started about 91 small poultry units in 91 Thanas with the objective of supplying improved types of birds to the villagers. However, these efforts were not very successful in promoting commercial poultry production among the rural poultry rearers (Asaduzzaman, 2000).

After the independence in 1971, Bangladesh had to deal with widespread and rising poverty and malnutrition exacerbated by several natural calamities. During the 1970s, food for works, food aid and relief were major sources of food security for millions of rural households. Many national non-government organizations (NGO) emerged and developed at this time alongside established international NGOs undertaking relief and food for works programmes. By the late 1970s some of these national NGOs were trying to combine relief work with development work as a vehicle to create long-term sustainable livelihood opportunities for the poor. BRAC, already a large and highly regarded NGO by that time, was one such organization which pioneered activities for

income generation for vulnerable groups of households implemented through its rural development programme.

2.2 Formative and development stage

According to Saleque (2000), BRAC considered poultry as a potential candidate activity for income generation among the landless, particularly destitute women, many of whom owned a few chicken. There were almost no job opportunities for the landless, disadvantaged women in the country, who were BRAC's targets for relief and development work at that time. So it was conceived that poultry rearing in which these women were already engaged but at a miniscule level, could be an income earning activity for a large number of landless, poor women. This decision to target poor women was a major factor in the future course of development of this initiative. The belief that relief dependent ultra poor could be helped to undertake some income earning activities starting with a few chicken to gradually move away from relief to self-sustained livelihood activities was the basic foundation of the poultry model that eventually became a major development innovation.[2]

High mortality and low productivity were major problems with scavenging poultry. So BRAC started participatory action research in the late 1970s in Manikgonj district involving poor households aimed at increasing productivity of scavenging poultry. Initially efforts were made to increase the productivity of local breeds through cockerel exchange, i.e. giving improved breeds of cockerels for breeding and facilitating exchange among neighbours. This initiative largely failed because the supply of HYV cockerels was limited, some farmers sold the high value HYV cockerels rather than using those for breeding, and mortality among hybrid off-springs remained high. In order to reduce bird mortality, a trial was introduced wherein poultry birds were vaccinated regularly in five action research villages for one year. The positive results in terms of reducing mortality rate and increase in bird population led to realize that vaccination must be an integral part of any intervention to promote poultry rearing as an income earning activity.

Between 1978 and 1982 the BRAC poultry programme had no model or design, it was being done on an ad hoc basis. The programme included supply of improved chicks, common disease prevention and training in improved rearing under scavenging conditions. It was then decided to involve women in the vaccination work and let them vaccinate for a fee as a source of income, using vaccines supplied free of cost from the local DLS office. However, it was observed that under this programme the government

[2] In terms of its beginning, it has some similarity with the founding principles of the Grameen Bank, which started by challenging conventional wisdom that poor had no credit worthiness because they had no collateral to provide as security, they were risk as clients as they would be unable to generate enough income to repay the loan. Working with a few ultra poor households in a village in Chittagong in the mid 1970s, the founder of the Grameen Bank was able to show that those hypotheses were wrong, that material security was not needed for proving loan to the poor and that poor had the knowledge and ability to use credit as a vehicle to get out of poverty, and with additional technical assistance they could do even better. Thus, belief in the poor's ability to escape poverty was a fundamental element in both Grameen's development as an innovative micro-finance institution and BRAC's development of the poultry model.

and other firms were supplying inadequate number of pullets for delivery to the participating households and such pullets also faced high mortality in the scavenging rearing system. It was therefore decided to buy day old chicks from the government farms and let selected, trained and supervised rural women rear the day old chicks for two months in confinement in houses built in their homestead plots and thereafter sell the chicks to other women for rearing. The advantage was that the chicks would become better adapted to the rural environment.

These initiatives led to the development of a rearing model in the early 1980s with several complementary components that have been and are still under development. By about 1985, a prototype semi-scavenging poultry model especially targeted to poor women emerged for rural poultry development. The model was a supply chain consisting of the following beneficiaries :

- **Model Breeder-**Small low cost parent farms with a breeding stock of 54 Fayoumi hens and the requisite number (6) of RIR cocks received either from the project site or directly from Government Poultry Farms. The birds are raised under a semi-scavenging system with balanced rations for producing quality fertile eggs to be used for hatching. The fertile eggs were to be sold to Mini Hatcheries but a substantial amount of the fertile eggs would be sold to the Key Rearers who would hatch them under local broody hens.
- **Mini Hatchery-**Small low cost hatcheries operated with solar energy and kerosene stove. Black pillows filled with rice husk were heated in the sun or by means of kerosene and the eggs were placed into a cylinder between two pillows for hatching. Each hatchery had a capacity to hatch 1000 chickens per month. The day old chicks were sold to the Chick Rearers but Key Rearers also would purchase day old chicks to be reared by the broody hens.
- **Chick Rearer-**Small rearing farms, each with a capacity of 200-300 chickens per batch and 4 batches per year. The chickens were reared in low cost houses from day-old to 8 week of age. The chickens were fed with balanced feed. The 8 week-old birds were mainly to be sold to the Key Rearers within the same village development committee.
- **Key Rearers-**Small farms with only around 5 crossbreed layers for the production of table eggs. The primary outputs were eggs and culled birds. The hens were kept under semi-scavenging conditions with 30-70% supplementary feed. Additionally 4 local hens were kept to hatch preferably eggs from Model Breeders and rear chick from Mini Hatcheries.
- **Poultry workers-**A numbers of poultry workers were trained to vaccinate the birds to control diseases. The vaccine was supplied free by the DLS through the Area Office of BRAC and the Poultry Workers charged a vaccination fee for providing the service.
- **Feed Seller-**The feed sellers were trained to mix feed or sell pre-mixed feed as supplementary feed to the poultry keepers. They prepared balanced chicken rations from locally available feed materials supplemented by purchased nutrients.

- **Egg Collectors-**Table eggs were collected from the Key Rearers by Egg Collectors to be supplied to a community sale center or to the wholesaler at the nearby market.

Apart from the above technical components of the model, there was an organizational support system component including training in various aspects of poultry rearing, organizing target participants into groups, provision of credit, input, extension and health services. Several of these inputs and services required access to the DLS, and these were obtained through informal collaboration with the DLS staff and offices in Manikgonj district, where the action research sites were located. The DLS headquarters in Dhaka later extensively examined the model at work in Manikgonj and considered it viable and replicable.

Based on the experiences of the pilot tests in Manikgonj, BRAC and DLS together replicated the model during 1985-87 on a pilot scale in 32 thanas mainly in the northwestern part of the country through 54 Area Offices of BRAC with assistance from FAO/UNDP. The credit component of the model was adapted from the Grameen Bank's group collective debt responsibility approach. In this approach a group was formed with five credit beneficiaries and a Village Organization was formed with eight groups. The point of contact in terms of technical poultry extension and debt collection is the responsibility of a BRAC Programme Assistant who would regularly contact 10-15 Village Organisations representing 400 - 600 farmers (usually women) on a weekly basis (Fattah, 1999; Saleque and Mustafa 1997).

The outcomes of the extended pilot project appeared to be positive: bird population increased due to reduced mortality among participating flocks and participating women had increased their income, and through this effort BRAC and DLS, an NGO and a government department, learned to work closely together and they also came closer to people who needed their services. Lessons were also learnt about the advantages and problems of functional relationships among the various enterprises in the model and the optimal size of each enterprise, which helped to modify the model components later (Saleque, 2000).

2.3 Replication of the model

Based on these experiences, the model was further modified and replicated with assistance from DANIDA, IFAD and the Government of Bangladesh through the Smallholder Livestock Development Project I (1992-98) in 80 thanas in the western part of the country. The structure of the model as implemented through this project is shown in Figure 1. The model centred around the Key Rearer with some 10 improved hens supported by a number of small entrepreneurs, all available in the village, to provide the inputs and the services needed to maintain the flock. The Key Rearers were wrapped together by community groups, awareness programmes, training and access to micro-credit. The model was designed to create an enabling environment in which all inputs and services needed were available in the village to minimize the risks of investment in a smallholder activity. Even though the different enterprises were established as an

integrated production chain, each unit would operate on free market principle and was free to sell to customers outside the integration chain. Furthermore, no subsidies were provided at the user level. A poultry activity was compulsory for the first loan, but after repayment of the first loan the beneficiary was entitled to a new loan for an activity of her own choice.

The main objective of SLDP-I was to increase per capita income and animal protein consumption among rural poor through participation in the poultry production model. Apart from BRAC, two more large NGOs- Proshika and Swanirvar Bangladesh- were also involved in project implementation. Each NGO was responsible in its mandate area for : 1) establishment of Area Offices; one for each 3,000 to 6,000 women members, 2) selection of potential beneficiaries, 3) organization of village groups, 4) commence a saving programme, 5) training of beneficiaries, 6) creation of an enabling environment by establishing income generating activities such as input suppliers, veterinary service activities, and marketing, 7) provision of loans and assist each of the beneficiary in establishing an income generating activity. 8) technical support for operation of the different activities. During SLDP I, there were on average 3853 Key Rearers per Area Office and matching numbers of other enterprises (Figure 1).

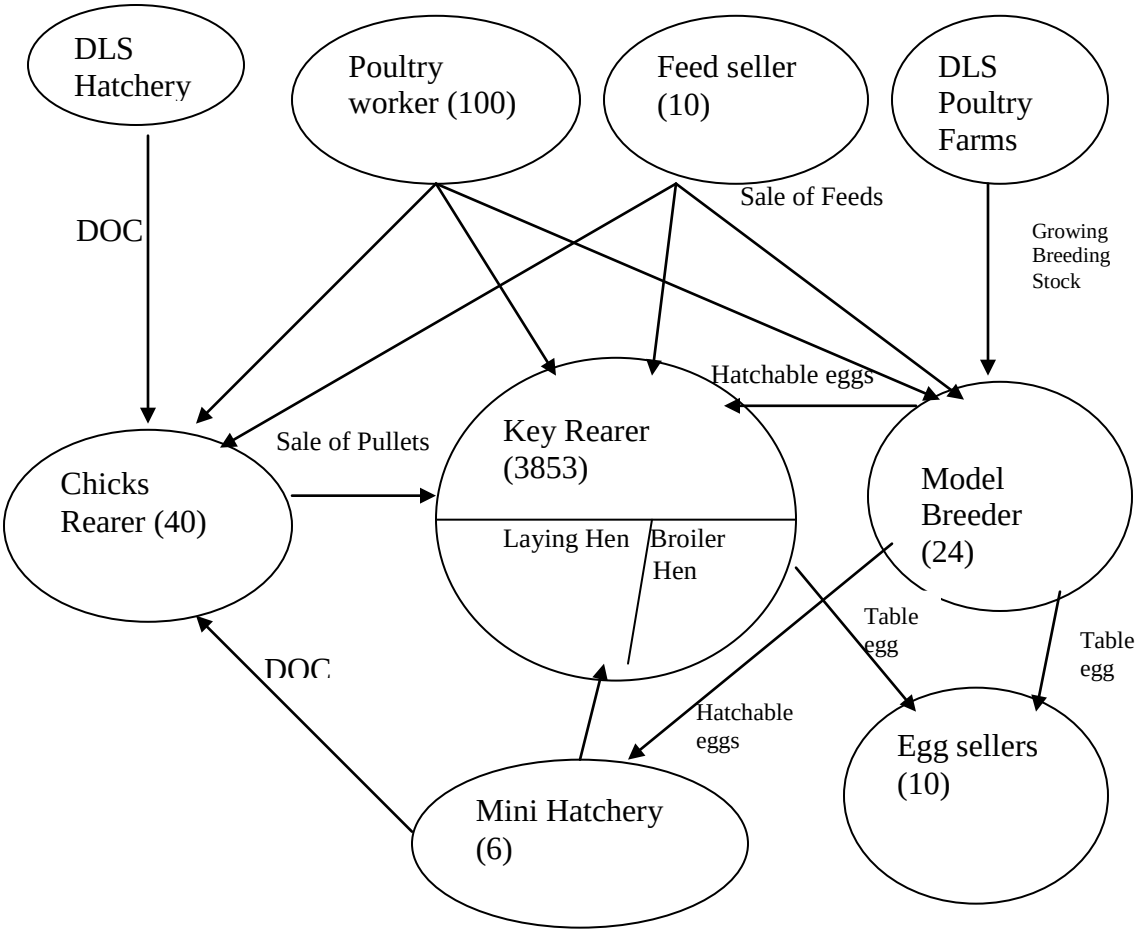


Figure 1: The Bangladesh poultry model in SLDP I including the number of each enterprise per Unit of Area to be served by an Area Office of the implementing agency

The establishment cost and the first 3 years operational costs of an Area Office was covered by the project (Donor). After that, the profit margin from loans, sales of inputs and service fees from the 3,000 to 6,000 members was assumed to be enough to cover the NGO's cost of maintaining and operating the office.

The role of DLS, as the implementing agency, was to coordinate, monitor, control and to provide technical support. The DLS was responsible for : 1) activities and facilities for implementation of a breeding programme, 2) activities and facilities for establishing a Management Information System, 3) activities and facilities for establishing an international training institution, 4) budgets for applied research activities and a comprehensive human resource development programme.

The poultry model was further modified and extended through implementation of the PLDP to a target of 364,000 beneficiaries (Table 1). The objectives of PLDP were:

- To increase the income of rural poor families through the smallholder live-stock enterprise model in 89 poor thanas in the north and northwest regions;
- to increase access to, and control of, resources for women; and
- to develop functional and sustained delivery systems for the smallholder semi-scavenging poultry farmers (particularly vaccines, medicines and scavenger-suitable day-old chicks).

DANIDA funded the project through a grant (US $ 11 million) for Technical Assistance delivered through DARUDEC, a Danish consulting firm, to support NGOs, training and field research. ADB contributed US $ 20 million to DLS to support the credit component of the proejct. DLS was the implementing agency. The PLDP covered 89 thanas in 17 districts in northwest of Bangladesh. The project provided loans averaging Tk2300 (US$48 with the exchange rate of Tk49/US$) each to 364 000 beneficiaries through 10 NGOs including the three large ones included in SLDP I, having experience in administering livestock credit programme. The credit funds were channelled from ADB through a semi-autonomous apex micro financing organization in Bangladesh "Palli Karma-Sahayak Foundation" (PKSF) to the NGOs who were registered as partners of PKSF.

SLDP I was further extended to 26 thanas in five districts in the southern part of Bangladesh through SLDP II with a target of 109,000 beneficiaries. A new phase of the project has been recently agreed between IFAD and the Government of Bangladesh through the Ministry of Finance, not Livestock and Fisheries, with PKSF as the executing agency mainly to support capacity building efforts to make the poultry model more widely used for the benefit of the poor. And this project is first and foremost a micro-credit project but with support for capacity development on livestock as most of the micro-finance investment goes to livestock related activities.

2.4 Changes in the model

An important aspect of the evolution of the model was to accumulate experiences from previous and ongoing projects and ensure that these experiences were reflected in formulation of new projects. Any sustainable model has to be dynamic. A conceptual framework provide elements of the model but these elements- their nature and dimension, may change over time under changing conditions. In the evolution of the model, feedback and learning have played and still play an important role (Dolberg, 2001; Saleque, 2000). Among the NGOs, BRAC operationalised some informal and formal feedback systems both upward and downward. Feedback took place through the numerous meetings and dialogue that was held regularly at all levels (i.e. village, area, regional and head office level). Feedback from and to villagers (various enterprises) provided a foundation for learning. The Programme Organisers met regularly with village groups, discussing issues and problems. Regional Managers and head office Staff visited village meetings or visit with individual enterprise operator when they were in the field. These meetings, together with informal discussions, formed the basis for feedback of the Programme from and to the village groups. In short, there were strong elements reminiscent of the Kolb (1984 p.43) learning circle (Figure 2) involved in the way the model has evolved. This circle underlines learning on the basis of experience.

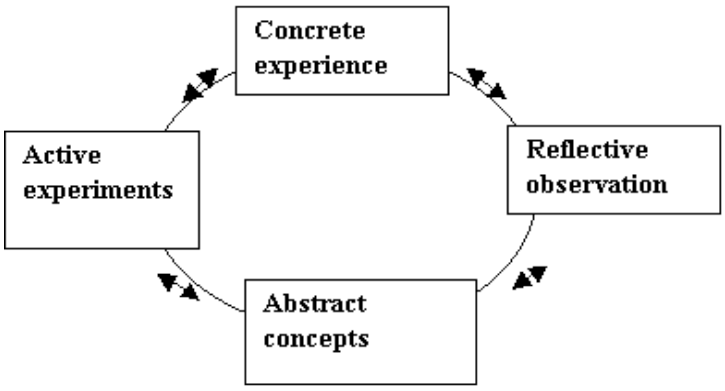


Figure 2. Feedback and learning in the Bangladesh Poultry Model

Source: Kolb, 1984

Experiences gathered from implementation of SLDP-I were used later in redesigning the model in PLDP and SLDP-II. Some of the major changes made in the model are presented in Table 2.

An important change in the model was the use of Sonali crossbreed (Rhode Island Red cock x Fayoumi hen). On-farm research in SLDP I showed Sonali to be the most appropriate breed for semi-scavenging system (Rahman *et al.,* 1997).

The feed choice system was introduced by PLDP to allow hens of Key Rearers to choose own feed supplement. It used a simple bamboo pole split in half as a trough with three

compartments for the protein (soybean), carbohydrate (maize) and the shell (oyster) supplements.

Another important change introduced in PLDP was the hatching and rearing of Sonali chicks by the Key Rearers. Instead of rearing Sonali hens for table egg production, the Key Rearer could have local hens, which brood and hatch fertile Sonali eggs purchased from the Model Breeder. This means the Key Rearer could produce their own replacement pullet, and eliminate the need for both Mini-Hatcheries and government farms as sources of day-old chicks. Hatching and rearing Sonali chicks was also a profitable activity for the Key Rearer.

Experience has shown that mini hatcheries have some problems. Mini- Hatcheries were designed to be operated in remote areas by solar energy and kerosene stove. Black pillows were filled with rice husk and heated in the sun or by use of kerosene stove. The eggs are placed into a cylinder with two pillows for hatching. Their capacity was typically 1000 chicks (or ducklings) per month. Although Chick Rearers were their primary client, many day-old chicks were sold to Key Rearers. This was a profitable activity but inherent problem was that it was most management and labour demanding as eggs had to be turned every four hours including at night. Another problem had been with DLS selling DOC for Tk 8 each, which was lower than charged by Mini-Hatcheries and Model Breeder. So, it was difficult for the Mini-Hatcheries to be competitive in the market.

Table 2. Modification of the poultry model in PLDP and SLDP II from SLDP I

Component	SLDP I	PLDP and SLDP II
Key rearer	10 exotic hens and one cock of different breeds	5 exotic hens of the Sonali breed, with n cock
	Local hens only used to generate income prior to production by exot hens	4 local hens used to brood and hatch fertile eggs from Model Breeder
	No programme for rearing chicks	Chick rearing system involving feeding and ‘Polo’ (basket) shelter
	Semi-scavenging system not fully understood	Choice system to allow hens to choose own feed supplement
	Chicken only	In SLDP II, ducks included
Model Breeder	No specific exotic breed	Fayoumi hens and RIR cockerels
	20 hens plus 3 cockerels	54 hens plus 6 cockerels
	Birds kept on floor system	Matcha (raised floor) system used
	Hatching eggs sold in open market or to mini-hatcheries	Hatching eggs sold to Key Rearer or mi hatcheries
Chick rearer	Birds kept on floor system	Matcha (raised floor) system used
	Males and females reared together	After one month sexes separated for bet feeding and management
Mini-hatchery	Used for chicken eggs	Less emphasis on mini-hatchery, and in SLDP II dropped entirely except for duc

		eggs
Poultry worker	No provision for credit	Credit can be provided
Egg seller	Sell both hatching and table eggs	Sell table eggs only
Feed seller	No change	No change

Source: Dolberg *et al.,* 2002

Mini-hatcheries appeared to work better for duck eggs, which have thicker shells and are less likely to break than chicken eggs. The hatchability of duck eggs was reported by PLDP to be 80% to 90% as compared with 50% to 70% for chicken eggs.

Major problems were anticipated with the supply of essential inputs for poultry farmers. Day-old chicks and vaccine to control Newcastle Disease (locally known as Ranikhet) are produced by DLS. Some of the larger NGOs are already producing their own day-old chicks (though the suitability of breed may be subject to verification) as the DLS hatcheries are not able to supply the full requirement of the Sonali breed. BRAC is hatching a commercial brown egg-layer cross from a RIR cock and a Barred Plymouth Rock hen. Males from this cross may be suitable for using with Fayoumi hens as pure-line RIR are difficult to find and are very expensive. The same can be said for Fayoumi in terms of difficulty of supply.

Some of the other changes include: number of beneficiaries per area office increased by about 50% requiring support staff to handle households per head, the loan size was increased considerably, for key rearers up to 100%. However, the poverty criteria used in SLDP-I seem not to have been used in the later projects, thus allowing field staff some most of the new NGOs to select relatively well-off households as participants. Moreover, in SLDP-I, the three large NGOs involved had an exit strategy. Once the project was finished, the participants were to be transferred to regular poverty alleviation and rural development programmes of these NGOs, so participants would continue to have access to credit and other services for poultry or any other economic activity they wanted to pursue. The smaller NGOs participating in PLDP and SLDP-II apparently did not have any exit strategy, nor did they have infrastructure or experience in livestock related programmes to implement an exit strategy. This aspect might have contributed to larger drop out rates and poor performance of the later projects, as will be shown later.

Much work remains to be done to determine the "best" breed or breed combination under scavenging/semi-scavenging sysetms, and DANIDA has allocated US$ 800 000 for this and other field research topics within SLDP II. If the appropriate breed combination can be found which will produce sufficient eggs while still retaining scavenging ability and disease resistance when crossed with the local hen, then this will contribute significantly to the income generation ability of the beneficiaries in the project. However, this objective needs to be assessed with caution as except the Sonali breed there is no other successful example of improved breed coming out of the scavenging system, and none of the backyard poultry development or cockerel exchange programmes anywhere has produced any stable , sustainable crossbreed (Hans Jensen, personal communication).

Imported vaccine is also commonly used and NGOs are field-testing the *haemagglutination* response of these vaccines in the field. There is also a need for testing these vaccines, as well as the locally produced DLS vaccine in controlled and confined conditions of challenge from the local virulent Ranikhet virus. Heat tolerant V4 Newcastle vaccine strains have been field tested by BLRI (the Bangladesh Livestock Research Institute) under contract research from BRAC, but further tests will be undertaken before large scale usage.

The new project which has been started in 2003 is focused mainly on the capacity building activities of various NGOs and the DLS, as this aspect has been weak in all the three projects implemented so far. By enhancing capacity building efforts of the DLS and the implementing NGOs, it is hoped that these organizations will be able to serve the smallholder poultry activities for poverty alleviation more effectively.

3. Impact Assessment

3.1 Impact studies on the BRAC-DLS model in Bangladesh

Both SLDP and PLDP project designs required establishment of systematic monitoring and evaluation procedures by the implementing agencies (DLS and the concerned NGOs) to monitor the progress in implementation and performance of the projects as well as assess impact of the projects. However, DLS was not successful in establishing an effective monitoring and impact assessment system in either SLDP or PLDP. Most of the results reported on the progress of implementation of the model came from participating NGOs as a part of their routine programme report without detail analysis. Some data were generated mostly by consultant teams, which visited some beneficiaries on periodic basis and by ad hoc studies. It appeared that PLDP also has made little progress toward establishing a viable monitoring system as envisaged in the project plan (Dolberg *et al*., Donor evaluation missions consisting of consultant teams produced some field observation based reports without using any systematic impact assessment design.

In the absence of systematic monitoring and evaluation within the projects, several small and large studies have been conducted at various stages of the projects specifically to assess their impacts. An inventory of studies so far conducted for assessment of impact of the Bangladesh poultry model applied in SLDP I and II and PLDP is shown in Table 3. A brief explanation on each in terms of the background, sampling frame and analytical methodology applied is given followed by a summary of the results obtained.

A mid-term review of the SLDP I done in 1994 recommended generation of field data through survey to assess the impact of the project (DANIDA, 1995). Consequently, the technical assistance team of the project planned a socio-economic survey in co-operation with DLS and the Bangladesh Livestock Research Institute (BLRI). The survey was conducted in 1995 in 4 districts covered by BRAC on a sample of 1000 beneficiaries active at the time of the survey distributed among the various categories in proportion to their share in the target population of beneficiaries (Alam, 1997). Areas covered by the other two NGOs- Proshika and Swanirvar Bangladesh- was not included in the sample as they had just commenced operations (Nielsen, 1998). Results of this study further encouraged DANIDA to use poultry as an important tool in poverty alleviation and provided further justification for DANIDA's involvement in PLDP and SLDP II, as well as DANIDA's support to establish the Smallholder Poultry Network at the Royal Veterinary and Agricultural University in Denmark (www.poultry.kvl.dk). The network has since been active in supporting replication efforts on the Bangladesh model in other countries.

Another survey was conducted in 1997 in five districts covering SLDP I operational areas under all three NGOs on a sample of 1,085 including active beneficiaries, dropouts and non-participants Neilsen (1998). Seeberg (2002) undertook an anthropological analysis of the impact of the poultry model under PLDP based on a purposively selected sample of 30 beneficiary women from the area operated by the ESDO and 11 other respondents

Table 3. Impact studies conducted on Bangladesh poultry model

Source	Study yea	Districts covered	Sample size	Indicators considered
Alam, 1997	1995	Natore, Kusht Chuadanga, Rajshahi	1000 beneficiaries	Poultry population, adoption of breeds, costs and return of beneficia farms, income, consumption, saving gender issues
Nielsen, 1997	1997	Faridpur, Jessore, Gopalganj, Narail, Madaripur	1,085 includi some dropout	Household income, expenditure, foo intake, loan repayment, use of incon gender specific decisions, investmen in assets, dropouts, empowerment of women
Seeberg, 2002	2002	Pirganj and Rangpur	54 beneficiari	Access to land, type of households, loan size and uses, income, empowerment of women, problems
DARUDEC, 2002	2001	10 districts: 1 Thanas	110 beneficiaries 65 dropouts	Household income, food consumptic loan size, livestock per household, enterprise size, training and technica support, performance of DLS, linkag to NGOs, dropouts.
Nielsen, 2003	1999, 200 2003	10 out of 17 districts	Purposive sample of 24 case studies a three points ir time	Income, consumption, investment; woem empowerment, reasons for dr out for key rearers; cooperation between poultry workers, DLS field staff and NGOs
DARUDEC, 2003	2001-02	14 districts: 28 Thanas	5,776 beneficiaries	Credit received, extent of vaccinatio volume of feed sold, mortality, disea prevalence, feed consumption, egg production, costs, profit and household income
Nabeta, 1997, 2002	2002	NA	Secondary dat	Services provided, production syste breed, marketing problem, credit repayment, extent of adoption and benefits.
Raha, 2003	2002	Chapai Nawabgonj, Rangpur, Sherpur distri	547 beneficiaries	Profitability, sale and consumption; marketing efficiency

from an area operated by BRAC. A team of DARUDEC consultants conducted a rapid appraisal to assess the impact of the poultry model under PLDP with a sample survey of 110 beneficiaries selected from 10 thanas located in 10 districts (DARUDEC, 2002). DARUDEC also engaged a consulting firm (Mitra and Associates) to conduct a survey among 5776 PLDP beneficiaries from 28 thanas in 14 districts to assess impact of PLDP

(DARUDEC, 2003). However, this study so far presented only the results of average profitability analysis of different enterprises.

Nielsen (2003) conducted a longitudinal study following a panel of 24 beneficiaries as case studies in 1999 when they joined the PLDP, in 2001 and in 2003 in order to assess the evolution and impact with a focus on the gender dimension of the impacts.

Nabeta conducted a desk study based on a review of IFAD funded projects implemented in different countries including Bangladesh, mission reports and secondary data (Nabeta, 1997, 2002).[3] The report highlights the lessons learned, and the technical and design issues for possible replication. It also aimed to identify areas of research, which would improve the performance of future interventions in smallholder poultry development.

Raha (2003) conducted a study in purposively selected three upazilas (thana) in three districts where the project was more successful and assessed profitability of various enterprises and their marketing efficiency.

Several papers have used the results of the above studies in varying degrees to highlight lessons in terms of evolution of the model, scaling-up, organization of training, credit and delivery of inputs, impact on poverty eradication, impact on food intake and empowerment of women (e.g. Dolberg, 2003; Dolberg *et al*, 2002; Saleque, 2002; Fattah, 2001). These are not original impact studies and their interpretation of the various surveys and their results are not always complete and the same.

3.2 Methodological limitations of the impact studies

The BRAC-DLS poultry model was replicated through three large projects, each implemented in different geographical areas, in different periods of time with some overlap, by different combination of NGOs with varying capacity and experience. Although the basic poultry model structure remained fairly similar, several changes were introduced at different stages. All of these factors may have implications for how the model performed under different projects, how the various technical, institutional and organizational components of the model performed under different projects and situations, what impacts the projects and their enterprises made through which pathways. If beneficiaries succeeded to get out of poverty, how did they do so and what did they do once they passed the threshold of poverty? If some failed to successfully use the enterprise to help them get out of poverty why did they not succeed? It is imperative that these and other related questions needed to be addressed through appropriate sampling frame and analytical approaches to assess the impact of the poultry projects under discussion. But most of the studies listed above suffer from important sampling and analytical limitations, which need to be kept in mind while interpreting their results and their implications. These limitations are summarised below before discussing the results.

[3] Nabeta's results on Bangladesh projects are discussed in this section, results on projects in other countries are discussed in the next section.

Sample size: Given that each project had a large number of target beneficiaries, a representative and adequate sample size would be needed to draw statistically valid conclusions. Due to various factors that might influence performance and impact of the model as outlined above, appropriate stratification criteria and their application would be needed to draw representative samples. Alam (1997), Nielsen (1998), DARUDEC (2003) and Raha (2003) used fairly large samples though not all the important stratification requirements were considered in sampling design. Raha selected three upazilas purposively in accordance with the advice of the NGO which had operational mandate in those upazilas, and the upazilas with reasonably high success records were recommended and selected. Moreover, only households that were operating at the time of the survey were selected, consequently the results are biased upwards and can't be generalized. Seeberg (2002) and DARUDEC (2002) used very small, unrepresentative samples drawn from observed high performing areas often at the suggestion of the implementing NGOs, so they did not allow rigorous statistical analysis and inference. Rahman et al. (1997) also had a fairly small sample though it was subjected to statistical analysis. Nielsen (2003) used a case study approach with a fairly small purposively selected sample, which were interviewed at three different points in time. Case study approach often allows in depth analysis of representative cases for drawing general conclusions, hence Nielsen's results could be considered valuable but by her own account, the samples were selected by the NGOs operating in the selected project areas, so there perhaps was a bias towards selecting more well-off and more successful cases, thereby limiting the degree of generalization that can be derived from the study.

Basis of comparison: The projects operated under a dynamic socio-economic environment where poor peoples' conditions might have changed to some degree without the poultry projects. Therefore, to assess the net effect of the projects at household or higher levels, both before-after (for participants) and with-without (including both participants and non-participants or control group) comparisons would be needed (Table 4). Either before-after or with-without comparison on its own may generate biased estimates of the effects of the project if there were initial differences between participants and non-participants and /or there were changes in peoples' conditions (positive or negative) without the project. The before-after comparison also needs to address the time path of adoption as not all participants joined the project in the beginning or at the same time and problem of using constant or current prices in valuing products and inputs. If the number of participants joining the project has an unequal (skewed) distribution over the life of the project, the sample should also reflect that distribution in order to obtain an unbiased estimate of the impact of the project.

Another aspect of sampling for impact assessment is how to treat active vs dropout participants. Empirical studies on agricultural technology adoption generally divide a population into adopters and non-adopters, and analyse the reasons for adoption or non-adoption at a point in time and then the impact of adoption may also be measured. In reality, technology adoption is not a one-off static decision rather it involves a dynamic process in which information gathering, learning and experience play pivotal roles particularly in the early stages of adoption. The adoption pathway may involve a process in which farmers move from learning to adoption to continuous or discontinuous use over

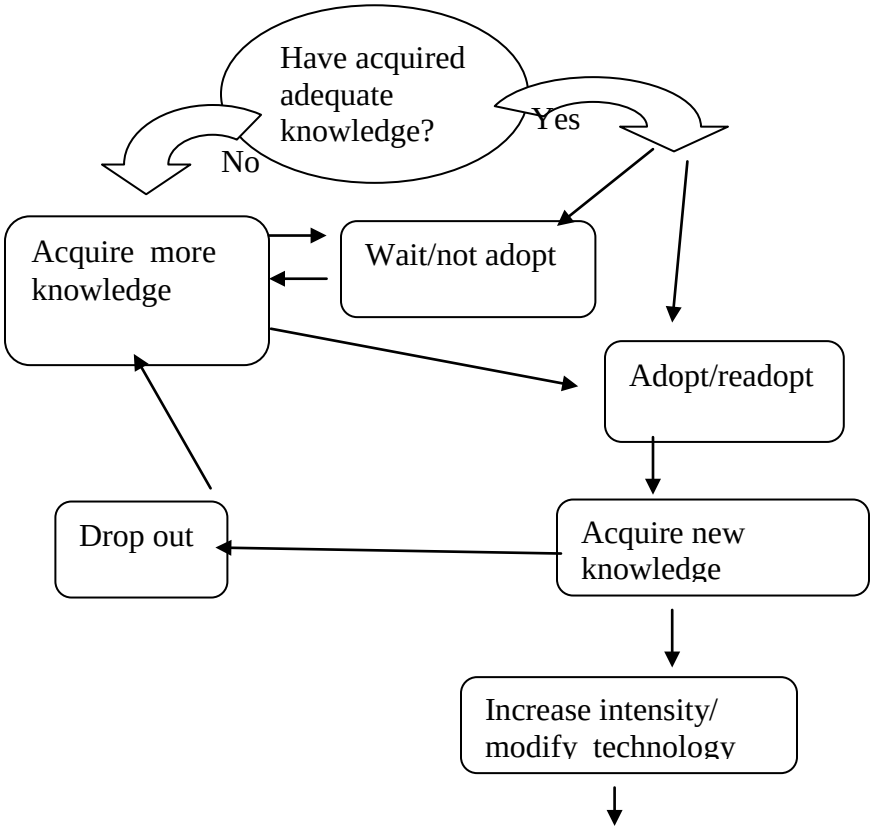
time (Figure 3). Inclusion of drop outs in the sample and analysis of their profiles are very important where high drop out rates, permanent or temporary, are observed, as apparently the situation in all three poultry projects under discussion.

Table 4. The framework for assessing the net effect of any project intervention

	Before Project	After project	Difference
Participants (with project)	A	B	G
Non-participants (without project)	C	D	H
Difference	E	F	I

E = A-C= Difference in initial condition. Assumed to be 0 or no difference but can be different
F= B-D= Project effect without controlling for initial differences
G=B-A= Project effect without controlling for possible change without project
H=D-C= Effect of time/autonomous change without project
I = G-H= Net effect of project intervention

Figure 3 : Learning and adoption pathways for a new technology



Source: Jabbar et al, 2003

All the impact studies under review except that of Nielsen (1998) and Nielsen (2003) used only simple before-after comparison, some included dropouts in the sample but in most cases the depth of analysis remain low. Only Nielsen (1998) used a before-after as well as with-without sampling frame including dropouts but here also the depth of statistical analysis to draw robust inferences remain poor. Nielsen (2003) used a longitudinal approach following a panel at three points in time, including dropouts so provided a more robust basis to assess the impacts over time.

More specific analytical deficiencies will be mentioned where relevant.

3.3 Impact on the beneficiaries

3.3.1 Types of beneficiaries

Alam's (1997) sample comprised 75.2% key rearers, 6% chick rearers, 4% model rearers, 4% feed sellers, 0.8% mini hatcheries and 10% poultry workers and no egg sellers. Male and female headed households in the sample were 76.5% and 23.5% respectively. The study mentioned that the number of samples in each beneficiary group was more or less proportional to the total number of beneficiaries in each group (Alam, 1997, p2). In theory, all the enterprises in the model are targeted to poor women and about 95% of the beneficiaries are supposed to be Key Rearers around whom other enterprises are built (Figure 1). Therefore, there seems to be a major divergence between the expected theoretical composition of the model and its actual composition in the field. Most likely the imbalance occurred because egg sellers were not yet a part of the model when this survey was done and Alam did not include dropouts (majority of which would be key rearers, the largest beneficiary group) in the sample rather took a reasonable number from each of the other categories to allow meaningful analysis.

Nielsen (1998) did not give a breakdown of its 1085 samples according to active beneficiaries and dropouts by type of enterprises, and control group. However, an aggregate gender breakdown was given showing that among the sample active beneficiaries 15.4% were female headed compared to 8.6% for dropouts and 12.2% for control group. Others were male-headed households, which indicate that either the sample was biased toward male headed households or that the project did not really reach its targets who should be principally women. Among the active beneficiaries, 44% could read and write, 52% could sign and 4% were illiterate; the corresponding figures for the control and dropout groups combined were 25, 40 and 36% respectively.

Similar problems in the sampling composition remain in most other studies. For example, Swan (2000) identified three categories of beneficiaries as follows without giving any quantitative figure about the distribution of these beneficiaries:

- Women from poor and landless farmer households and female-headed households. (Female-headed households made up about 15% of the total households in Bangladesh, most of them are married women, but either separated,

divorced or abandoned by their husbands. In some cases, their husbands died leaving behind the burden of children and other family members on them).

- Poor landless farmers who operate less than 0.5 acres (0.2 ha) of land and depend on the sale of more than 10 days per month of their manual labour as the main source of income; and
- Poor and marginal farmers with between 0.5-1.0 acres (0.2-0.4 ha) of land and an average daily income of less than Tk 17/day (about US$ 0.35/day or $ 128/year).

Seeberg (2002) reported that 74% of the beneficiaries had less than 0.50 acre of land and 12% had 0.51-1.00 acre and 4.3% had 1.01-1.50 acres. This is also an indication that a good proportion of the participants were well-off households (with over 0.5 acre land and perhaps some livestock, as land and livestock ownership has good correlation), who were not the basic target of these projects.

The complexity and capital and skill requirements are not the same for the different enterprises, and the enterprises need to be adopted as independent individual choices on a voluntary basis but function as an integrated chain. Therefore, finding the ratio of different entrepreneurs and their profiles (asset and income base, skill level, demographic characteristics, market orientation and access etc) would be useful in explaining which type of poor women adopted which enterprise and why, what participant characteristics contributed to non-participation, participation, success or failure and why there was an imbalance in the model composition, if any. Such detailed analysis was missing in all the studies.

Some studies mentioned that some benefits from the poultry projects have spilled outside the model participants. Rather than using the loan for poultry, some members used part or entire loan for other enterprises, some initially took up poultry but gradually moved into other things such as rickshaw, petty trading. But these results could also be interpreted differently. Rather than spillover benefits, they might indicate and explain the high drop out rates (see below). Perhaps these participants did not have any interest in poultry in the first place but joined the project to access credit and soon moved out of poultry to engage in what they wanted to do. This implies that given freedom to choose a business with the micro-credit, not everybody would take up poultry as the initial or first choice as required by the poultry projects. Mini-hatcheries and model breeders were supposed to sell their improved chicks to other enterprises in the model but some sold to local farmers outside the model either because there was inadequate number of key rearers in the model or because they produced a surplus. Other secondary beneficiaries include farmers in the locality who bought health services from the poultry workers, and feeds from feed sellers. The extent of such spillover beneficiaries of the project has not been analysed.

A more fundamental question is that the concept has been developed to target poor women, especially the ultra poor, but it is unclear from the various impact studies if the poorest women were targeted and reached in the various projects. An objective characterisation of the actual beneficiaries is essential because, while discussing the principles and problems of adaptation of the Bangladesh model elsewhere, Jensen (2002) mentioned that " it is surprising so many organizations and individuals have a policy to

target the poorest, but either on purpose or in reality exclude the poorest segment of the population from their activities. Common phrases are : the poorest do not have the capability to learn, the poorest are lazy, the poorest have chosen to live in poverty, or it is better to start with the better off and then the poor will benefit through a trickle-down effect –an approach which has been rejected long ago".

3.3.2 Drop out

None of the formal impact studies tried to estimate drop out rates though some studies included drop outs in the sample. Nielsen (1998) reported drop out rates of 2-3 percent based on estimates of the implementing NGOs. Quoting PLDP monitoring system data Nielsen (2003) reported that between 2001 and 2002, 59% of the Key Rearers in the PLDP project areas, who constitute 95% of the target beneficiaries, have dropped out. In her own case studies, 26% dropped out completely between 1999 and 2003 and another 30% stopped PLDP activities but have maintained contact with the NGO for savings and participation in group meetings. This latter group perhaps continue to maintain contact with the NGO to access credit to undertake activities of their own choice in the future. An IFAD review and evaluation mission reported that 50% of SLDP participants appeared to have dropped out after the project ended and 35-40% of PLDP beneficiaries dropped out even before the project was completed (Anonymous, 2002).

Nielsen (1998 and 2003) mentioned losses suffered due to high chick mortality, lack of technical services and low productivity, problems in repaying loan, family problems e.g. advice of husband to stay away to avoid being indebted, as reasons for drop out. About 33% of the dropouts showed interest to join the project again. There are indications that some people dropped out because they joined the model only to obtain credit and initially adopted a poultry enterprise but soon moved into their choice of business leaving poultry partly or fully. The IFAD mission mentioned several reasons for drop out : (a) small loan size and very small poultry enterprise do not provide a pathway out of poverty, (b) some poultry enterprises, especially mini hatcheries and model rearers, were not profitable, partly due to low market price of eggs and other market distortions, (c) the design being fixed with type, scale and relative number of enterprises, adopters did not always had the freedom to choose the enterprise they liked best, (d) the ratio of participant to NGO field staff was much higher than normal NGO micro-credit programmes, especially under PLDP and SLDP-II, hence supervision, training, input supply and services and regular contacts with participants could not be maintained at optimal level. A more schematic presentation of the causes of drop out is given in Figure 4. These features led the IFAD mission to express concern about the sustainability of the poultry production system. A detailed analysis of the drop out rates and profiles of drop outs vs those who stayed in the business may be very helpful in increasing the sustainability of the model and the projects as targeting potential adopters and their training and other needs may be more objectively and accurately done in future projects.

3.3.3 Profitability of poultry enterprises

A number of studies assessed profitability of different enterprises and found them positive. Some of the important results are summarised in Table 5. The absolute values of profit for some enterprises appear to be very low while for others they are reasonably good. However, there is no detailed analysis of profit variability and related causes or factors. Cost of day old chicks, supplementary feeds, if any, health costs and output prices may have influence on profitability. Also there may be differences between enterprises, locations and operating areas of NGOs. For example, the IFAD review and evaluation mission observed that mini hatcheries and model breeders found it difficult to run a viable business producing hatching eggs and chicks because DLS farms supplied chicks at below commercial prices. Mini hatcheries also appeared to be technically difficult to operate because of high labour and management demand. The mission also observed egg prices lower than usual in several locations, especially near the Indian border as eggs come across the border and drive down local prices (Anonymous, 2002).

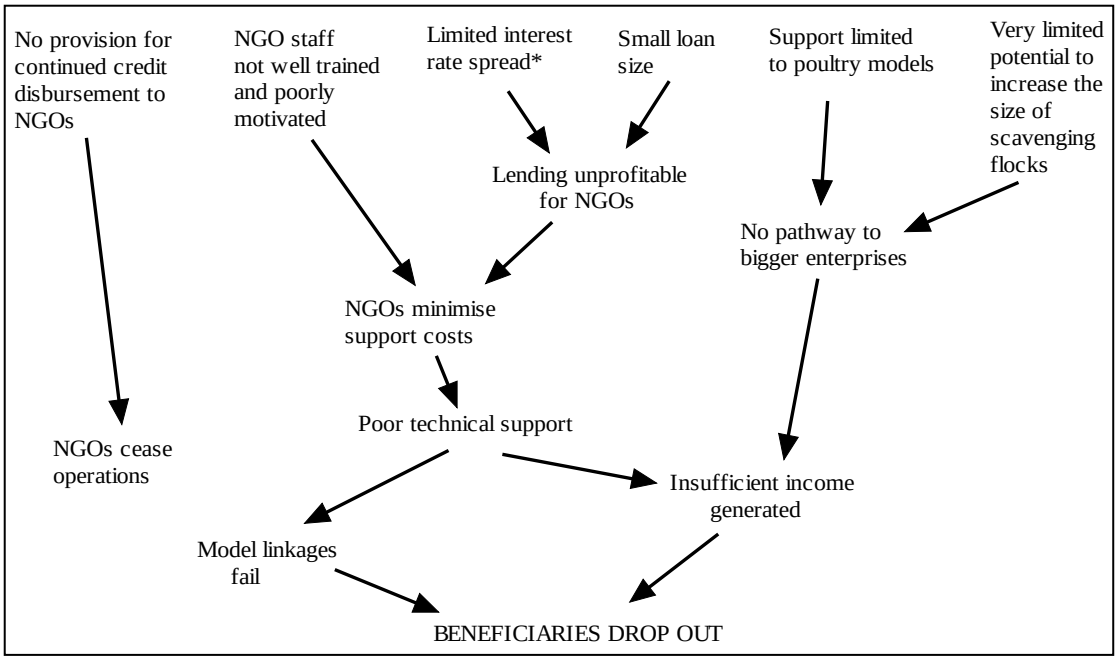
Market access for products may be a major factor in profitability. The implicit assumption is that poultry producers in the model should have no problem selling their small quantities of outputs locally. Egg sellers in the model buy eggs and sell usually in local markets. But if a large proportion of the poor families take up poultry and expand the size of the enterprise under semi-scavenging conditions, aggregate increased production may glut local markets unless traders can access larger urban markets. Moreover, increasingly these bigger markets and towns may be supplied by the rapidly expanding private commercial sector. Commercialisation may lead to falling poultry prices relative to feed cost but commercial farms may remain competitive due to economies of scale and they may push scavenging and other small-holder poultry units out of business. It is therefore necessary to analyse the competitiveness of scavenging/semi-scavenging poultry and identify production and market niches where they may have potential for survival.

Table 5. Profitability (US $) of semi-scavenging poultry activities 1994 and 1997

Year and parameter	Poultry workers	Chick Rearers	Key Rearc	Feed Sellers	Hatchery Operators
1994					
Profit per month	3	15	4	6	27
1997					
Gross revenue per week	3.66	28.70	1.44	53.39	23.64
Total expenditure per week	1.49	22.15	0.61	49.96	18.15
Total profit per week	2.4	6.55	0.83	3.43	5.49
Profitability (%)	59	23	69	6	23
2002	1.40	1.10	2.75	>1	1.14
Benefit/cost ratio					

Source: for 1994 (BRAC, 1995), for 1997 (Alam, 1997; Saleque, 2000); for 2002 (Raha,2003)

Figure 4: Causes of non-sustainability in SLDP



* only applied to the NGO Proshika

Source: Anonymous, 2002

3.3.4 Income of the beneficiaries

Several studies assessed income from poultry and its contribution to total household income. However, it is unclear how poultry income and total household income have been actually defined and if all the definitions are the same or comparable. It is also unclear if current or inflation adjusted prices have been used because inflation and currency devaluation would make comparison of values generated at different times difficult. Results derived from Alam (1997) are summarised in Table 6. The average weekly household income of the beneficiaries increased from taka 268 to 398, i.e by taka 130 or 48%. This was more or less equivalent to the income derived from the poultry enterprise at the time of the survey though in a few cases, poultry income was higher than the overall change in household income. The survey also showed that 28% of the households had increased their income above the poverty line (Nielsen,1997 based on Alam, 1997) although no details was provided on whether they could move up any further after crossing the poverty line and what pathway they took to move up the ladder. Therefore, it appears as though the entire change in average household income came from participation in the poultry project. Poultry income accounted for about 35% of household income at the time of the survey, the figure in the beginning of the survey was not available. There was considerable variation in household and poultry income and its share between the different enterprises and also between different districts.

Table 6. Average weekly income of different beneficiaries and its share in total household income, 1995

Beneficiary group	Total hh income before project, Ta	Change in total hh income at survey, Taka	Total poultry income at surve Taka	Poultry share total income,
Key rearer	270	121	122	31
Mini hatchery	289	188	261	55
Model rearer	275	78	151	43
Chick rearer	269	256	229	44
Feed seller	262	159	249	59
Poultry worker	243	129	161	43
All beneficiaries	268	130	139	35

Note: US $ 1= approx. TK 41 in 1995.
Source: Alam, 1997

Neilsen (1998) found that net poultry income and its share in total household income were higher for project beneficiaries before the project and increased five times among project beneficiaries but only marginally among the control group(though not clear, control group perhaps include the dropouts) (Table 7). Project members' own contribution to household income increased from 16 to 30% among the beneficiaries but only from 9 to 10% among the control group. Breakdown by type of enterprises was not available nor was any indication of the extent of variation across districts and NGOs.

Nielsen (2003) found average monthly beneficiary income of key rearers from PLDP poultry project activities was Tk 1470 in 2003, which was higher than the average for all PLDP activities though this comparison was perhaps not meaningful as the sample of different enterprises was not proportional. About 75% of the beneficiaries had more than one source of income in 1999 as well as in 2003. Average monthly income from non-PLDP activities increased from Tk 255 in 1999 to Tk 775 by the end of 2002.

DARUDEC (2002) showed that average monthly income of different beneficiary groups increased by 14-163% (Table 8). However, the small sample size and its lack of representativeness may have highly biased some of the estimates.

Table 7. Average weekly poultry income and its share in household income among beneficiaries and control groups, 1997

	Beneficiaries		Control	
	Before proje	At survey	Before proje	At survey
Poultry income, Taka	20	102	10	15
Total household income, Taka	346	455	292	326
Poultry share in total household income, %	5.8	22.4	3.4	4.6

Source: Nielsen 1998.

Table 8. Average monthly net income (Taka) from semi-scavenging poultry, 1997 and 2002

Beneficiaries	Increased Income	% change in income
Key Rearers	1193	56
Mini Hatchery	2557	61
Chick Rearers	1500	51
Model Rearers	728	14
Feed Sellers	2019	99
Poultry Workers	1025	58
Egg seller	2468	163

Source: DARUDEC (2002), US$1 = approximately Taka 56 in 2002.

To be able to make any impact on poverty, the poultry enterprises in the model have to be sufficiently profitable and generate adequate income to be attractive. The income and the cash flow pattern should also enable repayment of loan in the beginning and leave some margin for family expenditure. The beneficiaries are supposed to be poor women who have practically no or few other direct cash income generating activities though they contribute a lot of their time to other farm and household activities. Therefore, most producers practiced poultry as a complementary or supplementary enterprise to add to their other activities, direct income generating or not. In the absence of a good understanding or measure of the alternative income sources or opportunity cost of their labour and capital, it is difficult to judge if the profit rates and income derived from various enterprises shown above were sufficiently attractive for the majority of the poor to continue this as an income diversification strategy and use this to get out of the threshold of poverty. Whether the income and cash flow had any relation with repayment performance and drop out would also be useful information. None of the studies that assessed profitability and income looked at these issues thoroughly. The high drop out rates indicated by IFAD and Nielsen mentioned earlier imply that such detailed analysis is required to understand the viability and sustainability of the model and it's various components.

3.3.5 Consumption, saving and expenditure pattern

It was envisaged in the project design that increased poultry production would directly contribute to food security by enhancing consumption of poultry meat and eggs to some extent and indirectly by enhancing income to purchase other foods. Also enhanced income could be spent on non-food items, be saved and invested in other assets. Alam (1997) and Nielsen (1998) found significant increases in the consumption of several food items among the beneficiaries (Table 9). Nielsen also found that the control group had lower initial consumption levels and significantly less consumption increases over the project period. Nielsen (2003) found that starvation in the lean season (about 4 month per year) reduced in case of 75% of the beneficiaries and intake of meals with eggs and fish

had increased in the rest of year, though it is unclear how much of this could be attributed to the PLDP poultry activities. Raha (2003) found that consumption of eggs and chicken increased significantly among chick rearers and model breeders but not so significantly among other enterprises.

Table 9. Changes in average intake of some food items among project beneficiaries, 1995 and 1997

	!995 study			1997 study		
	unit	Before	After	unit	Before	After
Eggs	No/week	1.78	4.61	No/weel	2	5
Chicken	No/year	2.13	5.05	Gm/wee	62	105
Fish	Times/mont	10.0	12.0	Gm/wee	983	1310
Meat	Times/mont	0.87	1.88	Gm/wee	126	190
Milk	Litre/month	0.80	2.59	Litre/we	0.5	1.1
Grain	Kg/week	12.08	14.30	Kg/weel	14	15
Vegetables	Times/week	12.1	12.2	Gm/wee	3057	3801

Source: Alam, 1997; Nielsen, 1998

Nielsen (1997) showed on the basis of the survey reported in Alam (1997) that among the project beneficiaries ownership of improved breeds of chicken increased by 47%, ownership of goats increased by 30%, cattle ownership increased by 139%. Nielsen (1998) showed larger increases in saving and expenditure among beneficiaries compared to control groups (Table 10). Large increase in cash savings among beneficiaries is primarily due to compulsory savings requirements of the NGO credit groups. Other expenditure includes investment in non-farm activities such as rickshaw or other business

Table 10. Changes in average monthly expenditure and saving (Taka per household) among beneficiaries and control groups, 1997

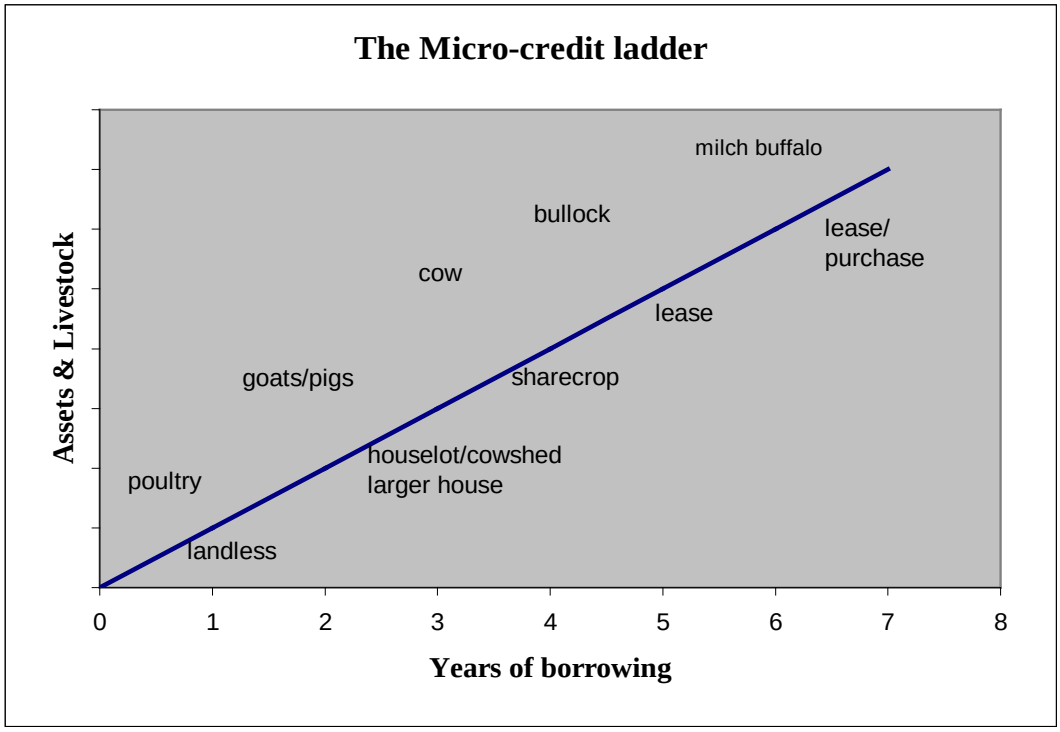
	Beneficiaries			Control group		
	Before	At survey	% change	Before	At survey	% change
Food	951	1181	24	795	924	16
Clothes	141	153	9	118	123	4
School fees	45	71	57	30	39	30
Medical	22	28	27	18	22	22
Marriage/gift	14	20	43	17	19	12
House repair	47	72	53	47	45	-4
Animals	22	38	73	11	16	45
Savings	57	144	153	20	40	100
Other	93	127	37	78	87	12
Total	13	18		11	13	

Source: Nielson, 1998

run by the male members of the household for additional income generation. Investment in animals showed a ladder pattern over time: from chicken and ducks to goats and cattle. Nielsen (2003) found that beneficiaries have increased their total savings by 60% (from

Tk 28314 to Tk 47278), have increased their average land holding- both owned and rented, and have improved their houses, invested in tubewells, improved latrines over the three year study period. Seeberg (2002) mentioned similar pattern in her case study households and Todd (1998) found a similar pattern among Grameen Bank's micro-credit recipients in Tangail district (Figure 5), which is outside the poultry project.

Figure 5. Micro-credit recipients' investment ladder over several loan cycles



Source: Todd , 1998

3.3.6 Empowerment of women

Participation of women in decision making about various aspects of the household and increased confidence in making decisions are often considered as good indicators of their status and power in the family and society. Mobility, e.g. going out of the homestead and to the market, may also indicate empowerment. Nielsen (1997) mentioned that beneficiaries had gained more influence on deciding the use of income and schooling of their children. With the project income, joint decision making by husband and wife had increased from 54% to 60% of all sample households. School attendance of children of beneficiary households increased from 86 to 99% and the increase was much higher for girls, which might be an indirect indicator of the influence of women in sending girls to school. Nielsen (1998) found large increases among both beneficiaries and control groups in women's participation in decision making on how to spend income. Also joint decision on which children to be sent to school increased from 44% to 70%, while women only decision increased from 14% to 27% among beneficiaries. For the control

group, the same trend in decision making was found. Seeberg (2002) reported that 92% of the interviewed women kept the income from selling of eggs and chicken in their own hands and they sent more of their children, especially girls, to school. Nielsen (2003) mentioned that beneficiaries had increased their confidence and mobility outside the homestead, they also had improved their status in the family by taking part in decisions as they were recognized as income earners. Women give priority to schooling of their children and they give priority to daughters.

Although participation in the poultry project might have positively contributed to some of the indicators of enhanced women power and status as mentioned above, a clear attribution to the project would be difficult because of the presence of other parallel programmes in which both the beneficiaries and the non-beneficiaries have participated. For example, there is a countrywide programme on food for education run by the Education Ministry and implemented through some NGOs including the ones implementing the poultry project. In order to encourage poor families to send their school age children to school, a certain amount of food grain is given per child every month if they attend school regularly. The food compensate for their lost work and income and contribute to the country's literacy expansion programme. Some NGOs also have informal literacy/schooling programme of their own. Increased school attendance in the project areas might have resulted largely due to these programmes rather than the poultry project *per se*.

3.4 Performance in delivery of services

3.4.1 Credit

Micro-credit is an essential component to support the expansion of the model. Alam (1997) found that the amount of loan received by different beneficiaries varied due to the type of enterprise. For instance the Key Rearers received the lowest amount of loan (Taka 1003), while the Mini Hatchery owners received the highest amount (Taka 5750). All loanees were found to be regular in weekly repayment. DARUDEC (2002) reported that among the Key Rearers, Poultry Workers and Egg Collectors around a third to half of the loan provided was used for the poultry enterprise; the rest was mainly invested in some other income-generating activities. Two main investment items from loans was petty trading and procurement of goat. A number of beneficiaries dropped out of the programme due to late disbursement of credit.

Nielsen (2003) found that one third of the PLDP beneficiaries had problems of loan repayment due to sickness in the family, natural calamities and livestock mortality. Among the drop outs, 65% had problems with loan repayment and finance, 22% had problems in repaying the first loan. An IFAD review and evaluation mission that assessed SLDP I observed that small loan size was a reason for many drop outs as it did not provide a basis for a viable business to get out of poverty. They also observed that in SLDP I project areas, poultry production has been sustained where the two larger NGOs- BRAC and Proshika- had the resources to continue the credit operation along with technical support. The mission also found poor loan recovery – below the level expected

in normal micro-credit programme, where drop out rates were high. Similar problems in SLDP II led the PKSF, the apex credit management agency, to suspend credit fund disbursement to 4 out of 10 of the NGOs whose operational areas had high loan default rates (Anonymous, 2002).

3.4.2 Training and technical support

Short term training to potential beneficiaries to be provided by the implementing NGOs is an essential component of the project. Under SLDP I, out of a target beneficiary of 400, 000, training had been provided to about 77,310: 3900 poultry vaccinators, 1400 chick-rearers, 400 feed-sellers, 71500 key rearers and 110 mini-hatchery owners, though it is unclear whether these numbers were for the entire project period or for an incomplete period (Nabeta, 2002). Up to September 1999, the total number of trainees covering the different beneficiaries of PLDP was 170,550 out of a target population of 364, 000 (Newnham, 2000). The type and duration of training provided to various target beneficiaries of PLDP appeared to be more or less the same irrespective of various type of cadres. The beneficiaries successfully operating their enterprises expressed a general positive attitude to the training they had received, whereas dropouts from the same groups and villages expressed negative attitude. Many of the beneficiaries could not recall much of the technical aspects that they had been taught and this was more apparent among the dropouts. Only Mini Hatchery owners, Chick Rearers and Poultry Workers received handouts. It appeared that NGOs, especially smalaer ones in PLDP and SLDP-II, put considerably more emphasis on credit disbursement and recollection, than on technical issues (DARUDEC, 2002). Nielsen (2003) mentioned that communication and cooperation among the DLS and NGO staff in the field and the poultry workers has been poor, and much less than desirable to make the model work efficiently. Since the poultry workers are the key players in providing health and other technical support to the various enterprises, it is essential that they get proper training and timely supply of vaccines and other inputs to perform their job. This did not appear to be the case in the PLDP project areas where 25% of the area offices of the NGOs did not keep the local DLS offices informed of who the poultry workers were.

There did not appear to be any understanding among the beneficiaries concerning the Poultry Model and the inter-action and inter-dependency of the various enterprises. A major problem with regard to training in the technical aspects of the Bangladesh poultry model as well as extension was that recipient organizations and donors alike have grossly neglected these issues and so only limited human capabilities existed in technical support of the model (Dolberg, 2001). The NGOs stated that 60% of the field staff time was used on credit disbursement, recollection and savings, 20% on technical aspects and 20% on social services. However, none of the Area Offices had staff fully conversant with poultry management. Although the projects paid for recruiting graduate level technical staff (with animal husbandry or veterinary training) for area offices, only about 5% of the staff had such qualification. The NGOs apparently had difficulty hiring and retaining staff with

graduate animal science training, as they tended to look for better paid and higher status jobs in urban areas[4] (Anonymous, 2002).

3.4.3 Research and capacity building

Teaching and research at universities and public sector institutions generally ignored the scavenging poultry sector, except in a few cases where backyard poultry projects through cockerel exchange programmes were implemented on a pilot scale, perhaps assuming that it had no prospect for development. Since the 1980s, there has been a rapid expansion of the work on the smallholder poultry concept in Bangladesh at the initiative of BRAC in collaboration with DLS and outside donors. The result is that there is a shortage of well trained livestock staff at all levels to address the research, extension and development issues to support scavenging poultry sector (Dolberg, 2003). SLDP and PLDP made provision for adaptive research and capacity building for developing the semi-scavenging poultry model. DANIDA has allocated US$ 800 000 for field research within SLDP II through 50 scholarships for M.S studies and thesis research (10 per year). The Smallholder Poultry Network based at the Royal Veterinary and Agricultural University, Copenhagen provided training to 15 Bangladeshi students at M.Sc level through a sandwich programme, where a University in Denmark has awarded degrees, but research has been conducted in one of the poultry project areas in Bangladesh[5]. These graduates are likely to make good contribution to the project in the coming years provided they are retained in the poultry related work rather than transferring to other sectors.

Poverty alleviation through scavenging poultry was the original goal of the initiators of the concept (BRAC, DLS and others who contributed to the design and evolution of the Model). However, the evolved model is no longer based fully on only local breeds and scavenging feeding systems rather a combination of local and improved breeds as well as supplementary feeding and management are part of the model, hence described as semi-scavenging. All of these require an elaborate technical and institutional support system. Although required input and service support systems have been developed through trial and error and implemented under the three projects, research on their effectiveness and alternative modes of delivery are absent.

Given the semi-intensive nature of production of different enterprises in the model, it became

[4] Given the number of unemployed agriculture, especially animal husbandry and veterinary, graduates in the country, finding trained staff for the project should not be a problem. It is however, to be expected that such graduates will look for better job opportunities if the NGOs do not provide adequate incentives for them to stay. Whether the salary and benefits offered to these graduates by the NGOs are reasonably attractive in relation to the market and whether the NGOs are budgeting lower benefit packages to keep project cost low needs to be closely examined.

[5] The main university involved in Denmark is the Royal Veterinary and Agricultural University, but the board of the Poultry Network is multidisciplinary with disciplinary support provided by some other institutions including Copenhagen University, The Centre for Development Research and Aarhus University.

necessary to consider if local breeds were appropriate or adequate to run market oriented poultry enterprises. This question led to the determination of the "best" breed or breed combinations under scavenging/semi-scavenging systems. If the appropriate breed combination could be found which would produce sufficient eggs while still retaining scavenging ability and disease resistance when crossed with the local hen, then this would contribute significantly to the income generation ability of the beneficiaries in the project. Some work has been initiated in this line though caution about its success is warranted (see above).

Rahman *et al* (1997) conducted a study to compare the performance of different breed combinations under semi-scavenging conditions at farm level. The breed combinations used for trial were based mainly on White Leghorn, Rhode Island Red and Fayoumi. Breeding for production of chicken was done at DLS farms. The chickens were reared by the Chick Rearers for up to 8 weeks of age in a flock of 250 chickens per rearer. 297 Key Rearers reared a total of 1,272 pullets and the trial was conducted in four districts in four seasons. Based on the results of this study Dolberg (2003) concluded that there was no significant difference in performance among the different breed combinations, and location rather than breed was more important affecting mortality and productivity. The implication drawn was for adoption of a flexible approach in breed use: while Sonali breed had done well and it made sense to use it when it was available, there was no justification to make the supply of the Sonali a bottleneck for expansion of the poultry model. If it could not be obtained, other breeds could be used and they could be obtained from sources other than DLS. However, a re-examination of the results indicated that Dolberg's interpretation of the results and the conclusion was not fully accurate. It was found that in terms of age at first laying there was no significant difference among the breeds and that the combination of RIR x Fayoumi (Sonali) had the statistically significant best performance with the highest egg production (156 eggs/hen/year), lowest mortality (16%) and highest profit per hen (205 Tk/hen). Among the other four breed combinations these differences were not statistically significant. There was no significant seasonal effect on egg production.

Another field trial conducted in 2001 in the PLDP area as part of an M.Sc thesis research under the guidance and support of Danish Poultry Network compared Fayoumi breed with the Sonali and crosses with the Native Naked Neck, and confirmed the superiority of the Sonali (Zaman, 2002). On the other hand, Ali et al. (2002) found in a similar trial elsewhere in the country that location had significant effect on productivity. However, it is quite possible for location to have general effect on productivity because of ecological and production system differences: a grain based production system may generate more feed supply for scavenging poultry than a non-grain based system, a dry environment may produce less organism in the soil for birds to pick and may produce less disease conditions than a flooded, wet condition. [6]

[6] The numbers of observations involved in experiments in these studies were relatively small. For example, in the trial by Rahman et al., there were 3 sites, 8 breed combinations and 4 hatches, i.e. 3 factors and 96 cells. There were 1272 birds in 297 households , i.e 3 hh/cell or 12-13 birds/cell or 4 birds/household. Ali's trial included 72 birds distributed to 18 households in 10 locations in 7 villages.

In pure scavenging systems, perhaps significant attention needs not be given to breed, as people will be expected to use whatever breed they have locally. If the system is semi-scavenging or semi-intensive for which day old chicks and other support services have to be organized, and if improved breeds are to be considered, choice of breed(s) may become a major consideration because even with one improved breed, Sonali, the supply of day old chicks from the DLS farms is often inadequate. With several breeds and several suppliers, the system may be even more complex and chaotic. Partly as a response to this problem, BRAC has started to produce DOC in order to service the requirements of the poultry model (Dolberg, 2001). BRAC perhaps also sees here a business opportunity as DLS farms may not be able to continue supplying the expanding demand for DOC from the rural areas. It is likely that BRAC will use the poultry model to develop a contract growing system whereby BRAC will supply DOC and other inputs and buy back eggs and broilers. The difference with commercial contract growing may be that BRAC will still keep the focus on poverty alleviation and target the poor women, or poor households in general, as in the poultry model.

Some of the changes introduced in the model as it evolved from scavenging to semi-scavenging system are partial confinement and feed supplement. Since improved breeds are used, supplement has to be of good quality protein to be useful. Confinement and supplementation is also required in local chicken to reduce mortality due to predator and diseases. The Newcastle Disease is found to be most common, so regular vaccination through poultry workers has been introduced in the model. However, interaction between breed, feed supplement and disease control need to be systematically studied in order to define optimal ration and management regimes to produce best results. An extension and dissemination system with high biosecurity has to be developed and implemented as the first step to make semi-intensive systems viable (Jensen, 2000; Dolberg, 2001). But research in these areas is virtually absent in Bangladesh. Ali et al. (2002) conducted a small trial to assess the effect of supplementation on egg production of crossbred birds and found that ad libitum feed supply gave the highest egg yield and also location was a significant factor in egg yield difference. Several papers on the subject quoted a study by Roberts et al. (1994) conducted in Sri Lanka, showing that a supplement containing 26% crude protein significantly reduced mortality in village chicken, 9 and 15% crude protein supplements were not effective as it was well known that sufficient protein in the diet was required to build up a chick's immune system. However, it is not clear whether supplementation with 26% crude protein (or 16% for local chicken) was adequately profitable to encourage poor people to make such investment in scavenging poultry, especially with local breeds.

Therefore it is unclear if statistical analyses and conclusions drawn from such small numbers of observations are robust enough for generalization.

3.4.4 Stakeholder participation and sustainability of the system

From the foregoing analysis it appears that the poultry model has been developed as an integrated supply chain. The enterprises in the model were designed from the suppliers' perspectives and new enterprises were designed in the process of evolution to fill a perceived gap. Although feed back from beneficiaries and learning have been used to some extent in introducing changes in the model, it is clear that a fully or sufficiently demand driven, beneficiary participatory approach was not applied in designing the model or in introducing changes. All three poultry projects funded by donors had explicit budgetary provision for hiring adequate technical staff, for providing adequate and appropriate training to potential beneficiaries, and for establishing a sound monitoring and evaluation system. In all three areas, actual performance appears to be poor and the IFAD review and evaluation mission expressed concern about the sustainability of the semi-scavenging production system.

In order to address some of these concerns, the newly agreed project funded by IFAD and DANIDA is primarily focused on enhancing capacity building of the various agencies that are involved in servicing the poultry model. NGOs have developed good micro-credit systems but such credit is often provided without technical training, and the objective of the new project is to promote a 'credit plus technical support' approach. Moreover, credit will be made accessible without restriction on the choice of enterprise so credit recipients can choose what they want and can do best. This will also reduce the drop out rate from poultry. Several enterprises in the poultry model will be either eliminated or be made optional and changed in terms of content so that beneficiaries at a location may use a flexible approach, i.e. there will no longer be a fixed model with fixed number of enterprises, beneficiaries and scale of operation. The IFAD evaluation mission concluded that "in fact, with a demand driven approach it may be best not to talk of a model at all, but let the components evolve as the circumstances permit" (Anonymous, 2002).

If this is the key lesson from the three big projects implemented in fairly large areas over a decade, and if this is assumed as the key to development of a sustainable approach to scavenging poultry for poverty alleviation, then it appears that all the experiences of the BRAC-DLS poultry model development and its evolution need to be put upside down in spite of its several positive achievements. Also, widely held belief among some professionals and practitioners that 'the idea of smallholder poultry for poverty alleviation is well established' (Funso Sonaiya, personal communication) needs to be significantly moderated until more sustainable scavenging systems can be established.

4. Experiences from Other Countries

4.1 Smallholder poultry development projects in other countries

Several smallholder poultry development projects have been implemented in Cameroon, China, Egypt, Indonesia, Lesotho, Malawi, Nepal, Pakistan and Sri Lanka in the 1980s and 1990s. These projects evolved in parallel with the Bangladesh model and they are not replications of the Bangladesh semi-scavenging model *per se*, but it is likely that some lessons from the early experiences of the Bangladesh model were used to design these projects.[7] More recently, adaptation of the Bangladesh model has been made in some countries, e.g. Benin, Kenya, Mozambique, Tanzania. Although these projects vary in size, composition and organizational mechanism for implementation, all are targeted to the poor, especially women. IFAD conducted an analysis on the performance of these projects mainly based on secondary data and reports of project missions. The study was provoked by what was happening in Bangladesh and a need to compare and share experiences of different countries in applying similar approaches (Nabeta, 1997, 2002). A summary of the main features of the projects including those not studied by Nebata is given in Table 11.

Table 11. Smallholder poultry development projects in different countries: objectives, activities and achievements

Project	Objectives	Poultry development activities	Achievements
Cameroon/LSDP	To increase meat and milk production and raise the incomes of poor livestock herders by promoting produ associations, enhancing the participation of the private sector in providing services strengthening land regulatio to improve the use of rangelands.	The formation of poultry and dairy produce groups (for input supply and marketing, wi particular focus on women). Credit for sem intensive poultry production. Vaccination campaigns against NCD and the privatizati of animal health care, including credit lines beneficiaries.	A Cameroonian specialist was trained in Burkina Faso. Vaccinations were carried out in villages identified by the project. Seven poultry loans have been provided against 160 of the staff appraisal report), with the average loan size of about USD 30 000 (MTR, 12/93). Ten villages have been selected for the experimental establishment of village vaccinators to implement a campaign against NCD and Peste des Petis Ruminants.
China/SYADP	To improve the living stand among 34 resource-poor townships, mostly through a credit mechanism for impro infrastructure (251 irrigation schemes, etc.), production initiatives, the supply of inp and support for project management.	The setting up of two broiler parent-breedin farms for the production of day-old chicks (owned and operated by the townships) and broiler slaughtering plant. Production credi beneficiaries for 650 broiler units.	The breeding farm in Qixia is in operatio and quite adequate for producing both broiler and laying hen DOCs, but, at the other farm, the management and the hatchery is not of a high standard. The broiler slaughtering plant processed 30 a 40 tons in 1991 and 1992, respectively (against its capacity of 1 000). (Mid-Ter Evaluation
Egypt/MADP	The strengthening of Minya Governorate's extension and research services to increase small farmers' crop and livestock production.	To establish 20 chicken-rearing units (reari DOCs for 40 days) and distribute improved and vaccinated (NCD) birds to small-scale poultry producers, especially women The provision of a feed mill and mixing plant to meet the feed needs of small-scale poultry producers The provision of support to the vaccine production centre.	Over 137 000 chicks sold; farmers are responding well to this activity (MTE, 12/86). The planned 20 chick-rearing un have been constructed. Average number pullets sold per farmer (mostly women) 10-15; overall economic benefits from poultry production accruing to rural wor and are reflected in their economic status

[7] The parallel development of the concept of smallholder poultry for poverty alleviation targeting women somewhat resembles the concept of multiple sources of innovation model of agricultural research and technology development (see Biggs, 1989; Biggs and Clay, 1981).

			(Women in Development Case Study Report, 11/91). The construction of the f mill is 95% completed .
Indonesia/IGPMFL	To raise the incomes of 287 500 households that are below the poverty level by initiating a range of on and off-farm income-generating activities and the development of small farme groups.	The provision of credit (joint-liability grou credit) for small-scale poultry production.	The project groups have a repayment rat of 99.3%. Number-wise, livestock loans represent the largest share (49%), and poultry represent 9.3%, of which about 80% are specified as free-range poultry (1992). The income increase by agriculture-livestock income-generating activities has been reported at 35%
Malawi/MSPPM	Provision of village-based food and income-generation opportunities by small-scale poultry enterprises to the poorest segment of the village population, especially women	Preparatory phase for expansion of semi-scavenging poultry model); provision of training in health and husbandry practices and credit to the women for poultry enterprises	The Bangladesh poultry model has been modified and simplified and tested unde village conditions in 11 villages involving a total number of 520 poor women households. The poorest segmen of the village population accepted the model and able to generate income and savings through managing a small flock of chicken under improved condition.
Nepal/PCRWP	To improve the economic conditions and the social status of approximately 16 000 poor rural women through the provision of credit and training.	The provision of production credit for livestock. The credit for off-farm activities includes the establishment of livestock vaccination services and veterinary medicine supply by private entrepreneurs.	Livestock represents the highest share in all the credit (66.9%), whereas poultry constitutes 1% in the amount and 3% in the number of loans. The women borrowing for livestock took training on loan transactions and veterinary services Livestock vaccination was a noticeable achievement in the project area; 61% of the women in Kaplvastn and 33% in Gorkha had vaccinated their livestock.
Pakistan/NJVCDP	To raise the living standards and incomes of the poorest small farmers through the identification, introduction and promotion of new technologies, skills and enterprises suitable for adoption by the target group.	To improve the capacity of the Department of Animal Health (DAH) to produce and distribute – on a full-cost-recovery basis – appropriate breeds (DOCs) of poultry to subsistence-oriented small households and to support six village poultry-breeding unit (500 birds; through credit). The flock maintained at the DAH farm would act as a grandparent flock, supplying parents to the village units; villagers would replace part o their birds with the improved breeds supplied by the village units.	The livestock section continues its poultry and animal de-worming programme in a competent manner (SMR, 05/94). Several instances were observed where high mortality rates had been experienced by villagers who had been supplied with chickens.
Sri Lanka/SBIRDP		The provision of credit, training and mobile animal health clinics. The Department of Animal Production and Health will work together with Social Mobilises to establish livestock demonstration, mostly among groups of women interested in establishing livestock enterprises. One member of a group participates in the demonstration programme. Groups will have previously established a savings programme and will use this as a foundation for obtaining acces to credit (e.g. for ten-hen poultry units and three-doe goat flocks).	The Department of Animal Production and Health completed 12 and 30 demonstrations for goat and poultry (50-bird units, not 10), respectively, during 1993-95. The credit activity has been initiated. Social Mobilises, which forms the backbone of the community mobilization programme, is showing strength. Overall, the participatory approach adopted through the project ha started showing positive results.
Republic of Benin	To improve livelihood of the rural population through improvement of traditional village poultry	Training of village vaccinators, support to construct hen houses, training of poultry producers, access to a micro-credit scheme	First phase of the project finished With observed positive improvements in terms of reaching the poor, especially women, reduced mortality, increased sales and income.

LSDP- Livestock Sector Development Project, SYADP- Shandong/Yantai Agricultural Development Project, MADP- Minya Agricultural Development Project, IGPMFL- Income-Generating Project for Marginal Farmers and Landless, EJRAP- East Java Rainfed Agriculture Project, LISP- Local Initiatives Support Project, DWRDP- Dowa West Rural Development Project, MSPPM- Malawi Smallholder Poultry Production Model , PCRWP- Production Credit for Rural Women Project, Neelum and Jhelum Valleys Community Development Project, SBIRDP- Second Badulla Integrated Rural Development Project (SBIRDP)

Source: Nabeta, 1997, 2002; Jere and Jensen, 2000; Anonymous, 2003.

The production system followed in the projects studied by Nebata was either semi-intensive, based on confinement or semi confinement, and scavenging (Table 12). Eight projects support semi-intensive system, while three projects support scavenging system. The projects promote exotic/improved breeds or local breeds. In five projects, poultry and eggs are sold within the project areas, and in three outside the project areas. With regard to the remaining four projects, there was either no information available, or the intervention was not directly related to marketing.

Table 12. Production system, breeds, marketing strategies and problems of smallholder poultry development projects in different countries

Country/Project	Production systems	Breeds	Marketing	Credit repayment	Marketing Problem	Feed probl	High mortality
Cameroon/LSDP	1	NA	2**	NA	2	1	NA
China/SYADP	1	1	2	NA	2	NA	NA
Egypt/MADP	1	1	1	NA	2	1	1
Indonesia/IGPMFL	2	Na	NA	1	NA	NA	NA
Indonesia/EJRAP	2	2	1	1	1	NA	NA
Lesotho/LISP	1	NA	2**	2	2	NA	NA
Nepal/PCRWP	1	1	NA	2	NA	NA	1
Pakistan/NJVCDP	2	1	1	NA	NA	NA	1
Sri Lanka/SBIRDP	1	NA	1	NA	NA	1	NA

** Though the project is not meant to export products, international competition for products exists in the country.

Production system: 1 = Confined/Semi- Confined, 2= scavenging; Breeds: 1= Improved, 2 = Local;
Marketing: 1= Within project area, 2= Outside project; Credit repayment: 1= Good repayment, 2= Has problem;
Marketing problem: 1= God progress, 2= Has problem; Feed problem: 1 = Yes, NA= Not available;
High Mortality: 1 = yes. No= 2.

Source: Nabeta, 1997, 2002.

Among the types of support provided for poultry development, 10 out of 12 projects provided credit support, 7 out of 10 projects provided support for veterinary services (Table 13). The Minya Agricultural Development Project in Egypt provided facilities for the production of the pathogen-free eggs that are used for the production of Newcastle Disease (NCD) vaccine. The project also provided beneficiaries with improved and vaccinated day-old chicks.

The main findings of IFAD review were that some common features identified during implementation which have a bearing on the overall performance of project interventions relate to credit repayment trends, marketing options, mortality rates and feed costs. The marketing constraints include competition with large commercial producers. Other

common problems are high mortality rates and high prices for feed, which are usually attributed to marketing problems and are the main cause of poor credit repayment.

Table 13. Types of support provided for smallholder poultry development. in different countries

Country/Project	Credit-supported a farmer-managed production	Provision of improved veterinary serv	Training to women animal husbandry health	Activities specific focused on wome
Cameroon/LSDP	X	X		X
China/SYADP	X			
Egypt/MADP		X		X
Indonesia/IGPMFL	X	X		
Indonesia/EJRAP	X	X	X	X
Lesotho/LISP	X			X
Malawi/DWRDP	X			
Malawi/MSPPM	X	X	X	X
Nepal/PCRWP	X	X	X	X
Pakistan/NJVCDP	X			
Sri Lanka/SBIRDP	X	X		X

Source: Nabeta, 1997, 2002 and Jere and Jensen, 2000.

The IFAD review concluded that there is a need for development projects to continue introducing new technologies by which an increased level of profit can be achieved from smallholder semi-intensive poultry-rearing. In view of the observed shift in emphasis from scavenging to semi-intensive systems, there is an urgent need for research to study alternative systems and to develop the most appropriate systems for the poor, IFAD's target groups. The introduction of exotic or improved breeds is a useful tool for the genetic improvement of local birds in terms of both productivity and viability if the conditions required for health and nutrition are met. The introduction of such breeds can represent a good incentive for farmers to participate in projects. However, the promotion of improved breeds should be conditional on the provision of intensive training for farmers and improved health services. The problems experienced often relate to the management skills and the husbandry practices needed by farmers for unconventional types of production. Therefore, farmer training is considered to be of primary importance.

The project implemented in Malawi was a modified and simplified version of the Bangladesh poultry model (Jere and Jensen, 2000; Jerry *et al*, 2002). The components of the model were Pullet Rearer, Key Rearer, Model Breeder, Feed Sellers and Egg Sellers. It has been tested under village conditions in 11 pilot villages involving a total of 520 women; most of them belong to the poorest segment of the rural communities. The main findings of the preparatory work was that the poorest segment of the village population in Malawi accepted the model, they were to contribute to savings leading to management of a flock of chickens under improved conditions. The model has the potential for poverty

alleviation of the rural women. The main obstacle has been the lack of an appropriate micro-credit structure; none of the available micro-credit providers were geared for the purpose of MSPPM. However, the project was discontinued before becoming fully functional as DANIDA suspended its support activities in the country due to a political decision by the Danish government. However, there still is an interest to continue work with the model and incorporate in the broader poverty reduction strategy of the government (Jensen and Nielsen, 2003).

The project in Benin has completed the first phase. A rapid appraisal to assess the impacts and project performance concluded that even though the project was not demand and need driven and was designed and implemented from above, it has reached the target, i.e. the poor, especially women who now believe that the activities of the project are worthwhile for them as it has created positive impacts in terms of reduced mortality, increased sales and income. The vaccinators are providing their services to non-project farmers but in case the project is not funded for a second phase, the activities and services are not likely to continue (Anonymous, 2003).

4.2 Other experiences

Scavenging/semi-scavenging poultry is common in the rural areas of developing countries. In some countries further development of these systems are being tried either through national organisations or through some donor support but without a formal structure or model as in Bangladesh. A few such cases are discussed here for illustration of the various problems being addressed and the nature of results obtained.

Poultry is an essential component of the smallholder farming system in Vietnam. The size of flock of local chicken is about 10 – 20 per family (Tu, 2002). About 75% of the national flock is kept under traditional village conditions. Villagers use free–range, back yard or semi–intensive systems, but not intensive systems. Village chickens obtain feed mostly from their natural environment by scavenging. They also receive supplementary feed, usually paddy rice or some commercial concentrate at the end of the day. Supplementary feed varies from 10 to 30% of total daily feed intake depending on the family's economic situation, age of poultry and production stage as well as current market price. The insufficient daily feed intake causes poor growth rate and low productivity. Recently the nutrition of village chicken has been improved considerably by introducing a new technology to successfully raise earthworms at the household level using ruminant and pig manure mixed with decayed rice straw. The productivity of local poultry in Vietnam is moderate. The body weight of 5-month-old local chicken broiler is only 1.3 – 1.5 kg and local laying hens produce 70 – 80 eggs per year. The annual live weight off-take vary from 0.8 kg to 2.1 kg of meat per head and from 10 to 26 eggs per head in different agro-ecological zones. Productivity is weak given the low initial production base and there is potential for increased productivity through better nutrition and cross breeding. Newcastle disease is the main fatal disease of chicken. The disease is endemic in the country and outbreaks are reported throughout the year with a peak during the months of November to March. Vietnamese government has encouraged farmers to actively participate in vaccination campaigns against Newcastle Disease. More

information is given at: http://www.vsap.uq.edu.au/RuralPoultry/Country%20profile%20Vietnam.htm

In Bhutan the estimated population of scavenging rural poultry is 169,208. Women are mainly involved in various tasks associated with poultry production (Table 14). The New Castle disease is widely prevalent and is more likely to occur in May to July. AusAID is currently funding the project "Development of New Castle disease vaccination programme for village chickens in rural Bhutan using locally produced thermostable vaccine". More information may be found at: http://www.vsap.uq.edu.au/RuralPoultry/Country%20profile%20Bhutan.htm

Table 14. Involvement of women in various tasks associated with smallholder poultry production in Bhutan.

Task	Man	Woman	Boy	Girl
Feeding chickens		X	X	X
Watering chickens		X	X	X
Construction of chicken house	X			
Nest making	X	X		
Cleaning of chicken house		X		
Who should be informed about vaccination campa	X	X		
Procurement of birds	X	X		
Deciding when to sell and eat eggs		X		
Who sells the eggs		X		
Deciding whether to vaccinate chickens	X	X		
Opening and closing doors of chicken house			X	X
Collecting eggs		X		
Who eats eggs	X	X	X	X
Nursing of sick birds	X	X		
Care of chicks		X		
Who decides if vaccination successful	X	X		

Source: Alders,1999

In most of the West African countries, flock sizes of scavenging poultry range from 9 to 22 (Missohou *et al*, 2002, Kitalyi and Mayer, 1998). Information on rural poultry production and productivity in some African countries are presented in Table 15. The total number of egg production per hen per year ranged from 18.5 to 48.9. In general, egg productivity of scavenging poultry in 9 African countries is low and chick mortality is high. Hatchability in Burkina Faso, Ghana and Mali is lower than in Guinea and Sudan. Analysis showed that most of the unhatched eggs are not fertilized due to inadequate sex ratio (Missohou, *et al*, 2002). In addition to genetic effect, this low egg production could be improved and even doubled without any detrimental effect on hatchability through rational feeding as demonstrated by Buldgen et al (1992). Sonaiya (1990) suggested that the implementation of a mini-hatchery, which would buy fertile eggs and sell chicks to farmers, could be an alternative solution to improve egg productivity. The improvement of egg production could also be achieved by early weaning of the chicks but its effect on chick survival and female reproductive life needs to be known.

Scavenging poultry play a key socio-economic role and largely contribute to protein malnutrition alleviation in African countries. However, there still exist serious constraints to its development in terms of low egg production, hatchability and survival of chicks. Rural poultry production as a means to alleviate poverty could be highly increased if those constraints are properly targeted in terms of improvement of the rate of reproduction and reduction in mortality (Missohou *et al*, 2002).

Table 15. Production coefficients of rural poultry in selected countries in Africa

Source	**Country**	**Clutches year**	**Egg pe clutch**	**Egg wei (g)**	**Hatchabilit (%)**	**Chick mortalit (%)**
Kitalyi & Mayer, 1998	Ethiopia	1.1	13	-	71	66
	Gambia	3.2	13	-	71	19
	Tanzania	2.4	15	-	78	32
Missohou *et al*, 2002	Senegal	3.9	11	37.5	77	43
Buldgen et al., 1992	Senegal	5.0	9	40.0	80	66
Mourad et al., 1997	Guinea	3.8	10	30.7	87	11
Shanawany & Banerjee, 1991	Ethiopia	-	-	44-4	39-42	-
Bourzat and Saunders, 1990	Burkina Fa	2.9	12-18	30-4	60-90	-
Msami, 2000	Tanzania	2.9	12	-	84	30
Minga et al., 1989	Tanzania	-	6-20	41.0	50-100	80
Van Veluw, 1987	Ghana	2.5	10	-	72	50
Wilson et al., 1987	Mali	2.1	9	34.4	69	56
Wilson, 1979	Sudan	4.5	10.9	40.6	90	-

Source: Missohou *et al.*, 2002

In Tanzania, a research project on family poultry has been conducted from 1999 to 2001, under the auspices of International Atomic Energy Agency (I.A.E.A) and Animal Diseases Research Institute, to identify the major disease conditions and factors limiting family chicken production in Coast and Dar es Salaam regions (Msami, 2000). Farmers in both the zones mentioned Newcastle disease as the major constraint inhibiting rural chicken development. It was found that the women play a major role in family poultry development. Women provided most labour for family poultry activities but men made several decisions on their use. Nutritional status of the birds has proved to be low and strategic improvement in feeding will result in concomitant increase in productivity. The feeding system to be designed should consider the available feed resources that include coconut cake, maize bran and selected grains. When farmers were asked to rank the functions of chickens in their village, source of food was ranked highest (67%), followed by source of income (31%), and social functions (ceremonies, gift, ritual) (2%). More information on country profile on smallholder poultry of Tanzania and current project is available at http://www.vsap.uq.edu.au/RuralPoultry/Country%20profile%20Tanzania.htm

Approximately 70% of the 3 million rural families in Mozambique raise chickens, around 30% raise goats, 20% ducks and pigs (Anjos and Alders, 2003). Chickens are most likely to be cared for and owned by women. Chickens are possibly the major livestock contributor to the diet in the family sector. They also play a major role in poverty

alleviation and food security at the household level. Research has revealed that Newcastle disease (ND) is the major constraint to chicken production in rural areas, causing mortalities of 50 to 100% of birds annually (Mavale 1995). Family poultry development in Mozambique currently focuses on the control of ND in rural areas, the distribution of crossbred chickens and the production of broilers in peri-urban areas of the capital city, Maputo. A range of extension material was produced by the project to facilitate access to key information for all those involved with ND control activities (from National Directors to farmers). The material includes a field manual (Alders and Spradbrow, 2001), a training manual (Alders *et al*., 2002), a laboratory manual (Young *et al*, 2002), a flip chart, a vaccination calendar, a vaccination poster, a vaccination song, radio programs, a play, basic vaccine usage instruction sheets, information for vaccine distributors, a pamphlet and a video. Much of this material is available t at: (http://www.vsap.uq.edu.au/ruralpoultry).

The Australian Agency for International Development (AusAID) proposed to build on the ND control research conducted in Mozambique by supporting a three year project (was expected to commence in June 2002) that will seek to establish sustainable ND control activities in rural areas of Mozambique, Tanzania and possibly Malawi.

The General Union of Cooperatives in Maputo (UGC) has a total of 5,500 members, 95% of whom are women (UGC 2001). It has been assisting members in the production of broilers in peri-urban areas. In 2001, over 2,000,000 broilers were produced. Groups wishing to produce broilers initially receive a loan to enable the construction of a poultry house, provision of a water source and equipment (feeders, drinkers, etc). The loan is granted without any collateral and its repayment, including interest, usually takes 6 to 7 years. After beneficiaries receive basic training in poultry raising techniques and elementary rules of business management, the UGC provides credit in the form of necessary production inputs (day old chicks, feed, poultry extension and veterinary assistance). The broiler is marketed through the cooperative. The credit provided for the chicks, etc is repaid and of the gross profit, 50% is used to repay the initial loan and the remaining 50% is handed to the producers.

5. Summary and Guiding Principles for Future Impact Studies

The smallholder poultry development concept has been developed and widely applied in Bangladesh and in a number of other countries and further adaptation is underway in a number of other countries including Burkina Faso, Benin, Ghana, Eritrea, Malawi, Kenya, Tanzania, Zimbabwe, Vietnam, Cambodia, Indonesia, and Nicaragua with donor support from DANIDA. EU, ADB, IFAD and the World Bank (Jensen, 2003). Scavenging poultry is common in the rural areas of most developing countries and in some countries there are efforts to support its development though such efforts have not been structured into formal models as in Bangladesh.

A number of impact studies on the poultry model implemented in Bangladesh through three large projects and in some of the countries where similar projects have been implemented show positive results in terms of the number of beneficiaries reached, and their increased income, consumption and nutrition, expenditure and savings and empowerment of women. They also indicate varying degree of performance of the supply and delivery services including credit, day old chick supply, research, training and capacity building. However, these findings need to be interpreted with a high degree of caution because the studies suffer from one or more of the following methodological deficiencies: size, distribution and stratification of the samples; approaches used in attributing benefits to the projects and their beneficiaries.

More objective, inclusive and systematic impact studies are required to assess the characteristics of the actual beneficiaries reached by the projects, the impacts made (where, how and why), the indicators of success or failure and sustainability of the model. Such knowledge is essential to guide the intended adaptation or replication underway in several countries or to guide further efforts in using poultry as a tool for poverty alleviation. Three major issues need to be considered in future studies. First, the concept of smallholder poultry for poverty alleviation, its feasibility and limitations. Second, the choice of impact indicators, their measurement and attribution. Third, policy and research needs to support smallholder poultry development for poverty alleviation.

5.1 The conceptual framework

The literature on 'poultry for poverty alleviation' is now quite extensive, especially in relation to the Bangladesh model. In these writings, the terms scavenging, semi-scavenging, village poultry and smallholder poultry are frequently used, often interchangeably, and without a clear definition or description of what they are or what they constitute. The Bangladesh model as implemented through the three large projects is more frequently described as 'semi-scavenging'. The need for a clear definition or conceptualization arises because these terms do not convey the same meaning or thing.

While discussing the principles and problems of adaptation of the Bangladesh poultry model, Jensen and Dolberg (2003) write, "the smallholder poultry development concept has been developed in a unique learning process in Bangladesh over a period of more

than two decades. It is seldom that a development concept, in its basics, is maintained over such a long period and that lessons learned in one project are incorporated in the succeeding project, especially when different donors are involved. It is also unique that the same stakeholders, and to a great extent the same persons, have been involved from the very formation of the concept till its present stages" (p.1). These authors are some of the few who have been involved throughout the evolution of the model and is often considered as the architects of the structure of the model and its rationale. They suggest six essentials for successful adaptation of the Bangladesh model as below:

1. The *beneficiaries*, the target group, must be poorest segment of the village population and in particular women;
2. The *comparative advantage* of village poultry keeping must be sufficient to reduce the cost per egg produced to be less than that in commercial egg production;
3. There should be an *enabling environment*, i.e. all input supplies including micro-credit and services shall be timely available in the village;
4. Poultry should constitute only *the first step out of poverty*, but the possibilities and the opportunities for the beneficiaries to take the next step must be built into the enabling environment;
5. Institutional development is an essential part of the pilot activities, and the adaptation process must be to develop an *institutional capacity* for countrywide implementation of the concept;
6. The aim should be quickest possible attainment of *institutional self-sufficiency* that is consistent with the overriding goal of poverty alleviation.

These essentials have been derived from experiences in Bangladesh and elsewhere over many years. Only some of them were mentioned at the early stages of development of the Bangladesh model. However, it is unclear what is actually meant here by 'village poultry keeping', whether it is purely scavenging or semi-scavenging, because enabling environment, support services and institutional development are also considered essentials. The confusion or lack of clarity on the content of the concept increases when they further explain comparative advantage as follows: "the main comparative advantage is the scavenging feed resource base (SFRB). However, it is a common mistake to ignore the limitation of the SFRB and start with flock sizes far above the bearing capacity and, consequently, the main part of the feed will be supplementary feed. Such an operation will not be viable" (Jensen and Dolberg, 2003, p.4). It appears as though they are arguing for village poultry to be based primarily on scavenging but argue the need for other services such as health, credit, extension etc to make it productive and profitable. Depending on the proportion of feed coming from supplementation and the level of investment required to procure other inputs and services, the system may lie anywhere between pure scavenging to very intensive. The experiences in Bangladesh and elsewhere show that development projects have been unable to meet all the seven essentials of success, hence achieved different levels of performance. As mentioned earlier, the impact studies conducted so far did not analyse the economics of supplementation of indigenous or crossbred poultry or assessed the implications of seven essentials in a holistic manner to to shed any light on this question.

What can then be the conceptual or guiding principles for using poultry as a tool for poverty alleviation, especially targeting the poorest? In general terms, 'poverty is pronounced deprivation in human well-being encompassing not only material deprivation but also poor health, literacy and nutrition, vulnerability to shocks and changes, and having little or no control over key decisions' (ILRI, 2002). Lack of adequate productive resources often force poor people to develop a livelihood strategy using low opportunity cost resources, especially common property resources, into valuable goods and services. Examples are scavenging garbage in urban settings, grazing marginal lands, recycling waste into usable goods such as sandals out of old tyres, tin articles out of cans, etc. Smallholder poultry production fits into this model.

Throughout the developing world, few scavenging chickens or ducks include the little resources that most poor, especially women, can afford to have. Scavenging poultry use low opportunity cost resources otherwise not accessible to humans. That is why scavenging poultry is a commonly practiced activity among the poor providing a source of occasional food (meat and eggs) as well as cash income in times of need. In most developing countries, most of the urban and rural chicken meat and eggs supply come from this system. In many situations, where commercial poultry production dominates the market, smallholder poultry has a niche market as richer consumers show a willingness to pay for traditional breeds and species. Because of widespread practice of this activity, it has good potential for scaling up to help the poor get out of poverty. There are few other alternatives in the livestock sector that can be used to reach so many poor people in remote as well as high market access areas.

Using this strategy as a development tool will require recognition of a number of facts. The finite nature of food to be scavenged in the surroundings of the homestead and competition for the same food resources among several households limit the flock size in pure scavenging system. Where settlement pattern is more dispersed and individual household based, such problem may be minimal. In the absence of support from formal extension, health, credit, marketing sectors, productivity is low and mortality, especially among chicks, is very high yet free range combined with adaptability of indigenous breeds to local environment form the basis of comparative advantage of this enterprise. Feed and diseases are major constraints for improving productivity. Increasing flock size beyond certain limit, introduction of improved breeds in pure scavenging system or scaling down the commercial production system to fit into the scavenging system is unlikely to work effectively without investment and support in feed, health, extension, credit and marketing to create an enabling environment. Such investment will also be required for reducing mortality and improving productivity of local birds under scavenging system. However, the economics of such investment from both public and private points of view need to be assessed carefully to design interventions.

The various components of the poultry model were developed to overcome local constraints, e.g. limited access to health service from the Livestock Department in remote areas, lack of access to feed supplements in local markets, lack of supply of day old chicks in local markets and high transactions cost to access these from commercial

hatcheries. However, with extension of markets and infrastructure in the rural areas, the degree of some of these constraints has reduced or disappeared. Therefore, it may be unnecessary to keep all the components of the poultry model in future replications in Bangladesh or elsewhere. The model should be used more as an organizing concept or framework and model components suitable for a given country or circumstance need to be conceptualized, tested and evaluated continuously rather mechanically replicating the model that evolved in Bangladesh under specific market and service delivery conditions. Much remains to be done in this regard to make the poultry model as a sustainable tool through its flexible use in varied circumstances by the poor themselves.

5.2 Impact indicators and measurements

There is much debate in the development community, especially among those involved in project evaluation and monitoring and in evaluating project impact, on how to assess the impact of development projects on poverty. The problem may be complicated because some projects are of a general nature while others have more specific objectives and targets. Poverty is indicated both by lack of resources and the consequent outcomes. Several indicators may be chosen in each domain, e.g. one or more of the five types of assets described in the DFID livelihood strategy, or income, nutrition, consumption etc from the outcome side. Some of these indicators may be more easily tractable and directly attributable to a project intervention than others. Yet donors and their governments are increasingly asking for putting numbers on what public donations are doing to help overcome poverty in developing countries. There is no general consensus on how to address the problem though it is generally agreed that impacts and outcomes should be measured in terms of the explicitly stated project objectives and targets rather than trying to link every project with specific indicators of poverty. Where projects are designed to address poverty alleviation through changing specific indicators, easily tractable and directly attributable indicators should be chosen such as income and employment generation, food consumption (quantity and quality), nutritional status of children (anthropometric measures), extent of income diversification and asset accumulation which may provide the basis for more sustained way out of poverty. For example, IFAD is currently discussing the possibility of using a common set of indicators as above to monitor the impact of its projects specifically targeted to the problems of the poor (Kennedy, 2003).

Given that poultry is to be used as a tool to help alleviate poverty, and a few poultry birds will often constitute the first step to get out of poverty, it is essential that easily tractable and directly attributable indicators are chosen in impact measurement. For example, some studies tried to link scavenging poultry with increased school enrollment of children where a number of other programmes were involved in enhancing school attendance. Similar is the case of the asset ladder concept in which one moves from a few poultry bird owner to a goat then a cattle owner over time. Practically, poultry income might have complemented income from other activities in the household to acquire the goat, and the goat and a host of other things might have helped to move up the ladder to acquire cattle. Charting the asset growth path may be useful provided all the sources of growth including the role of poultry can also be identified.

The mechanism by which any poultry model affects poverty suggests multiple dimensions through which poverty impact need to be measured and assessed. These include: effectiveness of delivery of services by public, private and NGO sectors to the target groups; whether different component of the poultry model are functioning well as per the model design and why; how the benefits of the model are distributed among the different levels of the food system chain including farmers, traders and consumers and how supply changes affect prices; some measures of individual and community capacity including impacts on individual capacity for decision making and at the community level, enhanced capacity for taking collective action. Capturing these dimensions will require adoption of an appropriate sampling and survey design.

5.3 Policy and research support

A pure scavenging system of poultry production, with all its limitations and potentials, may be used as an entry point for helping the poor to diversify activities as a pathway out of poverty but poultry alone may not be adequate to get out of poverty in the long run for every poor household. Widespread use of the strategy in different countries and socio-economic and ecological situations will require policy and research support in several areas and these also need to be built into any project design and its impact assessment.

One of the important policy factor to be considered in using scavenging poultry as a strategy for poverty alleviation is the dynamic market context in which this system has to operate. An implicit assumption of the Bangladesh model is that local market can absorb the small quantities of output coming out of the model participants. However, some marketing problems have already been observed in Bangladesh and in other countries where such model has been applied. If a significant proportion of the poor take up poultry, aggregate local supply may be too much for the local market to absorb yet provide a price that will make smallholder poultry viable. Therefore, access to distant market may become a necessary condition for viability once the initial success is achieved. One potential problem for accessing urban markets is the expanding commercial poultry sector in many countries. Technical progress in the commercial sector and economies of scale, often facilitated by public policies such as subsidized credit, liberal tax and tariff policy, may push the smallholder low productive systems out of the market. In an increasingly globalised world, the growing food safety and quality requirements, even in domestic urban markets, may limit the market opportunities for the smallholder sector as increased transaction costs will be required to engage in modern marketing chains, e.g. supermarkets and feed trade. Potential of the scavenging system and its impact on poverty reduction need to be assessed within this broader context.

Feed available in the natural environment and the incidences of diseases are major factors limiting the flock size and productivity of the scavenging system. Improving productivity of the system then will require supporting extension, health and credit services targeted to the poor and these have to be supported by appropriate policy and investment. Private sector investment in these areas is highly unlikely and sometimes public investment may not be justified on only economic criteria, e.g. rate of return, given the scarcity of

resources and alternative demands for that resources. Poverty alleviation is a social as well as an economic goal and public investment to support scavenging poultry for poverty alleviation may need to be justified on a broad set of criteria including cost effectiveness. Project design and impact assessment also need to address these issues.

Research is required to solve technical problems and constraints and also to facilitate decision making at household, community and higher levels. Given the current status of scavenging poultry as a development tool and its problems in developing countries, a group of practitioners in the field suggested the following research areas[8]:

Nutrition and management

- Nutrition, especially micronutrient and disease (e.g. Newcastle Disease) interaction in chicks. Malnutrition of chicks may make vaccination less effective and also increase mortality. Behaviour of local and improved breeds under confinement. Potential gains from nutrition and health interaction may justify additional investment in this enterprise.
- Feeding and management of young chicks to reduce mortality and its effect on economic returns.
- Assessment of feed resource base and optimal flock size as the size of the flock is likely to be constrained by the physical area covered by the flock as well its ecosystem that generates food supply. Often the feed supply range may be a local common resource, so flock size and options for management of the local common feed resource need to be determined.
- Role of supplementation with alternative resources from within the production system where birds scavenge, basically looking at the prospect of cycling resources within the farm household system.
- Supplementation from outside the household system, collected or purchased, their prospects, impacts, and economics.
- Brooding productivity (different options for management may be found).
- Chick mortality in systems where day old chicks may be supplied from organized stock multiplication farms: role of chick production and delivery systems, extension and health services.
- Breed x location (ecosystem or production system) interaction. The value of indigenous breeds for maintaining genetic diversity and for developing smallholder commercial poultry enterprise.

Economic and institutional issues

- Economics of scavenging poultry enterprise including optimal flock size
- Institutional mechanism, policy and support services for promotion of semi-scavenging poultry, especially the role of NGOs, health and extension services, credit and marketing opportunities, local organizations, role of the private sector.

[8] Summary of a group discussion held at the workshop on 'Management of research, communication and change within Agricultural Sector Programmes', held at Tune, Denmark, 31 March – 4 April, 2003.

- Measuring household level impact of interventions using simple indicators to capture changes. Where food security is a severe problem, the indicators may include number of meals by season and gender, quality of food consumed, anthropometric measures (height for age, weight for age) and Body Mass Index of the mother (BMI). Also overall impact of investment is required to guide policy and investment options.
- Work with farmers to find how they diversify out of poultry to get out of poverty. Some may scale up poultry (larger flock, better breed and management), some may scale up by acquiring larger species (asset ladder through acquiring goats, cattle), some may add new activities, farm or non-farm, some may leave poultry to do other things.

Which of these research topics may generate location, project or country specific outputs and which may generate public goods for wider adaptation and application is an important issue for guiding research investment decisions. Both public sector investment in a country and donor supported development projects targeting poultry need to consider these in order to make decisions on investment in research and assess its impact.

References

Ahmed, N. 2000. The smallholder poultry model in Bangladesh. In: G. Pedersen, A. Permin, and U. M. Minga (eds.) *Possibilities for smallholder poultry projects in Eastern and Southern Africa*. Proceedings of a workshop, Morogoro, Tanzania, 20-25 May 2000. Network for Smallholder Poultry Development, Copenhagen. www.poultry.kvl.dk

Alam, J. 1997. Impact of smallholder livestock development project in some selected areas of rural Bangladesh. *Livestock Research for Rural Development*: http://www.cipav.org.co/lrrd/lrrd9/3/bang932.htm

Ali, M S, Chwalibog, A. and Howlider, M A R. 2203. Study on the effect of feed supplementation to laying hen under the rural condition of Bangladesh. Unpublished manuscript . 15pp.

Anjos, F.D and Alders, R. 2002. Family poultry development in Mozambique, Paper presented at the "Second FAO/INFPD Electronic Conference on Family Poultry, pp. 4 http://www.fao.org/waicent/faoinfo/agricult/aga/agap/lpa/fampo1/econf/econf2/Mozambique%20case%20study.htm

Alders, R.G. 1999. First Field Trip Report to the Australian Agency for International Development, Development of a Newcastle disease vaccination program for village chickens in rural Bhutan using locally produced thermostable vaccine. Oct. 1999. pp. 5. http://www.vsap.uq.edu.au/RuralPoultry/content/publications/Alders2000_0008.htm

Alders, R. and Spradbrow, P. 2001. Controlling Newcastle Disease in Village Chickens: A Field Manual. ACIAR Monograph Nº 82, pp.12, http://www.aciar.gov.auc http://www.vsap.uq.edu.au/ruralpoultry

Alders, R., dos Anjos, F. , Bagnol, B. , Fumo, A. , Mata, B. and Young, M. 2002. Controlling Newcastle Disease in Village Chickens: A Training Manual. ACIAR Monograph Nº 86. pp. 128. http://www.aciar.gov.au

Anonymous. 2002. Bangladesh: Micro-Finance and Technical Support Project -IFAD Design Document (Annex 3- Livestock). Unpublised document.

Anonymous. 2003.Programme d'Appui au Developpement de l'aviculture villageoise : Impact study. Network for smallholder Poultry Development, Copenhagen, Denmark. 32pp.

Asaduzzaman, M. 2000. Livestock sector, economic development and poverty alleviation in Bangladesh. In : M A S Mandal (ed) *Changing rural economy of Bangladesh.* Bangladesh Economic Association, Dhaka. Pp.42-53.

Ashley, S., Holden, S. and Bazeley, P. (1999). Livestock in poverty focused development. In: Livestock in Development. Crewkerne. United Kingdom.

Biggs, S D. 1989. A multiple source of innovation model of agricultural research and technology promotion. Agricultural Administration (Research and Extension) Network paper No 6. Overseas Development Institute, London, UK.

Biggs, S D and Clay, E J. 1981. Sources of innovations in agricultural technology. World Development, 9(4): 321-336.

Bourzat D and Saunders, M. 1987 Improvement of traditional methods of poultry production in Burkina Faso. Paper presented in, "Third International Symposium on poultry production in hot climates, Hameln, Germany, 12 June 1987.

BRAC, 1995. The BRAC report-1994. BRAC, Dhaka, Bangladesh.

Buldgen A, Detimmerman, F., Sall, B. and Compere, R. 1992. Etude des paramètres démogrphiques et zootechniques de la poule locale du bassin arachidier sénégalais. Revue d'élevage et de médecine vétérinaire des pays tropicaux, 45 (3 - 4) : 341 - 347.

DANIDA. 1995. Mid-Term Review Report: Smallholder Livestock Development Project in Bangladesh, Ministry of Foreign Affairs, Copenhagen, Denmark.

DARUDEC, 2002. The Bangladesh semi-scavenging poultry model: Study on the impact, structure and function of the poultry model in the DANIDA funded Agricultural Sector Programme Support (ASPS) with special reference to the Implementation of the Participatory Livestock Development Component, Ref. No. 104, Bangladesh. 805-11.

DARUDEC. 2003. Extraction of information from the Poultry Model Monitoring System (PMMS): Participatory Livestock Development Project, Bangladesh, Ref. NO. 104, Bang. 805-8

Dolberg, F. 2001. A livestock development approach that contributes to poverty alleviation and widespread improvement of nutrition among the poor. *Livestock Research for Rural Development*: http://www.cipav.org.co/lrrd/lrrd13/5/dolb135.htm

Dolberg, F. 2003. Household poultry production and poverty alleviation: Learning from the Bangladesh experience, Invited theme paper to the joint FAO-NDDB International Workshop on "Livestock and Livelihoods: Challenges and Opportunities for Asia in the Emerging Market Environment". March 24-26, 2003, Anand, Gujrat, India. Pp. 33.

Dolberg, F. and Mallorie, E. and Brett, N. 2002. Evolution of poultry model- a pathway out of poverty, paper presented at the workshop, "People Fight with Poultry. Learning from Bangladesh Experience" held in Dhaka, October 20-24, 2002, organized by International Network for Family Poultry Development. (The paper is an edited version of material gathered by the IFAD project Formulation Mission for the proposed GOB-IFAD "Micro finance and Technical Support Project. Pp. 18.)

Fattah, K. A. 2000. Poultry as a Tool in Poverty Eradication and Promotion of Gender Equality. In: F. Dolberg and P. H. Petersen (eds.) *Poultry as a Tool in Poverty Eradication and Promotion of Gender Equality*. Proceedings of a workshop, March 22-26, 1999, Tune Landboskole, Denmark. Pp. 9, http://www.husdyr.kvl.dk/htm/php/tune99/2-Fattah.htm

Gibbons, D.S. 2000. International replication of Grameen banking: What can the poultry network learn from it? In: F Dolberg and P.H. Petersen (eds), *Poultry as a tool in poverty eradication of gender equality*, Tune workshop, March 22-26, 1999, Tune, Denmark. Pp10, http://www.husdyr.kvl.dk/htm/php/tune99/6-Gibbons.htm

Hossain, M. and Bose, M. L. 2000. Growth and structural change in Bangladesh Agriculture : implications for strategies and policies for sustainable development. In: M A S Mandal (ed) *Changing rural economy of Bangladesh.*Bangladesh Economic Association, Dhaka. Pp.1-20.

ILRI (International Livestock Research Institute) 2002. Livestock – a pathway out of poverty. ILRI strategy to 2010. ILRI, Nairobi, Kenya. 24pp.

Jabbar, M A, Beyene, H, Mohamed Saleem, M A, and Gebreselassie, S. (2003) Role of knowledge in the adoption of new agricultural technologies – an approach and an application. *International Journal of Agricultural Resources, Governance and Ecology* 2(3/4):312-327.

Jensen, H a (1996) Semi-scavenging model for rural poultry holding. Paper presented at the XXth World Poultry Congress, New Delhi, India, Volume I, pp-61-70.

Jensen, Hans Askov 1996. Semi-Scavenging Poultry Flock. In: Frands Dolberg and Poul Henning Petersen (eds) Proceeding of a Workshop.Pp.9.
http://www.husdyr.kvl.dk/htm/php/tune.htm

Jensen, H. Askov. 2000. Structures for improving smallholder chicken production in Bangladesh: Breeding Strategy. *Developing breeding strategies for lower input animal production environments.* In: S. Gallal, J. Boyazoglu and K. Hammond (eds). ICAR Technical Series No. 3. paper presente din the workshop on Developing Breeding Strategies for Lower Input Animal Production Environments. Bella, Italy. 22-25 September 1999. pp. 11.

Jensen, H.A. 2002. A Conceptual framework for using poultry as a tool in poverty alleviation, Second FAO/INFPD Electronic Conference on Family poultry, pp. 14, http://www.poultry-development.dk

Jensen, H A. and Dolberg, F. 2003. Essentials and constraints – Adaptation of the Bangladeshi smallholder poultry development concept. Paper presented at the workshop on "Management of research, communication and change within Agricultural Sector Programmes", held at Tune, Denmark, 31 March – 4 April. 5pp. http://www.poultry-development.dk

Jensen, K V and Nielsen, M. 2003. Profiling poverty and Malawi's poverty reduction strategy paper. Unpublished draft, University of Aarhus, Denmark. 49pp.

Jere, Judith and Jensen, H.A. 2000. Bangladesh poultry model in Malawi: Modifications and lesson learnt during the adoption process. (Unpublished), 13 pp.

Jere, Judith, Scheiss, K. and Lipta, W. 2002. Poverty alleviation and gender: Bangladesh poultry model in Malawi: Modification and application, Tune workshop, 2-6 April 2002. Proceeding in press.

Kennedy, Sean. 2003. Malnutrition and the millennium development goals for impact assessment: practical tools for planning and designing survey. Paper presented at the workshop on Management of research, communication and change within Agricultural Sector Programmes", held at Tune, Denmark, 31 March – 4 April.

Kitalyi A J and Mayer, A. 1998. Village chicken production systems in rural Africa household food security and gender issues. FAO, Rome. Pp. 80.

Kolb, D A. 1984 Experimental Learning. Experience as the Source of Learning and Development. Prentice-Hall, Inc.

Mavale, A.P. 1995. Epidemiology and control of Newcastle disease in rural poultry in Mozambique. Masters Degree Thesis, Veterinary Epidemiology and Economics Research Unit, Department of Agriculture, University of Reading.

Minga U M, Katule, A., Maeda, T. and Musasa, J. 1989. Potential and problems of the traditional chicken industry in Tanzania. In proceedings of the 7th Tanzania Veterinary Association Scientific Conference, p. 207-215.

Missohou, A, Die, P.N. and Talaki, E. 2002. Rural poultry production and productivity in southern Senegal, Livestock Research for Rural Development, 14(2), pp. 1-6

Mourad, M, Bah, A.S. and Gbanamou 1997. Evaluation de la productivité et de la mortalité de la poule locale sur le plateau du Sankaran, Faranah, Guinée en 1993-1994. Revue Elev. Méd. Vét. Pays Trop., 50, 343-349.

Msami, H.M. 2000. Studies on the Structure and problems of family poultry production in Tanzania with suggestions on improvements and interventions, paper presented at the "Second IAEA/FAO Research Coordination Meeting on, " Improvement of Health and Management of Family Poultry Production in Africa", held on 408 September, 2000. pp. 3, http://www.vsap.uq.edu.au/RuralPoultry/content/publications/Msami2000_0060.htm

Nebata, H. 1997.
http://www.ifad.org/lrkm/theme/husbandry/poultry/poultry_foreword.htm

Nabeta, H. 2002. IFAD's experience in supporting smallholder poultry production system, Paper No. 21, IFAD, pp. 34

Nielsen, H. (1997). Socio-economic impact of Smallholder Livestock Development Project, Bangladesh. In: F. Dolberg and P. H. Petersen (eds.) *Integrated Farming in Human Development*. Proceedings of a workshop, March 25-29, 1996, Tune Landboskole, Denmark. Pp. 7 http://www.husdyr.kvl.dk/htm/php/tune96/5Nielsen.htm

Nielsen, H. 1998. Socio-economic impact of the smallholder livestock development project in Bangladesh: Results of the Second Impact Survey, In: Women in Agriculture and Modern Communication Technology, pp. 8. http://www.husbandyr.kvl.dk/htm/php/tune98/4-HanneNielsen.htm

Nielsen, H. 2003. Participatory Livestock Development Project –Bangladesh. Fifth Mission Report to DANIDA.

Newnham, J. 2000. The BRAC Poultry Programme in Bangladesh: A Performance Measurement Framework Case Study on Business Development Services for Micro, Small and Medium Enterprises, paper presented in the international conference on, "Business Services for Small Enterprises in Asia: Developing Markets and Measuring Performance", held on April 3-6, Hanoi, Vietnam. Pp.1-34.
http://www.ilo.org/public/english/employment/ent/papers/bangbrac.htm

Raha, S K. 2003. Poultry farming under participatory livestock development project – an agribusiness study. Report prepared for the Participatory Livestock Development Project (draft).

Rahman, M., P. Sorensen, H. A. Jensen, and F. Dolberg . (1997). Exotic hens under semi-scavenging conditions in Bangladesh. *Livestock Research for Rural Development*. Pp. 12, www.cipav.org.co/lrrd/lrrd9/3/bang931.htm

Roberts, J a, Gunaratne, S P, Wickramaratne, S H G, Chandrasiri, A D N. (1994) The benefits form the use of a creep feeder for scavenging chickens in villages. In: Proceedings of the 7th Asian-Australian Animal Production Science Congress, Bali, Indonesia, Voll II. Pp 69-70.

Saleque, M.A. (2000). Scaling-up: Critical factors in leadership, management, human resource development and institution building in going from pilot project to large scale implementation: The BRAC poultry model in Bangladesh. In: Dolberg, F. and Petersen, P.H. (eds), *Poultry as a tool in poverty eradication of gender equality*, Tune workshop, March 22-26, 1999, Tune, Denmark. Pp.15. http://www.husdyr.kvl.dk/htm/php/tune99/5-Saleque.htm

Saleque, A. and Mustafa, S. 1997. Landless Women and Poultry. The BRAC model in Bangladesh. In: F. Dolberg and P. H. Petersen (eds.) *Integrated Farming in Human Development*. Proceedings of a workshop, March 25-29, 1996, Tune Landboskole, Denmark. Pp. 18, www.husdyr.kvl.dk/htm/php/tune96/3Mustafa.htm

Seeberg, D.S. 2002. Money in my hand: An anthropological analysis of the empowerment of women through participation in Participatory Livestock Development Project in Northwest Bangladesh, Field report based on ethnographic fieldwork in Bangladesh, MA student of Ethnography and Social Anthropology, Aarhus University, Denmark pp.62

Shanawany, M M and Banerjee, A.K. 1991. Indigenous chicken genotypes of Ethiopia, *Animal Genetic Resources Information* 8 : 84-88.

Sonaiya, E B K. 1990. Poultry husbandry in small farms. Entwicklung and landlicher Raum 4, 3-6.

Swan, S.E.J. 2000. The poultry development strategy of the participatory livestock development project in Bangladesh, In: Dolberg, F. and Petersen, P.H. (eds), *Poultry as a tool in poverty eradication of gender equality*, Tune workshop, March 22-26, 1999, Tune, Denmark. 10 pp, http://www.husdyr.kvl.dk/htm/php/tune99/index.htm

Todd, H. 1998. Women at the center- Grameen bank women ten years on. Cashpor, Malaysia. Mimeo.

Tu, T.D. 2002. Village poultry production in Vietnam, "Second FAO/INFPD Electronic Conference on Family Poultry, pp.1-3. http://www.fao.org/waicent/faoinfo/agricult/aga/agap/lpa/fampo1/econf/econf2/vietnam.htm

UGC. 2001. General Union of Co-operatives Infopage, Maputo. http://www.ugc.org (updated December 2001).

Van Veluw, K. 1987 Traditional poultry keeping in Northern Ghana. ILEIA 3 (4).

Wilson, R T.1979 Studies on the livestock of Southern Darfur, Sudan. VII. Production of Poultry under simulated traditional conditions. Tropical Animal Health Production, 11 / 143-150.

Wilson R T, Traore, A , Kuit, H G and Slinger, L M . 1987 Chicks mortality in scavenging village in Scri Lanka. Tropical Animal Health Production, 19 / 229-236.

Young, M., Alders, R., Grimes, S., Spradbrow, P., Dias, P., da Silva, A. and Lobo, Q. 2002. Controlling Newcastle Disease in Village Chickens: A Laboratory Manual. ACIAR Monograph Nº 87

Zaman, M.A.U, 2002. Egg production performance of different breed/breed combinations of chicken in semi-scvenging system under PLDP, M. Thesis, Department of Animal Science and Animal Health and Network for Smallholder Poultry Development, the Royal Veterinary and Agricultural University and DLS, Dhaka, Bangladesh.

Reference not cited

Anonymous. 2000. Poultry as a tool in poverty eradication of gender equality: Outcomes and recommendations. In: Dolberg, F. and Petersen, P.H. (eds), *Poultry as a tool in poverty eradication of gender equality*, Tune workshop, March 22-26, 1999, Tune, Denmark. Pp. 8. http://www.husdyr.kvl.dk/htm/php/tune99/29-Conclusions.htm

Anonymous. 2000. Inception report: Second Smallholder Livestock Development Project, http://www.poultry.kvl.dk/poultry_index.htm, proceedings are placed at http://www.husdyt.kvl.dk/htm/php/tune99/index.htm

Anonymous. 2002. People Fight with Poultry: Learning from the Bangladesh experience, Dhaka, Bangladesh, October 20-24, 2002.

Dolberg, F. (2001). A livestock development approach that contributes to poverty alleviation and widespread improvement of nutrition among the poor, paper presented at the workshop, “Malnutrition in Developing Countries: Generating Capabilities for effective Community Action” conducted by IFAD, download address: http://dhaka.inasia.lk/resourcesdocuments.html

Jensen, H.A. 2002. Adaptation of Bangladeshi smallholder poultry concept, pp1-5, http://www.poultry-development.dk

Jensen, H.A. 2002 Smallholder poultry for rural development, pp.1-4, http://www.poultry-development.dk/document/aSLDPpotential.rtf

Jere, J.A., Schleiss, K. and Lipta, W. 2002. Poverty alleviation and gender: Bnagladesh poultry model in Malawi: Modifications and Applications, Paper presented in "Tune workshop", 2-6 April, 2002.

Jere, J. 2001. Background to the Development of the Malawi Smallholder Poultry Production Model. Proceedings of a Stakeholder workshop. Judith Jere and F. Chindime (eds.). DASPS II, P.O. Box 2096, Lilongwe, Malawi.

Jensen, H. Askov 1996. Semi-scavenging model for rural poultry holding. In: *Proceedings of XX World's Poultry Congress*, New Delhi, India. Vol. I, 61-70.

Jensen, H.A. 1996. Semi-scavenging poultry flock, In: Dolberg, F. and Peterson, H. (eds), Tune workshop, Tune Landboskole, Denmark. pp. 10, http://www.poultry-development.dk/document/flock.doc

Jensen, H.A. 1998. Network for poultry production and health in developing countries, In: F. Dolberg, and H. Peterson (eds), *Women in Agriculture and Modern Communication Technology*, Tune Landboskole, Denmark.http://www.poultry-development.dk/document/Network,rev.doc

Jensen, H.A. 2000. Paradigm and visions: Network for poultry production and health in Developing countries, In: Dolberg, F. and Petersen, P.H. (eds), *Poultry as a tool in poverty eradication of gender equality*, Tune workshop, March 22-26, 1999, Tune, Denmark. Pp.15. http://www.husdyr.kvl.dk/htm/php/tune99/3-AJensen.htm

Rahman, M., Sorensen, P., Jensen, H. A. and Dolberg, F. (undated), Cross bred hens under semi-scavenging condition in Bangladesh, pp. 17, http://www.poultry-development.dk/document/mafhaj.doc

Sonaiya, E.B. 2000. International Network for Family Poultry Development: Origins, Activities, Objectives and Visions. In: F. Dolberg and P. H. Petersen (eds.) *Poultry as a Tool in Poverty Eradication and Promotion of Gender Equality.* Proceedings of a workshop, March 22-26, 1999, Tune Landboskole, Denmark. Pp.8, http://www.husdyr.kvl.dk/htm/php/tune99/4-Sonaiya.htm

Sorensen, A. M. 2002. The Danish human resource base in agricultural resource for development: Its capacity and limitations in relation to interventions that aim to respond to gender and poverty alleviations objectives. In: F. Dolberg and P. H. Petersen (eds.) *Poultry as a Tool in Poverty Eradication and Promotion of Gender Equality* Proceedings of a workshop, March 22-26, 1999, Tune Landboskole, Denmark. Pp. 8, http://www.husdyr.kvl.dk/htm/php/tune99/1-AnneSorensen.htm