Thermostable vaccine or inactivated vaccine: the key to extensive poultry farming problem in Sub-Saharan Africa

Rene Bessin

INTRODUCTION
The Newcastle disease in extensive poultry farming, constitutes the main scourge in poultry farming in sub-Saharan Africa, especially for traditional breeding in indigenous poultry species.

In sub-Saharan Africa areas, with difficult conditions and access, practising extensive poultry farming in indigenous poultry species, the production of thermostable vaccine for collective distribution should enhance immunization on a wide scale.

Work leading to the production of such a vaccine has been carried out in many parts of the world especially in France, Malaysia, Australia and in sub-Saharan Africa.

In general, the strain used is a Newcastle disease V4 virus hypovirulent strain. The aim of this document is to provide some information on the immune reaction of poultry vaccinated with an inactivated vaccine (ITA-NEW) and a Newcastle disease V4 virus hypovirulent strain in Inter-tropical Africa.

The trial was carried out in Burkina Faso in August 1991 and covered a total of 104 indigenous poultry species, from poultry farms around Ouagadougou.

EQUIPMENT AND METHODS USED
The use of V4 vaccinal strain in Malawi proved a two-hour thermostability at 56°C. Studies in Malaysia have made it possible to develop a more thermostable strain known as V4 (UPM) (University Pertanian Malaysia). A vaccine was made from different abstracts (cereal grains coated with vaccine, food granular between 1987 and 1989).

V4 vaccine preservation tests (UPM) lactalbumin freeze-dried (2.5p.100) and saccharose (10p.100) have been produced in 1990 at the Veterinary Medicine and Livestock Institute for Tropical Countries (IEMVT - France).

The preservation of this type of vaccine in veterinary departments under cold temperature would enable future use in the field without a cooling facility at a room temperature of 45°C for more than two weeks.
HYPOTHESIS, PROTOCOL APPLIED

Poultry immunization leads to the production of inhibited haemagglutination antibodies; these antibodies do not provide protection but their titre gives an indication of their kinetic and eventually the level of animal protection.

As a result, this would enable the verification of the efficiency and the level of protection of this thermostable vaccine.

The vaccination was done orally with the V4 hypovirulent strain (live vaccine) on birds aged five (5) weeks; and the ITA-NEW vaccine (inactivated vaccine) was done by intramuscular injection. A sample of blood taken weekly made it possible to monitor the evolution of antibodies.

Studies focused on the titres in inhibited haemagglutination antibodies for Newcastle disease virus. Results obtained allowed us to study the antibody kinetic and be able to highlight the differences between the batches.

RESULTS

IHA tests show the following titres for samplings carried out. Jo represents the day of the first vaccination.

FIGURE 1

Titre in Inhibited Haemagglutination Antibodies of the subject batch (non vaccinated)
FIGURE 2
Titre in Inhibited Haemagglutination Antibodies of batch vaccinated with Ita-New (inactivated vaccine)

FIGURE 3
Titre in Inhibited Haemagglutination Antibodies of vaccinated batch with V4 vaccine (thermostable vaccine)
Birds vaccinated with ITA-NEW inactivated vaccine prove a significant growth of antibody titre after the immunization from the fourteenth day.

Animal vaccinated with the inactivated vaccine and animal vaccinated with V4 vaccine after twenty eight days, show a significant difference: the titre being higher in the animal with inactivated vaccine (ITA-NEW).

The exercise of virulent strain inoculation to different batches after twelve days have produced the following results:

**TABLE I. MORTALITY RATES OBTAINED AFTER THE VIRUS INOCULATION IN TOULOUSE**

<table>
<thead>
<tr>
<th>Type of batch</th>
<th>Mortality%</th>
<th>Number of birds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject batch</td>
<td>50</td>
<td>8</td>
</tr>
<tr>
<td>Animal vaccinated with Ita-New</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Animal vaccinated on V4 vaccine with crushed millet twice</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Animal vaccinated thrice with crushed millet</td>
<td>20</td>
<td>10</td>
</tr>
</tbody>
</table>

Among the vaccinated chicken all animal having a titre higher than 2.32 survived.

**CONCLUSION**

The inactivated vaccine ITA-NEW gives titres in inhibited haemagglutination antibodies from the fourteenth day and guarantees a long-life protection.

Trials on V4 vaccine do not seem to be efficient and appropriate for V4 strain against the virus of the Newcastle disease.

A large-scale use deserves to be carried out.

The realization of a field trial on a realistic scale proves to be necessary. Furthermore, the choice of a substrate which would serve as a boost to oral vaccines requires in-depth study in order to make a proper selection of food vaccine.

**REFERENCES**


Nguyen, B.V. Etude complémentaire de la thermostabilité de la souche de virus V4 (UPM) de la maladie de Newcastle et évaluation du pouvoir immunogène d’un vaccin aliment. IEMVT, Alfort, 1990


* Organization of African Unity - Inter-African Bureau for Animal Resources (OAU-IBAR), Coordinator for the Pan-African Programme for the Control of Epizootics (PACE)
La avicultura de traspatio en zonas campesinas de la provincia de Villa Clara

Alcides Pirez Bello y Guillermo Polanco Expósito

RESUMEN
Con el fin de conocer las particularidades de la crianza de gallinas locales en el sistema de traspatio en zonas campesinas, se llevó a cabo un censo y un estudio del comportamiento reproductivo de las gallinas locales, resultados de la incubación natural y periodo de crianza natural de polluelos; en el municipio de Santo Domingo, Provincia Villa Clara. Se registró información acerca del número de aves de diferentes categorías y sexo, de diferentes indicadores bioproductivos, instalaciones, enfermedades y tipo de alimentación. Se obtuvo que el número promedio de gallinas por familia fue de 52,3.

Las aves con una edad entre 0 y 8 semanas constituyen el 49,7% de la población avícola; en la siguiente etapa de vida, que comprende desde 9 hasta 20 semanas de edad, las existencias representan el 27,4% y los adultos solo representan el 22,9%. La alimentación se basa en los desechos de cocina y el alimento que sean capaces de consumir en el campo; pero el 70% de los criadores suplementa y de ellos el 50% lo hace con maíz en grano.

Son empleadas pocas instalaciones y equipos en este sistema de crianza. Las principales enfermedades detectadas son las afecciones respiratorias (39,6%), el cólera aviar (18,9%), enterobacteriosis (18,1%), helmintiasis intestinal (17,2%), coccidiosis (13,7%) y se observa que el estatus alimenticio influye significativamente en la aparición de estas enfermedades. Estas aves se incorporan a la producción después de los 6 meses de edad, producen 43,4 huevos al año. Se encontraron diferencias (P<0,05) en el número de huevos, días de puesta y pollitos nacidos por nidada. La incubabilidad natural fue del 87,2% y la etapa de cría de los pollitos por la gallina se extendió a los 58 días. Palabras Claves: Gallinas, Producción de Huevos

INTRODUCCIÓN
La producción animal de traspatio es una actividad importante en las comunidades rurales de la mayoría de los países en desarrollo. Dentro de las especies animales que se explotan bajo este sistema, son las gallinas las más importantes debido a su frecuencia, ya que sus productos se destinan principalmente al autoconsumo. Más del 90% de las familias rurales con animales de traspatioPoseen gallinas. El promedio de gallinas por familia rural varía de 8 a 20 según la región y disponibilidad de recursos (Rodríguez et al., 1996).

Son escasos los estudios sobre el comportamiento de producción y de las principales enfermedades que afectan a las gallinas locales en este sistema. Este estudio se propuso...
como objetivos la descripción de la población de gallinas locales en zonas campesinas de un municipio de la provincia de Villa Clara (Santo Domingo), la determinación de algunos de sus indicadores bioproductivos y las principales causas de mortalidad de estas gallinas.

**MATERIALES Y MÉTODOS**
Para la realización del presente trabajo, se censaron 116 criadores de gallinas locales en sistema de crianza de traspatio; para obtener información acerca de diferentes características de este método de crianza tradicional en cuanto a:

- Estructura poblacional del rebaño; registrándose el número de aves por edad y sexo
- Edad en que alcanzan la madurez sexual hembras y machos
- Producción anual por gallina
- Relación hembras:macho
- Alimentación empleada
- Instalaciones
- Principales enfermedades que afectan las existencias de estas aves

En una segunda fase se estudió el comportamiento reproductivo de 30 gallinas recién incorporadas como ponedoras, en sus tres primeras nidadas. Se controló el número de huevos producidos por gallina en cada nidad, los días que duró cada ciclo de puesta, los pollitos nacidos en cada nidad después de la incubación natural y la duración del tiempo que transcurrió en que la gallina cría a sus polluelos.

Se comparó el peso vivo entre ambos sexos dentro de la estructura de edades de la población, empleando el método de comparación de proporciones, para determinar si existían diferencias significativas entre ellos. A los indicadores bioproductivos: edad en que se alcanza la madurez sexual por sexo, producción anual por gallina, incubabilidad, período de cría promedio de cada nidad y la relación hembras: macho, se les determinaron los valores promedio, máximo y mínimo, desviación estándar y coeficiente de variación.

Mediante una prueba de Chi-cuadrada se determinó si existía dependencia entre la suplementación alimenticia y la aparición de enfermedades infecciosas y parasitarias. Los promedios de los indicadores bioproductivos: huevos por gallina, duración de la puesta, pollitos nacidos en cada nidad, fueron comparados mediante un análisis de varianza de clasificación simple y determinada la significación estadística de las diferencias entre ellos mediante una Prueba de comparación múltiple (Duncan, 1955).

**RESULTADOS Y DISCUSIÓN**
Al estudiar la estructura poblacional por edades y sexo de la gallina local en Sistema de Crianza de Traspatio (tabla 1), se observa que las aves con una edad entre 0 y 8 semanas constituyen el 49,7% de la población; en la siguiente etapa de vida, que comprende desde la 9. hasta la 20. semana de edad, el número de animales representa el 27,4%. Esta reducción en la cantidad de aves, se debe a las elevadas pérdidas que en este sistema de crianza ocurren durante la primera etapa de vida del pollito.

Durante las etapas de inicio y crecimiento no se observan diferencias (P>0,05) en las proporciones entre sexos. Los animales de más de 20 semanas de edad constituyen el 22,9% de la población y se aprecian diferencias (P<0,05) entre sexos, provocadas estas por el sacrificio de los machos, y a consecuencia de ello se observan también diferencias (P<0,05) en la proporción entre los sexos en la masa total.
La avicultura de traspatio en zonas campesinas de la provincia de Villa Clara

**TABLA 1. ESTRUCTURA POBLACIONAL DE LA GALLINA LOCAL EN SISTEMA DE CRIANZA DE TRASPATIO**

<table>
<thead>
<tr>
<th>Categorías</th>
<th>Machos</th>
<th>%</th>
<th>Hembras</th>
<th>%</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-8 semanas</td>
<td>1 489</td>
<td>24,5</td>
<td>1 527</td>
<td>25,2</td>
<td>3 016</td>
<td>49,7</td>
</tr>
<tr>
<td>9-20 semanas</td>
<td>736</td>
<td>12,1</td>
<td>925</td>
<td>15,3</td>
<td>1 661</td>
<td>27,4</td>
</tr>
<tr>
<td>Adultos</td>
<td>144</td>
<td>2,4</td>
<td>1 245</td>
<td>20,5</td>
<td>1 389</td>
<td>22,9</td>
</tr>
<tr>
<td>Total</td>
<td>2 369</td>
<td>39,0</td>
<td>3 697</td>
<td>61,0</td>
<td>6 066</td>
<td>100</td>
</tr>
</tbody>
</table>

Resultados similares son reportados por Mopate et al. (1995) y Mopate & Lony (1999), quienes plantean que la estructura de las poblaciones de gallinas de traspatio se caracteriza, por tener un número mayor de polluelos que de adultos. Además, los polluelos experimentaron más pérdidas, como consecuencia de las enfermedades, las prácticas inadecuadas de manejo, la depredación y los accidentes.

La nutrición de la gallina es un factor que limita la producción de huevos. La base de la alimentación en la producción de las aves de corral por los campesinos es el alimento que la misma ave se procura en el campo, los desechos de la casa (cualquier cosa comestible que se encuentre en el ambiente inmediato) y pequeñas cantidades de granos como suplemento. En el presente estudio cerca del 70% de los criadores suplementan a sus aves (tabla 2) y el 50% lo hace con maíz.

**TABLA 2. EMPLEO DE SUPLEMENTACIÓN EN LA ALIMENTACIÓN DE GALLINAS LOCALES EN SISTEMA DE TRASPATIO**

<table>
<thead>
<tr>
<th>Suplementación</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criadores sin empleo de suplemento en la alimentación</td>
<td>35</td>
<td>30,17</td>
</tr>
<tr>
<td>Criadores con empleo de suplemento en la alimentación</td>
<td>81</td>
<td>69,83</td>
</tr>
</tbody>
</table>

**Tipo de suplemento**

<table>
<thead>
<tr>
<th>Tipo de suplemento</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maíz</td>
<td>58</td>
<td>50,00</td>
</tr>
<tr>
<td>Sorgo</td>
<td>3</td>
<td>2,59</td>
</tr>
<tr>
<td>Cabecilla de arroz</td>
<td>4</td>
<td>3,45</td>
</tr>
<tr>
<td>Maíz + Sorgo</td>
<td>2</td>
<td>1,72</td>
</tr>
<tr>
<td>Maíz + Girasol</td>
<td>3</td>
<td>2,59</td>
</tr>
<tr>
<td>Maíz + Girasol + Cabecilla de arroz</td>
<td>2</td>
<td>1,72</td>
</tr>
<tr>
<td>Maíz + Cabecilla de Arroz</td>
<td>8</td>
<td>6,90</td>
</tr>
<tr>
<td>Sorgo + Cabecilla de arroz</td>
<td>1</td>
<td>0,86</td>
</tr>
</tbody>
</table>

Dessie & Ogle (1996a; 1996b) han demostrado que los recursos alimenticios en el Sistema de Criaanza de Traspatio no es constante. La proporción de alimento que proviene del ambiente y la suplementación de granos, depende de la disponibilidad del grano en la casa, la estación del año, los ciclos de cosechas, los ciclos vitales de insectos y otros invertebrados. En las aldeas las aves son mantenidas alrededor de la casa durante el día, alimentándose de los desperdicios de la casa. Algunas son suplementadas con maíz y en las noches son
recogidas y colocadas en pequeñas naves que garantizan su protección, donde están los nidales. Las enfermedades se controlan o se tratan raramente (Kabatange & Katule, 1990).

La alimentación en el Sistema de Crianza de Traspato es deficiente en proteína, energía y calcio; esta afirmación es confirmada por Dessie & Ogle (1996c), quienes observaron un elevado aumento en la producción de huevos, cuando las aves recibieron una suplementación rica en proteínas, energía y calcio.

La suplementación estratégica de las aves criadas en un Sistema de Producción de Traspato según su edad y el estatus productivo, es recomendada como una solución conveniente por Roberts (1991), después de analizar la base de recursos alimentarios en diversos sistemas de producción de aves locales en Asia, la cual es definida por Cumming (1991) como variable, dependiente de la época del año y de las precipitaciones.

La fuente de alimentos es un importante factor que influye en la producción de las aves de corral de traspatio y se ha calculado que estas aves son capaces de encontrar la alimentación necesaria para su mantenimiento y producir alrededor de 40 huevos por año, pero para alcanzar niveles de producción más altos se requiere de alimentación suplementaria. Si se asume que el valor del alimento consumido por estas gallinas, es el reflejo de la composición bromatológica de la cosecha, se puede entonces afirmar que los resultados de 52,3 ± 12,5% en Materia Seca; 9,1% ± 2,3% en Proteína Bruta; 0,9 ± 0,4% en Calcio; 0,75 ± 0,3% en Fósforo y 11,9 ± 0,9 kJ/g de Energía Metabolizable obtenidos por Dessie & Ogle (1996b) están por debajo de los requerimientos para la producción de huevos e indican la importancia de la suplementación de estas aves. Como los alimentos balanceados no están disponibles, se hace necesario entonces la utilización de materias primas convencionales o no disponibles en la localidad.

Las instalaciones para la crianza de las aves son muy limitadas; sólo un 8% de los criadores emplean caseta para las aves y estas se emplean sólo para protegerlas por las noches. Son confeccionadas con materiales reciclados, piso de tierra, las paredes son de malla o de madera y para el techo se emplean las hojas de la Palma. Un 22% emplea un casillo donde se encierra la gallina durante el día, en las primeras 2 o 3 semanas de cría y del que pueden salir los pollitos. Esto lo hacen con el objetivo de limitar el movimiento de los polluelos y de suministrarles alimento suplementario.

La utilización de equipos avícolas también es limitada, sólo el 17% emplea comederos para suministrar el alimento. Como bebederos se emplean preferentemente neumáticos desechados que se colocan en lugares sombreados. Los nidales también son rústicos y se colocan en lugares tranquilos y sombríos; en el 26% de los criadores son las mismas gallinas las que los construyen.

Las principales enfermedades detectadas que afectan este Sistema de Crianza de Traspato en las gallinas son mostradas en la tabla 3; donde también aparece la influencia que sobre la aparición de ellas tiene la suplementación alimenticia.

Existe una elevada dependencia (P<0,001) entre la aparición de procesos Respiratorios, Parasitarios, eventos de Cólera Aviar, Enterobacteriosis y Coccidiosis en el lote de aves y la suplementación del alimento. Según Matthewman (1977) y Permin (1996), la elevada tasa de mortalidad de los animales en este sistema se debe a que en el Sistema de Crianza de Traspato la alimentación no es la más adecuada. Por otra parte, Ajuyah (1998), señala que la pobre nutrición, carencia de instalaciones que los protejan de los efectos perjudiciales
del medio ambiente y de un sistema eficaz de control de enfermedades, hacen que estas se extiendan con mucha facilidad por toda la explotación. Es muy frecuente que estén presentes eventos de Cólera Aviar, Viruela Aviar, Coriza Infecciosa, Coccidiosis, Parasitismo intestinal y ectoparásitos.

### TABLA 3. INFLUENCIA DE LA SUPLEMENTACIÓN DE ALIMENTOS CON LA APARICIÓN DE ENFERMEDADES EN LA GALLINA LOCAL DE TRASPATIO

<table>
<thead>
<tr>
<th>Enfermedad</th>
<th>Se suplementa</th>
<th></th>
<th></th>
<th>Total</th>
<th>Nivel de Significación</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Si (70%)</td>
<td>No (30%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>N   %</td>
<td>N   %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Afección respiratoria</td>
<td>15  12.9</td>
<td>31  26.7</td>
<td>46</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>66  56.9</td>
<td>4  3.5</td>
<td>70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Helmintiasis Intestinal</td>
<td>3   2.6</td>
<td>17  14.7</td>
<td>20</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>78  67.2</td>
<td>18  15.5</td>
<td>96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cólera Aviar</td>
<td>6  5.2</td>
<td>16  13.8</td>
<td>22</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>75  64.7</td>
<td>19  16.4</td>
<td>94</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viruela Aviar</td>
<td>8  6.9</td>
<td>2  1.72</td>
<td>10</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>73  62.9</td>
<td>33  28.5</td>
<td>106</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enterobacteriosis</td>
<td>5  4.3</td>
<td>16  13.8</td>
<td>21</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>76  65.5</td>
<td>19  16.4</td>
<td>95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coccidiosis</td>
<td>4  3.5</td>
<td>12  10.3</td>
<td>16</td>
<td>0.001</td>
<td></td>
</tr>
</tbody>
</table>

Las características reproductivas de la gallina local bajo Sistema de Crianza de Traspatio, son mostradas en la tabla 4. Estas aves alcanzan la madurez sexual como promedio después de los 180 días de edad en ambos sexos. Este indicador depende de un gran número de factores como son las características propias del genotipo, el sistema de crianza al que estén sometidas las aves, la alimentación, el peso vivo y la época del año en que nacen si no reciben iluminación artificial, entre otros.

Los efectos del peso vivo y de la alimentación en reemplazos de reproductoras pesados sobre la morfología del ovario y los contenidos plasmáticos de las hormonas reproductivas, entre las 21 semanas y el momento de la madurez sexual fueron examinados por Renema et al. (1999), quienes dividieron el rebaño en tres grupos de aves con el peso estándar, aves livianas (20% inferior al estándar) y aves pesadas (20% superior al estándar) y posteriormente los sometieron a dos regímenes de alimentación diferentes (Restringido y ad libitum) hasta la madurez sexual. Las aves alimentadas ad libitum alcanzaron la madurez sexual con un promedio de 11 folículos amarillos grandes (diámetro mayor de 10 mm) y de 10,3 folículos pequeños (diámetro menor de 5 mm), mientras que las aves bajo restricción alcanzaban 7,1 y 32,3 respectivamente.

El elevado número de folículos pequeños encontrado en las aves restringidas lo asociaron a que estos animales presentaron un período más largo de maduración sexual. La concentración de 17 beta-estradiol en el plasma de las aves pesadas fue más elevado a las 21 semanas que en las aves de peso estándar y livianas, lo que sugiere un desarrollo más
avanzado del ovario en estas aves. Después de la 21. semana de edad, las concentraciones de LH y FSH en el plasma de las aves alimentadas ad libitum se duplicaron en comparación con las aves restringidas. Se demostró que existe una modulación de las concentraciones de las hormonas reproductivas durante la maduración sexual por el nivel de alimentación.

El inicio de la puesta en 8 diferentes cruzamientos de gallinas explotadas en Sistema de Crianza de Traspatio realizados por Rahman et al. (1996), fue tardío en todas las combinaciones y no encontraron diferencias estadísticamente significativas y señalaron como causa de esto, las condiciones inferiores de alimentación que tienen las aves en este sistema de producción. También describieron la influencia de la estación del año en que se incuban los huevos sobre el inicio de la puesta. Las aves que nacieron en mayo produjeron el primer huevo a las 36 semanas de edad; sin embargo, las que nacieron en agosto y noviembre lo hicieron a las 30 y 28 semanas de edad respectivamente. Esta diferencia se debió a que las aves nacidas en mayo crecieron con un fotoperíodo cada vez menor y las que lo hicieron en noviembre y agosto fueron influenciadas por un fotoperíodo en aumento a partir de las 10 y 20 semanas de edad.


<table>
<thead>
<tr>
<th>Indicador</th>
<th>Promedio</th>
<th>Mínimo</th>
<th>Máximo</th>
<th>S</th>
<th>CV, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Madurez sexual, meses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Machos*</td>
<td>6,1</td>
<td>5</td>
<td>9</td>
<td>± 0,893</td>
<td>14,75</td>
</tr>
<tr>
<td>Hembras*</td>
<td>6,4</td>
<td>5</td>
<td>8</td>
<td>± 0,823</td>
<td>12,85</td>
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<td>Relación Hembras: Macho*</td>
<td>9,2</td>
<td>2</td>
<td>21</td>
<td>± 3,524</td>
<td>38,45</td>
</tr>
<tr>
<td>Huevos por gallina</td>
<td></td>
<td></td>
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<tr>
<td>1. nidada**</td>
<td>9,0 c</td>
<td>7</td>
<td>13</td>
<td>± 1,486</td>
<td>16,51</td>
</tr>
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<td>12,5 a</td>
<td>9</td>
<td>15</td>
<td>± 1,592</td>
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<td>3. nidada**</td>
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<td>8</td>
<td>14</td>
<td>± 1,465</td>
<td>12,96</td>
</tr>
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<td>ES</td>
<td>± 0,277</td>
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<td>Huevo por gallina anual</td>
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<td>34</td>
<td>56</td>
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<td>ES</td>
<td>± 0,407</td>
<td></td>
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<td></td>
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<td>Pollitos nacidos</td>
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<td>1. nidada**</td>
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<td>6</td>
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<td>± 0,944</td>
<td>11,90</td>
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<td>6</td>
<td>13</td>
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<td>Incubabilidad, %</td>
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<td>61,5</td>
<td>100</td>
<td>± 9,294</td>
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<td>Período de cria, días</td>
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<td>45</td>
<td>81</td>
<td>± 8,630</td>
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**TABLA 4. CARACTERÍSTICAS REPRODUCTIVAS DE LA GALLINA LOCAL EN SISTEMA DE CRIANZA DE TRASPATIO**
Los resultados obtenidos en los indicadores huevos por gallina, duración de la puesta y pollitos nacidos en las tres primeras nidadas son similares a los reportados por Say (1987) en aves locales de Burkina Faso y por Aganga et al. (2000), en Botswana con aves de la raza local Tswana. Sin embargo, en el presente estudio, la incubabilidad fue del 90 % y el periodo de crianza de 58 días, que difieren del 62 % y los 90 días de crianza reportados respectivamente para estos indicadores por los autores anteriormente citados.

**CONCLUSIONES**

Existe una relación directa entre el estatus alimentario de la parvada y la aparición de enfermedades infecciosas y parasitarias.

El comportamiento productivo de la gallina local en Sistema de Crianza de Traspatio en la etapa de reproducción, se caracteriza por alcanzar la madurez sexual tardía y ser su producción anual de huevos baja, con períodos frecuentes de cloquez por incubar los huevos de forma natural y después criar los polluelos por 58 días como promedio.

**REFERENCIAS BIBLIOGRÁFICAS**


Discussions
Discussion on Bangladesh Model

CONDITIONS FOR THE BANGLADESH MODEL
The Bangladesh model is primarily based on the following two conditions for the integrated Family-Poultry production system.

1. The low cost of labour for producing artisanal inputs such as the poultry houses, or labour intensive production techniques such as in the mini-hatchery.
2. The high population density in rural areas. This facilitates interchange of inputs and outputs between the different enterprises of the system, as well as facilitating monitoring. In fact Bangladesh has the highest rural population density in the world.

STRENGTHS OF BANGLADESH MODEL
Jonathan Bell (Bangladesh) - To what extent are these conditions necessary for the model to work? Let me put this as an open question. I think the first one is certainly indispensable.

Incidentally, in response to an earlier comment, in the Southern districts of Bangladesh where we are working, industrialised intensive poultry production is virtually absent, so there is no market interference from this.

Thabani Maposha (Zimbabwe) - The destabilisation of prices from nearby battery systems is unlikely. My experience in Zimbabwe is that this has actually been positive for the CBOs we call them Chigs here, in the sense that it has helped the prices of village chickens to lag closely behind those of broilers without any additional input whilst the broilers have been facing shrinking profits because of feed costs which are in the margin of 70% plus of TVC.

Jonathan Bell (Bangladesh) - An important pre-condition for the success in Bangladesh is the presence of NGOs that can reach out to people. Almost as rule - I repeat myself - government cannot reach out and we need other types of organisations than government livestock departments to reach people. It would be useful if this conference could contribute to the list of working alternative institutional arrangements to reach out to people - or for people to reach the technology(ies).

Peder Lund (Denmark) - The strength of the Poultry Model is that the main support to the beneficiaries is provided by NGOs. The majority of these NGOs have other activities that seek to improve the overall socio-economic development of their beneficiaries (health, education, etc.). This implies that in cases where there are problems like gambling and drinking the NGOs should be able to address these issues and assist the beneficiaries in drawing up satisfactory solutions.

In areas where the Poultry Model (in one form or other) cannot be introduced, due to lack of one or more of the vital elements, simpler technologies can be introduced as an intermediary step for alleviating poverty, while still using poultry as the tool for poverty alleviation.
Per A. Eklund (former Sr. Evaluation Officer IFAD) - I am convinced about advantages and replicability of Bangladesh model with specified preconditions.

Two queries: how to enhance its longer-term sustainability?

Query One: Should on normative grounds poultry activities be diffused and services by/through single purpose community-based organisations (CBO) which then can/should federate? Or is there an advantage in seeking to broaden the platform.

I am asking this since for IFAD I have conducted a survey of women CBOs in two districts in Nepal. This study shows that community leaders consider that there is a primary question more important than even food insecurity that drives behaviour and community mobilisation. Leaders consider that their limited knowledge about their own nutrition - first are their children chronically malnourished or not, and if so, second, which are the location specific solutions - is a primary cause to malnutrition, a secondary concern is food insecurity.

On average in most South Asian countries each second child in rural areas remains chronically malnourished (stunted). Poultry generate cash income for mothers and animal protein, both are associated with reduced stunting levels. This implies that on a priori grounds, a multiple purpose CBO, i.e. one that is concerned with overall nutrition security or household well being could be a more effective driving force for poultry model uptake, compared to single purpose poultry CBOs.

Second, how do the CBOs deal with the eventual threat from nearby agribusiness that with battery production units may destabilise prices and markets?

Frands Dolberg (Denmark) - Working with this model can be used as a tool to identify the poor. We know of the housing index as used by many micro-credit programmes as a poverty indicator, but it is probably less well appreciated that most rural households who keep no other animals than local chicken or none at all are equally poor.

In whatever form the work is organised, it will be important that this original target group (the poor) is kept in focus - and this may imply a beginning with a single purpose (sub) organisation. However, as the group settles and gets on with its poultry vaccination and other related activities, it could be used as a focal point for other activities such as savings and credit etc. I feel that indicators of child malnutrition - and other indicators of human well-being like body mass index of adults - can very well be used as key indicators for baseline surveys and progress assessment - and using such indicators are likely to dig deeper into our understanding of the location specific causes of malnutrition, which in-turn - provided we are prepared to learn and adjust - are likely to lead to even more efficient interventions, not necessarily poultry or animal in any way to overcome malnutrition. We know from IFPRI's studies that the status of women and women's education are very important factors to overcome malnutrition and not only increased production in itself.

I do not take firms stands on any of the possibilities mentioned above as I am sure outcome will also depend on the type of interest and leadership that happens to exist in a given place. However, one thing is sure. It may sound simple to have 5 - 10 hens running in a homestead, but it is not if this has to happen on a larger scale and we are terribly short of people with appropriate skills to properly organise and technically guide such work. The work of the Danida sponsored Smallholder Poultry Network (www.poultry.kvl.dk) deserves mention in this context. We know that for the CGIAR system poultry is not a priority although the basic experience with the work so far, i.e. that it is a tool to entitle very poor
families, and not the least women and children with food, ought to interest the CGIAR system. In many countries I have visited there is a group of 20 - 25% of the households that suffer from lack of food, even if at the macro-level, we can calculate/claim that there is enough food in a country.

On the question of competition with large poultry units, I have no firm answers. However, interesting studies could be done - or comments invited - in India, where we see eggs from commercial farms being sold in villages. On the other hand, in many countries eggs and meat of local birds command a premium price over the products of exotic birds. However, if anyone has studied this question it would be good to hear from them.

**Hans Askov Jensen (Denmark)** - I will try to answer the two questions:

1. The community-based organisation (CBO) is an essential element in the concept, but how these CBOs shall be organised or federated depend on the specific country. In Bangladesh takes the NGOs the responsibilities for maintaining the support and provide the required services and in other countries as Malawi is it a severe problem. I agree with you on the integrated approach in which the families’ health and nutrition status has priority. However, the smallholder concept is based on viable activities for the individual enterprises and these enterprises can not directly finance the social aspect, but the CBOs already established in the model can be the entry point for other family related activities - if the organisation is there.

2. It is a common perception that the commercial sector is a threat. But as stated in Essential No. 2 in the introductory paper, the smallholder shall take the advantages of the natural conditions in the village in such a way they can produce an egg with lower cost that in the commercial sector.

**J.M.Ndegwa (Kenya)** - I agree with the community groups approach as a strategy in poverty alleviation but I would like to see people being the focus of development interventions rather than the family poultry per se. The community approach is an effort in this direction. From past experience of participatory research in Kenya, I see the major constraint to this strategy is being one of attitude and lack of motivation. Training and sensitising women groups would make them strategically harness the few birds each might have as exemplified by a case study placed below.

**Role of family poultry (scavanger poultry) production in sustainable livelihoods and poverty eradication - the case of wanjiku**

Wanjiku (not her real name) is a single mother of 3 in her 40s. I met her in the course of my field visits in an on-farm farmer participatory research project in 1997. Her story about indigenous chicken and poverty was first told to me by one of my project farmers in whose homestead, Wanjiku and her 3 children, had sort refuge (squatter). The story was just too good to believe. Too compelling indeed. This unassuming lady was determined to shake off her the chains of impoverishment. Landless and in terribly humiliating indigence, Wanjiku decided enough was enough. From her meagre earnings by selling her labour to neighbours, she would buy a hen now and a cock later.

Slowly by slowly, Wanjiku had a flock of her own however small in size. But then her eyes were firmly focussed beyond her small ‘wealth’. She began to manage her flock of birds to make it a ‘commercially’ viable enterprise. Her strategy involved ‘synchronised’ hatching whereby two or more hens would be allowed to sit (incubate) on eggs at the...
same time. This meant that Wanjiku was able to have about 50 or more chicks at the same time. She would then rear and sell them off as a single batch. She did this several times and soon she had enough money to purchase a small piece of land of her own.

Eventually Wanjiku managed to put up a modest house by the local standards where she moved in with her family. Firmly and happily in her new home of her own, Wanjiku continued with her chicken project but she now expanded the enterprise to include vegetable growing. Her children were very helpful in these endeavours. Soon she had bought and expanded her land. Other developments in her homestead include a separate house for her sons to keep with her community’s traditions, and water storage tanks - very hardy for her vegetable growing. My observation of this lady has convinced me that the war to eradicate poverty and establishment of sustainable livelihoods can be won and will be won. This requires the right approaches - the Wanjiku method. To hasten the process resources should be harnessed and directed through the ‘right’ channels. Focusing on the poor and landless, their participation and use of local resources such as family poultry (scavenging/indigenous poultry) is an imperative.

Yaglo M G S (Tanzania) - First I would like to commend the Bangladesh model for its role in poverty alleviation of the poorest people in Bangladesh. It’s encouraging learning that the model has undergone through some metamorphosis to the way it is now. I think the brilliance and dedication of all the people who have been involved in it need to be emulated elsewhere by people interested in using poultry as a tool for family poverty alleviation. However, Jonathan Bell has mentioned two conditions i.e., low cost of labour and high population density necessary for the model to work.

Now if these conditions were absent could the model have worked as it is now? I think the conditions Jonathan mentions are necessary for the Bangladesh model as it is. We have a different environment in Tanzania that could influence a kind of model if we have to start one or if we want to adopt some experiences from the Bangladesh model.

1. The common things with Bangladesh are; (i) rural people are very poor, (ii) labour is cheap (iii) poultry can be owned by the poor of the poorest
2. The difference is that poor people in Tanzania (i) are not densely populated (ii) all families own land, but they only differ in the capacity to utilise it effectively. Each family thus produces its own staple food mainly maize (iii) the land tenure gives all the people access to the use of natural resources (iv) almost over 94% of rural families keep poultry.

Each family owns poultry and land and can produce their own food and is therefore not necessarily dependent on market crops (which might of course not be enough for the whole year). The combinations of these factors make the rural market for poultry products minimal or absent. The main market is the urban population. Whereas in Bangladesh there is both the combination of rural as well as urban markets for poultry products, consequent-ly facilitating interchange of inputs and outputs between different enterprises at a rural and or local level.

Frands Dolberg (Denmark) - We very likely come to these questions from very different perspectives. My perspective is shaped by more than 30 years in rural development (adviser, researcher, consultant), mainly livestock and attachment to Aarhus University, which gives me an opportunity to read a book now and then, apart from the updating from students.
On this background, my pre-occupation is not models per se, but modes of organising the work that seems to achieve what we want. We now want to reach the poorest with our development efforts and poultry has proven - in what I have seen on the ground - to be a very useful tool, not much written about.

**Asifo O. Ajuyah (Fiji)** - In the Philippines small-holders of livestock in particular poultry play significant role in rural nutrition, economy and culture (gifts, marriages, settling strife etc). Based on experiences in the South Pacific Island countries general constraints encompass but not limited to the following:- feed (cost, availability, quantity and quality); capital; management; skills; land tenure; natural disasters, government policies, marketing, diseases, manure disposal (intensive), replacement stock, no herd sub-division, indiscriminate slaughter of potential breeder, water etc. I will presume that similar constraints exist in the Philippines as a result of which your model and the Bangladesh model with appropriate modification might be a novel panacea for small-holders of livestock in small Islands countries.

**Krishna Kaphle / J.H. Lin (Nepal)** - Taking lesson from the success of Bangladesh rural poultry scheme for poverty elimination, Nepalese government adopted it to experiment in remote rural Far Western part of the country. The mountainous areas, backward in all sphere of development and a hot bed of Maoist insurgency were chosen for this experiment. Selected personnel who would be involved at field level for implementing the programme were taken for a trip to Bangladesh where they got first hand experience. I was not included in the trip but I did visit those rural areas to monitor the preparation for the proposed programme assessing the strength and weakness of the preparation. I do not want to discuss in detail about the programme but just for recent information it is in its first phase and around 100,000 layer pullets have already been distributed among the selected farmers representing poorest of the poor. I gained some experience, which I feel is a right opportunity and forum to discuss:

Unlike Bangladesh, Nepal being a mountainous country, limited resources, market facility, technical supports will make-work little harder. At field level the programme is being considered as a bestowal from the government in an attempt to counter insurgency, monitory gains over long term adoption was sensed from almost all the areas where I travelled. The programme has emphasised in distributing hybrid breeds for obvious reasons and the management, nutrition they may receive is no doubt below their minimum requirement. The real test for breed supremacy prevails as different breeds from diverse sources were distributed and the results will speak by itself. Some villages where the programme was implemented lied close to wild life habitat and the ecological impact of disease transfer brought in by the birds, their density resulted disease harbouring and spread to native fowls, wild birds was never assessed. The involved participants of the programme hailing from backward class of the society will not hesitate eating a dead bird rather then carefully disposing it. The effect of such activities on human health, the improper disposal of the birds viscera and its wide scale contamination by crow, dog to the surrounding areas cannot be ruled out, what is the consequence?

Besides the continuity, successful follow up, utilising local genetic resources, drawing active participation by providing loans, and vast of other areas are intended in the second phase. We are waiting for the outcome of the first phase and till now it is promising, and
Edward Mallorie (Denmark) - I wonder how the smallholder poultry model can be made more flexible. There is some evidence from the earlier project that some women took up poultry production primarily to get credit, and did not continue to with poultry production for very long. It also seems that poultry may not appeal to all very poor people, who may lack homestead space for chickens, may not be able to afford the time for a part time enterprise (they need a full time occupation away from the home to survive), and who may be unwilling to take the risk involved in taking credit for livestock investment (especially at an initial stage). Would it be possible to have a more demand driven approach, allowing group members to make a choice of what livestock and non-livestock enterprises they invest in? What implications does this have for the linked enterprises of the poultry model? The usual NGO practice in Bangladesh is to allow people a free choice of what income generating activity they take up.

WEAKNESSES OF BANGLADESH MODEL

Lylian Rodríguez (UTA Foundation www.utafoundation.org) - Which do you think are the weaknesses of the model?

Hans Askov Jensen (Denmark) - The main weakness of the model is in my opinion the complexity, it is in no way easy to adapt the model to a specific country in such a way that it is ready for wider dissemination. The main reasons for those are:

1. The target group: It require hard work and commitments to convince donors and local authorities that the target group shall be the poorest segment of the village population. Even though it is the policy of the donors and the local authorities to target the poor, they often neglect the very poor. The same goes for micro-credit providers, they exclude the poorest segment of the village population - not in Bangladesh. To get the poorest segment organised in a group is not a simple job, they are invisible, they are afraid of committing themselves to something they can’t comprehend and they are used to that development aids are for the others. However, when you first get them organised and they are aware of the prospective, they become very powerful and eager to participate.

2. A small flock of hens is not a gold mine; on the contrary the income during the first year has to pay for establishing the flock and all the investment in housing facilities plus often a high interest rate for the loan. I still think, that it is the right policy not to involve subsidies at user level, but it is no room for additional expenses to other activities. These have to come later after the first loan is repaid.

3. To establish the enabling environment as a sustainable activity in the village is also complicated. The existing micro-credit providers are not interested, they feel it is too risky and too expensive to administrate the loans.

An importance element in this model is the simplification. The target group is the poorest segment of the village population and a small flock (5 hens) is used as the first income generating activity and is an important activity in order to organise the poor household in community groups. However, the concept has build in the opportunity for the households to take other loans when they have repaid the first. These loans can be used to other
Discussion on Bangladesh Model

income generating activities including expansion of the poultry activities. In this phase new technologies can be appropriated to reduce the feed costs or make added value to the by-products. However, that is another project. The objective with the smallholder poultry concept is only to help the poorest to take their first step out of poverty and give them the opportunities to take the next step.

SELECTION OF BENEFICIARIES AND SUBSIDIES

Asifo O. Ajuyah (Fiji) - I have the following questions:

(i) More information on criteria for selection of farmers into the LLIP team. (ii) How are the farmers motivated (usually in rural areas smallholding of livestock represent secondary activities), with the Bangladesh model I will presume that the farmers are motivated based on the availability of loan (capital). (iii) Definition of smallholder farmer within the mixed farming systems in the Philippines. (iv) More information on farmers literacy level since a major component of the project include continuous improvement in the creativity, decisions, processes, practices and performance of the farmer which means farmers must have potentials to acquire skills in pertinent aspects of pig and poultry production.

Christophe Chrysostome (Benin) - In starting up a model with a pilot programme with a view to extending it to the whole country, the choice of beneficiaries is of first importance. In a village where one wants to start, everyone will say that they are poor. How then can we distinguish those who are really poor? When we are choosing, should we use resource persons from outside the village or from within? In my opinion, when the choice is made by outside people, the advantage is that we work better on the selection criteria, but the disadvantage is that the hidden sociological mechanisms of the milieu are not understood, and one could make conceptual mistakes. If the choice is made by someone from the milieu, there is the risk of choosing people only wanting to benefit from the livestock credit for other activities. What are your experiences in this domain?

Hans Askov Jensen (Denmark) - Yes, the selection of beneficiaries is one of the most important elements, and in my opinion one of the essentials of the concept. However, it is in no way easy to develop a selection procedure and the poverty indicators vary from country to country. In Bangladesh the criteria are landless combined with piece work for others, in Malawi it is the length of period out of food and here in Vietnam it may end up to be length of period with no livestock (pigs and poultry) during the year. It is also important to involve the village authorities.

They shall understand and agree that this programme is targeting the poorest segment of the village population, and the entire village will benefit if the poorest segment contribute to the production of eggs and chickens (more purchasing power and cash inflow from outside the village). Moreover the enabling environment (availability of inputs and services) can be utilised by all the villagers. The identification of the beneficiaries can be done from an outsider but in cooperation with the village authorities or an insider such as persons connected to the extension system - in Malawi Livestock Field Assistants or Village Livestock Technicians - we will probably learn more of this during the African Hall. I agree this is not a clear answer, but the selection procedure has to be developed locally.

Mamadou Sangare (Mali) - It seems that in all the described models (Bangladesh, Vietnam, Malawi), the choice of beneficiaries looks for the extreme poor. But there are
always leaders in poor and in rich groups, and their presence in a project will commit better the groups of beneficiaries. It is possible that in countries where the model succeeded it isn’t the case. Would it be possible to consider that in some cases such leaders are taken into account even if there are not the typical profile of the beneficiaries, mainly to help the project starting?

**Hans Askov Jensen (Denmark)** - Dr. Ajuyah Asifo request a more user friendly concept than that developed in Bangladesh. It is important to be aware of; that the model in Bangladesh has been developed over two decades and it is still developing. The latter is clearly illustrated by Dr. Ziauddin (21.05.02-12:57) in showing the improvement of the model from the SLDP 1, commenced in 1993 to PLDP commenced in 1998. However, the model in Bangladesh was much simpler in the beginning as it is today.

In all countries, that I am aware of, in which the Bangladesh concept is replicated or adapted, use a much simpler model as the starting point. Jens Peter Tang Dalsgaard from Vietnam shortly described a model only comprising only a breeder component and a smallholder component with 5 HYV-hens and 2-3 local hens. In Cambodia is a model being tested with only a smallholder component using local breeds and the same set up is planned to be tested in remote rainforest areas in Indonesia. However, even a simplified model is rather complicated to develop and to implement.

It is, however, important that the 5 essentials of the Bangladesh concept described in the introductory paper are maintained. The target group is the poorest segment of the village population because, the scavenging feed resource base set a limit on the flock size. The proportion of scavenging feed shall keep the operational cost on a level where the cost per egg produced is lower than that in the intensive production systems. This limited the flock size to 5-10 hens, depending on the scavenging conditions and the scavenging area, and the income from such a small flock of hens will only have a substantial influence on the livelihood of a poor family. The enabling environments, all inputs and services shall be timely available in the village, is of equal importance in order to minimise the risks of investing in a small poultry enterprise.

**DRAWBACKS OF INVESTING IN GOVERNMENT FARMS**

Comments of **Frands Dolberg (Denmark)** to question of Christophe Chrysostome (Benin) on resources.

How in a given place, we will organise it, I dare not predict here. It will depend on the circumstances in each location. I am no longer (was at a point in time) so concerned about our theoretical calculations on resources (nitrogen or other), because, we have generally been very poor in any case, to have the poor benefit from these calculations. And I think that is very wasteful or disgraceful or whatever words we can use. For instance is our calculation complete, when - as in your example - we limit our calculation to the feed resources, but do not include the waste of human talent and the misery that goes into being ill-fed? Is it enough to limit such calculations to soil, water, plants and animals? Should they not also include people? There are overlaps in the model. No doubt and please consider that when/if you apply it. If I had my way, I would not include government farms as they almost as a rule are poorly managed.
I do find it undesirable to put money into government farms. In the case of loans, it is a way to run countries further into debts, so it should be avoided as poor management leads to low production and income and not create the profit required to repay the loan.

Asifo O. Ajuyah (Fiji) - I totally agree with you as a former county (Local Govt. Area) Senior Agricultural Officer in Nigeria (1980-1985) agricultural activities at all levels are usually significantly influenced by government policies which are formulated by arm-chair bureaucrats. Thus some funding agencies prefer liaison with rural communities through NGOs and Universities. Consequent to your comment the bumps of the ‘model’ are therefore dependent on the performances of the government farm, which might impact on its economic sustainability in the long run.

The ‘model’ in Fiji does not use government farm or government extension services and has been quite successful over the years based on increase in per capita consumption of poultry meat (12.5 kg) and eggs (65). The nerve centre or hub of the wheel is a commercial poultry industry that is vertically integrated to a feed mill, hatchery, breeder farms, broiler farms, broiler meat processing plant, extension and marketing division, with 80 spokes from the hub forming a rim of contract broiler growers located in rural areas. Currently the carrying capacity of the contract growers range from 1000-8000 meat birds.

We have designed research to look at input and output viability between contract farm based on pre-determined broiler performance indicators (note: input are the same but different output in terms of growth rate, mortality, feed conversion, slaughter weight and age etc). This model I will presume is based on concept from our developed Pacific neighbours BUT it is viable, functional and working well in Fiji. However, for other Island countries like Samoa, Tonga, Solomon Island and Vanuatu etc a different approach is required, especially with large number of village chickens and supermarket shelves stuffed with turkey tails and mutton flaps, both of which are now linked to high incidences of diabetes, obesity and high blood pressure in the population.

GENDER BIAS AND SOCIAL ASPECTS

Thabani Maposha (Zimbabwe) - responding to Frands Dolberg’s comments in Annex B.

I was very fascinated when you discussed the gender dimension of egg consumption, who gets what proportion? In Zimbabwe it is the other way round unless if it changed after I left the village; adults eat eggs, the excuse or taboo given is that if children eat eggs they will be thieves. In urban areas they are mainly bought for the father and children rarely do eat eggs unless they are from well up families.

Krishna Kaphle - Increase in income need not necessarily mean improved lifestyle, gambling and drinking being a notorious social evil in those regions may get a boost with the income if not guided in proper way. I know I will draw criticism for this but I have this experience from some other projects for poor.

Peder Lund (Denmark) - Dr Krishna Kaphle raised an important issue, which nobody apparently has commented upon. In Nepal there have been several cases, where increased household income has resulted in an increase in cases of gambling and drunkenness. This is one of the unfortunate aspects of development, which should not be overlooked. In some villages in Nepal the women have tackled the issue by forcing the local authorities to ban production and intake of alcohol.
Discussion on Mozambique Model

CONDITIONS FOR THE MOZAMBIQUE MODEL
Filomena dos Anjos and Robyn Alders (Mozambique) - Family poultry plays a key role in rural Mozambique where two thirds of the population lives in absolute poverty. Examples are given of three programmes that promote poverty alleviation and food security through improved production of family poultry:

1. The control of Newcastle disease in village chickens
2. The cooperative production of broilers in peri-urban areas of Maputo
3. Characterization of local chicken ecotypes.

Most of the rural population is involved with agriculture. Mixed farming (crop production and livestock raising) is most common. Rural households grow food and cash crops and generally have a small surplus for sale. Approximately 70% of the 3 million rural families in Mozambique raise chickens, around 30% raise goats, 20% ducks and pigs, and only 4% are cattle owners, and rabbit owners comprise 3% (GRM International 2001). Of all the livestock species, chickens are most likely to be cared for and owned by women.

Chickens are possibly the major livestock contributors to the diet in the family sector. They also play a major role in poverty alleviation and food security at the household level. There are no barriers to chicken meat consumption (religious or otherwise; although in some areas the consumption of eggs by women and children is prohibited) and so they are the most common source of protein of animal origin. They constitute an income source, are used for rituals, assist with pest control and supply manure.

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).

GENDER BIAS AND SOCIAL ASPECTS
Aichi Kitalyi (Kenya) - I would also want to add that there is need for more concerted efforts on improving family poultry production (egg and chickens) through addressing the major constraints namely, predators, diseases and preferential treatment for chicks, because to some households these products may be the only accessible source and very crucial in improving nutrition/health status of HIV/AIDS victims as well as those who are on TB treatment.

STRENGTHS OF MOZAMBIQUE MODEL
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.
The implementation of an effective ND control program in Mozambique has resulted in increased chicken numbers, increased household purchasing power, increased home consumption of chicken products and increased decision-making power for women (Bagnol 2001). Despite the need to control ND in village chickens, it has been difficult to achieve a sustainable control program. Experience has shown that a sustainable ND control program is composed of four essential components: an appropriate vaccine and vaccine technology; effective extension materials and methodologies that target NGO, veterinary and extension staff as well as community vaccinators and farmers; simple evaluation and monitoring systems of both technical and socio-economic indicators; and economic sustainability based on the commercialisation of the vaccine and vaccination services and the marketing of surplus chickens and eggs.

PERI-URBAN PRODUCTION OF BROILERS
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 the necessary production inputs (day old chicks, feed, poultry extension and veterinary assistance). At the end of the production cycle (6 weeks), the “commercialisation brigades” collect the broilers and send them to the abattoir or to the live bird market.

All details are recorded and once the birds are sold, the accounts are done. The credit provided for the chicks, etc is repaid and of the gross profit (the difference between sales revenues and production costs), 50% is used to repay the initial loan and the remaining 50% is handed to the producers. In the case of a producer experiencing a loss, UGC will reschedule the loan provided that adequate justification is given.

THE CHARACTERISATION OF LOCAL CHICKEN ECOTYPES
The characterisation of local chicken ecotypes is underway as is the development of a breed of laying hens suitable for egg production in peri-urban areas. The Italian Government, through the FAO, is financing a project entitled “Establishment of long term support to the rural village family poultry sector.” The project was developed to support rural families who suffered losses during the floods in 2000. With the assistance of the Veterinary Medicine Faculty and NGOs, the project will distribute village-adapted chickens imported from South Africa (Ovambo, Venda, Naked Neck and Koekoek breeds).

WEAKNESSES OF MOZAMBIQUE MODEL
K Ben Abdeljelil (Morocco) - I personally believe that this approach to specific development issues e.g., Bangladesh model with its apparent numerous successes, in one part of the world should not be a stereotype to be copied elsewhere. It has to be tested adapted, adjusted modified to fit the needs of the local populations involved.
I am sorry if my participation takes us back to some previously cited issues reported by other participants. We should be able to define regional objectives, development priorities focusing on local needs rather than copying all the components and findings of models developed elsewhere. I agree with many colleagues who found the model was rather complicated to develop and to implement, even when simplified.

Selection of participants is one of the first obstacles, defining the base line is another etc. Population participation in small animals production is another in some regions. It is also true that a package of appropriate practical technologies has not been reported for the presented model.

We should also bear in mind that the primary objective of Family Poultry systems is to produce animal proteins. In the case of several areas we are still far away from the effects of raising few chicken on health and environment. A lengthy discussion concerned health hazards, which are certainly very important but not the main focus of the conference.

I will appreciate on another hand sharing experiences in the area of feeds and feeding (strategies, evaluation programs, research methodologies to assess supplies and needs in these systems).

Frands Dolberg - I read you comments with a lot of agreement. However, I think that a primary condition for the success in Bangladesh is a political/administrative climate, which - after all - allowed the presence of NGOs. Otherwise people would not be reached.

I would say the same to Mamadou Sangare, while - of course - it is very helpful to also have committed people at village level.
Discussion on the Cuban Model

STRENGTHS OF CUBAN MODEL

Manuel P Balado (Cuba) - The Cuban model of familiar production of poultry eggs and meat has extended to the whole country and has contributed to the programs of Nicaragua and Haiti.

1. The program includes breeding farms and incubation plants for the production of chicks, which are sold to breeders vaccinated against Avianpox and Newcastle disease.
2. Genotypes of semirustic hens of high rusticity conditions, able to produce 180-190 eggs per year, are developed, being to sex at one day of age by the color of the plume.
3. The Cuban Peking duck is incorporated into the program, which reaches 187,5 eggs yearly, and meat chickens may weigh up to 1,4 kg.
4. An epizootiological monitoring and surveillance program has been established which guarantees the detection and control of diseases.
5. The feeding of backyard poultry is carried out with foods, which go from corn and soy beans up to harvest crops and sugar-industry byproducts.
6. Recommendations were made for poultry raising and the development of rustic equipment.
7. With all the results, a training and preparation program of breeders, of which there are more than 700 thousand in this country, where there are 6,7 million birds, which productions contribute to the food security and to raise the family incomes, improving their living conditions. The new genotypes created have increased the biodiversity of birds, with higher productive yields in poultry eggs and meat.

Jurgen E Lohr (Germany) - Referring to “Experiencia cubana…” I have the following questions:

1. Could you give details of the “Epizootiologal monitoring and surveillance program”?
2. Do you have a special program for the Peking laying ducks. Do you have details?

Jurgen E Lohr (Germany) - I would like to comment on de Vries’ contribution:

1. The common practice to distribute pullets at about 10-12 weeks should help to vastly reduce “early chick mortality” and ensure the supply of properly vaccinated birds. This may well be one of the keys to successful village chicken production.
2. Replacement of hybrids is a problem where chicken raising is considered as one of the means of alleviating poverty. Apparently, hybrids with local hens had no problems with hatching eggs in Nicaragua. Loss of hybrid vigour may not be a problem at the level of 150-180 eggs/year, but lack of broodiness may well be.
3. Calcium supplementation is a very important factor in preventing bone problems (“osteomalacia”) in the high production hen and in improving eggshell quality. However, its influence on the NUMBER of eggs produced is small at this production level.
Poultry Health and Zoonoses

VACCINATION AND PREVENTION

M M H Mondal (Bangladesh) - The small poultry farming in Bangladesh is facing a major set back towards sustainability due to various diseases/ailments. On an average 30 - 40 % poultry birds die annually due to various diseases and predators.

Various biological, cultural, social and economic factors greatly influence healthy flock management in the villages. High chick mortality has always been found associated with poor feeding, housing and health control practices. A closer look at the small poultry farming showed that in spite of training and motivation farmer’s attitude towards healthy poultry management was still hazy. Most of the farmers vaccinated their flocks without maintaining cool chain and indiscriminately. The principles of bio-safety are yet difficult to implement by small poultry growers because of various socio-economic barriers.

Tran Dinh Tu (Vietnam) - Poultry diseases are considered the largest threat to traditional poultry production in Vietnam. Newcastle disease is the main fatal disease of chicken occurring throughout the year, Fowl cholera and fowl pox are also common diseases in village chicken. The Vietnamese government has encouraged the farmers to actively participate in vaccination campaigns against Newcastle disease. Thanks to frequent vaccination campaigns, the incidence of Newcastle disease decreased sharply and chicken population increased rapidly in many villages.

Filomena dos Anjos (Mozambique) addressed to Prof. Tu (Vietnam) - I would like to have more details about your programs on vaccination campaign against Newcastle disease (ND) [the main problems in carrying it out, organization, etc].

Robyn Alders (Mozambique) by his experience of working with the ND control programme in Vietnam (Prof. Tu) gave a response to the above question. The I-2 ND vaccine (a live, thermostable, avirulent vaccine usually administered via eye drop) was introduced to NAVETCO (a parastatal company that produces veterinary pharmaceutical products in Ho Chi Minh City) with assistance from the Australian Centre for International Agricultural Research (ACIAR). The I-2 ND vaccine is sold as a freeze-dried vaccine with the smallest vial containing 25 doses. In village chickens, the vaccine is administered via eye drop (every 4 months) or via cooked white rice (given twice, two weeks apart initially and then every 2 months). NAVETCO has an extensive distribution network within the south of Vietnam and so the vaccine is available for purchase in many centres.

These centres and the extension services in general function well for large to medium scale farmers. However, in a study conducted by Ms Brigitte Bagnol (a sociologist) it was found that small-scale farmers (and women in particular) were not benefiting from the same level of service and that the extension material was not appropriate for this target group.

This study was done as part of a project entitled “Improving capacity to control Newcastle disease and duck plague in village poultry” that was financed by the Australian...
Agency for International Development (AusAID) and implemented in collaboration with NAVETCO. In response to this situation a new range of extension material and methods were developed to ensure that poorer farmers (both men and women) have access to the technology and that they are able to use it with success. ACIAR has been assisting with the development of appropriate technology for the control of Newcastle disease since 1984. It is able to provide a range of material to those working developing countries free of charge.

The following items can be ordered or downloaded from the ACIAR website (www.aciar.gov.au):

• SADC Planning Workshop on Newcastle Disease Control in Village Chickens, ACIAR Proceedings No. 103.
• Controlling Newcastle Disease in Village Chickens: A Field Manual. ACIAR Monograph No. 82.
• Controlling Newcastle Disease in Village Chickens: A Training Manual. ACIAR Monograph No. 86.

A French version of the ND field manual is available for download from the INFPD website. (www.fao.org/ag/aga/agap/lpa/fampo1.fampo.htm).

Much of this extension material is also available in Portuguese thanks to a project on ND control implemented in Mozambique by the National Veterinary Research Institute and ACIAR. This project will be described in more detail later in this e-conference.

Further information may be obtained from the ACIAR/UQ Village Poultry Website (www.vsap.uq.edu.au/ruralpoultry).

Asifo O. Ajuyah (Fiji) addressed to Murray Maclean (Vietnam) - You said in your paper that in Cambodia as in other countries in the region, village poultry raising is characterised by regular occurrence of Newcastle disease that kills a large percentage of chickens. This fact dominates the pattern of flock structure throughout the year. Frequent outbreaks of disease also have a large effect on profitability.

My question is, has the situation changed since your paper is pre 2000? However, based on figure 33 and table 43 the economical impact of disease on the village poultry in Cambodia is quite serious and strategies must be developed to ensure the long-term viability of the industry. Depletion of stock from disease might explain the low poultry number per head of population (1.2) and the trends observed in figure 30 viz. a viz. the theoretical flock structure. Finally, I must say that figures 31-33 are very informative and provide a good synopsis of a typical Cambodia village hen, which may not be atypical to hens in other developing countries.

Murray Maclean (Vietnam) - I have not been in Cambodia for 18 months, but I suspect that except for limited areas that have received assistance, the situation of regular such disease outbreaks (i.e. Newcastle Disease) continues. Activities to improve village chicken raising in Cambodia have been few and far between (although there have been some success), often because priorities have been in securing and improving cattle, buffalo, and pig production. A lot of work has been done on developing basic animal health services to farmers, through village animal health workers.

In such a system it is easy for chickens to be neglected because the incentive is not readily there for such private workers to organise chicken vaccinations, when the main income is coming from pig, cattle treatments, with some preventive thrown in. Improvement of
chicken raising (as shown by the Bangladesh model) would, I suspect, require specific attention with a long-term, targeted commitment, which as far as I am aware has not yet occurred to date. Some of the conditions similar so such a project, I would think would have a good chance of success.

ADVANTAGES OF NEWCASTLE DISEASE VACCINATION

Khieu Borin (Cambodia) - The intervention to the village poultry must look into the needs of existing practices of village poultry. As an example, in the villages of Cambodia where the Special Programme for Food Security (SPFS) was implemented, the main problem raised by local community was high mortality due to the outbreak of diseases such as Newcastle disease, fowl cholera, etc.

The first intervention therefore was focused on vaccination campaign through the trained farmers in each village. With this intervention SPFS gained farmers participation in the programme. There is no good or bad model. The successful model is one, which is supported by beneficiaries (farmers/producers). Therefore, I think the first foot print that you leave in the village must be appreciated by villagers. Through Telefood funding, SPFS provides assistant on vaccination against common diseases and housing for chickens, the survival rate has improved 15%. Presently, feed and feeding systems are also tackled.

Nitya Ghotge (India) - ANTHRA is an organisation working in India on issues on livestock development and health. A considerable part of our work is with poor rural women and many of the concerns raised such as high mortality and losses to Newcastle disease and predators have been major problems in the areas we work in. We have tried to tackle these problems mainly by using locally available low cost options, including ethnoveterinary medicine along with a successful vaccination programme against Newcastle disease and Fowl pox. Mortality rates have gone down significantly.

Yongolo M.G.S (Tanzania) - The Newcastle disease (ND) is possible to control by using thermostable as well as conventional ND vaccines, if it is well planned and synchronised. The results are so remarkable that it encourages poor farmers first to be interested and enthusiastic in keeping chickens as they get more surplus chickens for sale. That can lead in investing on poultry activities.

However I would like to ask if others in Bangladesh or elsewhere have experienced any post vaccination complications as we have in free ranged rural chickens. The main complication is occurrence of infectious coryza, pox, colibacillosis and sometimes ND itself.

Peder Lund (Denmark) - During my time in Noakhali, Bangladesh (1987 - 89) we interviewed a number of women concerning their poultry. The conclusion was that mortality of chicks was around 80%. The major losses occurred during the chicks first two months. Fifty percent of the losses were due to predators and the other fifty due to diseases (Ranikhet Disease [=Newcastle disease] getting the main blame). It was also interesting to note that the offspring from hybrid birds were the first to succumb to predators. This was mainly due to their colour (poor camouflage).

As a consequence the project trained female vaccinators (illiterate and semi-literate women) and advised the villagers to protect the young chicks during the first two months. The method of protecting the chicks was the same as the one recommended by the Poultry Model. In the villages where vaccination was provided and the chicks protected, mortality
fell to around 20%. An interesting aspect was that there was no substantial increase in the poultry population. However, the households had an increase in sales and consumption of birds and eggs.

Similar results have been seen on projects in Orissa, Chattisgarh and Tamil Nadu in India. One villager in Tamil Nadu reported “before we started vaccinating our birds and protecting our chicks, our village used to import hens for our festivals, now we have become self-sufficient”.

Tran Dinh Tu (Vietnam) - Newcastle disease is the main fatal disease of chicken occurring throughout the year in village chicken in Vietnam. Frequent vaccination campaigns using thermostable and conventional vaccines have helped in sharply decreasing the incidence of Newcastle disease and chicken population increased rapidly in many villages.

Chrysostome Christohe (Benin) I read the Introduction paper on Mozambique, which is included. Coming to the paper I want to ask some questions to Filomena dos Anjos and Robyn Alders

1. at the beginning of the program of the control of Newcastle disease which disease occur in your case? Because in my country the implementation of ND control program has really resulted in increasing of chicken numbers but CRD fowl pox appeared.
2. apart of these three programmes, do you have a program in the field of nutrition.

Robyn Alders (Mozambique) -

1. Initially we did some baseline studies and ND was always identified as the major constraint. We started with ND control, as it is easier for farmers to see the benefit of an intervention if they are introduced one by one. Once ND is controlled, other diseases and other constraints do become more apparent and sometimes will become major problems. Fowl pox is one disease that can become more prevalent. Our recommendation is that the community vaccinators and the extension workers (i.e. people on the front line) need to be alert and watching out for new problems. As the new problems appear, the ones that are priorities to the farmers need to be included into extension activities. With fowl pox, in the first instance, we suggest that farmers use improved husbandry techniques to try and control the disease. Where ever possible vaccination can be introduced. An introduction to the control of other diseases is given in the last appendix in our ND training manual. Improving village chicken production really is a good example of continuous improvement.
2. The ND vaccine is not free; farmers are generally expected to pay for the vaccine and its administration (USD 0.02 per bird). Some projects have given the vaccine free of charge in the past but the control activities always came to a halt when the project ended.

Chrysostome Christohe (Benin) - By your comment I notice that the price of the vaccine and its administration in your country (USD 0.02 per bird) is cheaper than in Benin (0.05-0.07).

Jürgen Lohr (Germany) - From my experience in Uganda and Malawi on behalf of GTZ I would like to confirm and also extend the experiences by Anjos and Alders in Mozambique and by Kitalyi in Kenya. Newcastle Disease (ND) is certainly the most important chicken disease in African and also Asian countries, followed by avian pox.
In a GTZ project in the Mzuzu district of Malawi in 1992 the following vaccination schedule was recommended for COMMERCIAL egg-layers (Lohr, 1993):

- Marek’s Dis. Day 1
- 1st ND (V4) Day 1 (eye-drop) OR day 4-5 (drinking water)
- 1st Gumboro Day 14
- 2nd ND - V4 3-4 weeks, drinking water
- 1st Fowl Pox 4 weeks
- 2nd Gumboro 5 weeks
- 3rd ND - V4 10 weeks, drinking water
- 2nd Fowl Pox 14-16 weeks (optional)
- 4th ND - V4 18-19 weeks (eye-drop or drinking water)

Repeat ND-V4 every 6 months, drinking water [this may have to be done more often]

In principle, such a vaccination recommendation should also be applied to family chickens, but may be more difficult to implement. It is generally accepted that the I2 vaccine strain from Dr. Spradbrow, Brisbane University, is equivalent to the commercialised and more expensive V4 vaccine. Experience from Ethiopia (Nasser et al., 2000) has confirmed the efficacy of the I2 vaccine via the drinking water, by eye-drop, or via parboiled feed. However, feed application has a number of organisational disadvantages.

There are still many other factors limiting production, particularly in scavenging-type poultry production, such as lack of regular feed supply, inadequate feed quality, inadequate water supply and quality, endo- and ectoparasites, predation and theft by humans. The latter can be a serious limitation.

Anjos and Alders also mentioned peri-urban production of broilers. Similar projects existed in Malawi in the early 90ies and may have been extended in later years. It was found (Lohr, 1993) that BROILER PRODUCTION was impossible without at least two ND and 2 IBDV (Gumboro) vaccinations. Our recommendation was:

- 1st ND-V4 Day 1 (eye-drop) OR day 5-10 (drinking water)
- 1st IBDV Day 14
- 2nd ND-V4 3 weeks, drinking water
- 2nd IBDV 5 weeks, drinking water
- 3rd ND (?) in case of extended growth period

Fowl pox, IB, ILT did not appear to play a major, if any, role in broilers, but CRD did in some cases.

Surely, conditions will vary from country to country within the African continent, requiring some adjustment to the vaccination schedule. Efficient and affordable vaccines are available but the organisation of regular vaccination campaigns, supply and application of the vaccines and a general system of disease surveillance appears to be a major task on which the success or failure of family chicken production may depend in many African countries.

May I also point to the benefits of small-scale pigeon raising to improve the nutrition of villagers. Pigeons can find their own feed within a much larger area than chickens and they are usually not vaccinated. However, certain housing standards are required to prevent endo- and ectoparasitism.
Literature

ZOOONES
Concerns have been raised about health hazards from poultry residues.
First comment on residue and health from Horst W. Doelle (Austria) - I was surprised to read that no care has been taken in this model for the residues from the poultry. Poultry manure as well as chicken residues are excellent resources for anaerobic digestion, which would give the poor free cooking gas. Bangladesh is one of the developing countries, which has adopted readily anaerobic digestion and I am surprised to see that the model has not been thought through properly. If you organise and construct such communities, one should not only look at the food and economics or money, but also on the health of the people, because poultry manure contains one of the most vicious pathogens and thus health hazard.

What is being done with the poultry residues?
Hans Askov Jensen (Denmark) - The poultry residues are mainly being used as fertilizer.
Peder Lund (Denmark) - Though I agree health is an important issue, I do not believe that investments on these aspects should precede income to provide two to three solid meals a day. Interviews with the beneficiaries of the poultry model in Bangladesh reveal that education and health are important issues and often the first investments made, once the beneficiary has satisfied the nutritional requirement within the household and stabilised income.
Horst W. Doelle (Austria) - I am sorry, but health goes before food in my opinion. I cannot agree that a family with 10 hens cannot use a small 6 m3 anaerobic plastic digester. What is the use of more food if the enormous health dangers from hens and/or chicken manure in general cause sickness and death? I am sorry, but I am very frustrated to see recommendations, which do not look after the health of people, as we still have 80% of the world population without any basic sanitation. It is in these areas where we have the 11 million children dying each year. To alleviate poverty and starvation, we must think and incorporate basic sanitation.
What is the good of trying to get people out of poverty and starvation when you dramatically increase the health hazard and risk? To put chicken manure raw onto the field is a severe health hazard. Try it in our countries and you will get a very severe reaction from the authorities. In removing poverty and starvation we need integrated biosystems, which not only provide food but also provide eliminating health hazards. One cannot go without the other.
Krishna Kaphle and J. H. Lin (Nepal) - Taking lesson from the success of Bangladesh rural poultry scheme for poverty elimination, Nepalese government adopted it to experiment in remote rural Far Western part of the country. Some villages where the programme was implemented lied close to wild life habitat and the ecological impact of disease trans-
fer brought in by the birds, their density resulted disease harbouring and spread to native
fowls, wild birds was never assessed. The involved participants of the programme hailing
from backward class of the society will not hesitate eating a dead bird rather then carefully
disposing it. The effect of such activities on human health, the improper disposal of the
birds viscera and its wide scale contamination by crow, dog to the surrounding areas cannot
be ruled out, what is the consequence?

The incidences of parasitic diseases take an example of tapeworm littered environment
resulted in the poultry droppings finding its way in the body of the toddler or adult member
of the family or neighbour cannot be ruled out. I was interested in knowing the human
health vis a vis this model, disease prevention in this model, and areas of improvement if
implemented in other countries e.g Nepal.

Intervention from Jonathan Bell (Danida Bangladesh) - I feel that the concerns that
have been raised about health hazards from village poultry are exaggerated. The risk to
health from having no protein in the diet is much greater that any risk involved in having
ten hens in the homestead.

Horst W. Doelle (Austria) - I would like to see some statistics on the suggestion stated
by Jonathan Bell. We certainly have the statistics on chicken and poultry as well as other
animals on health hazard if there is no sanitation. I suggest to Jonathan to look up the
statistics in the latest UNDP and WHO reports. How do you control 5-10 hens in a home-
stead? They will soon become 20 or more according to my experience. He also forgets that
a family requires sanitation for its own excreta. I am just amazed that we do so obviously
neglect health standards and requirements, maybe because we in the developed world
take it as granted

Response from Jonathan Bell (Danida, Bangladesh)
1. I feel the onus is on those who are suggesting that poultry are a health hazard to
produce the statistics.
2. Actually chickens offer benefits to human health. For one thing, they eat mosquito
eggs. In Bangladesh mosquitoes carry the deadly Dengue Fever, for which there is no
cure. Without the village chickens life would be worse for the villagers.
3. In the Bangladesh poultry model the “key rearers”, which constitute 95% of all the
entrepreneurs have 9 hens, but no cocks. So there is not so much danger of huge
flocks of rampaging chickens threatening people. Not to mention the classic restraints
of chicken diseases [not human diseases - these are not zoonoses], predators and lack
of food to growth of village chicken populations.
4. Human sanitation is a separate question. Actually, Danida, which supports the Small-
holder Livestock Development Project in Five Southern Districts of Bangladesh, also
supports a human sanitation programme in the same area.

Horst W. Doelle (Austria) - I just wrote an article on ‘Biotechnology and Human Devel-
opment’ and cited all the relevant recent literature I mentioned and you requested. Please
look at http://www.ejb.org/content/vol4/issue3/index.html

The statistics of 2001 say,
• 826 million people are starving
• 1.2 billion people are living on US$ 1/day
• 2.4 billion people have no basic sanitation
• 11 million children under the age of 10 are dying each year mainly on infectious disease.

Surely your veterinarian expert should be aware of the Salmonella problem in chicken and that this is an almost deadly disease for children. I like Lylian’s comment, that anaerobic digestion can overcome all this even in small digester of less than 2 m3. Why do we do only half of the job and not consider all the aspects of the poor people. My simple question is: why do we only look at food to live, when life can be shortened through increased pollution and danger of infectious disease. What a choice: starve and die or live, get sick and die. We can do better than that as all the technology is available and cheap.

Intervention from D. Hadrill - I agree with Jonathan Bell, that Dr Kaphle’s concerns regarding human health risks from family poultry may be exaggerated. In particular, tapeworms of chickens are not a risk for humans. The dung of a chicken infested with tapeworms would contain tapeworm eggs that are ingested by and develop in that worm’s preferred intermediate host, that is, earthworms or insects. Another chicken consuming the insect or earthworm may get the tapeworm.

Regarding protecting small flocks against diseases such as ND, I feel sure that other contributors, such as Dr Robyn Alder, will have more to say about appropriate vaccination.

R. Branckaert (France) -Certainly some possibilities exist of disease transmission between Poultry and Humans. Until now, poultry tapeworms have never been mentioned as a possible source of infestation for humans. The most important problem is certainly salmonellosis. It seems difficult to eradicate it as it is spread as well by domestic than by wild birds. Therefore, it could easily be spread in scavenging conditions. Until now, most efforts have been concentrated on Newcastle’s disease prevention with some success. I am afraid, that, in the near future, - with the progressive eradication of ND - research should be conducted on the possibility to develop cheap polyvalent vaccines, combining ND, Salmonellosis ( pullorosis ) and Variolo-diphteria.

Anders Permin (Denmark) -Yes it was nice to have a discussion on the zoonotic aspects of keeping poultry in the backyard. One of the beauties of the smallholder poultry model is certainly that there is almost no risk of transmitting diseases from the chickens to the humans. This is completely different when discussing for example pig production where we see high rates of Taenia solium (which can establish in humans either in the gut or in the brain causing epilepsy).

Trevor Bagust & Juergen Lohr (Australia) - We all perhaps can benefit from noting these veterinary facts for public health aspects of the recognised zoonotic i.e., animal-human spread infections of chooks (in Australian = chickens!)

Paratyphoid - the zoonotic disease role of motile (paratyphoid) salmonella in semi-intensive production units is not well documented but seems to being exaggerated by some commentators who are not fully conversant with the scientific facts. In laying stock transmission is predominantly by the trans-ovarian route. Therefore, control must be and can be achieved at the breeder/hatchery level (Lohr et al, 1998) [Salmonella Control in Layer Parent Stock and End Products]. In Germany all commercial pullets are required by law to be vaccinated. Both attenuated and live vaccines are available. In broilers transmission from bird to bird (horizontal spread) is more important.
According to Humphrey et al, 1989 (Epidemiol. Inf. 103, 415-423), only 1% of naturally infected hens shed salmonellae. Usually the number of organisms that is shed is well below the infectious dose. Environmental factors, such as long storage at high ambient temperatures, poor storage hygiene, insufficient cooking, use of raw eggs, will be needed for small numbers of salmonellae to multiply within the infected egg until infectious dose levels are reached. The salmonella risk, if at all present, can also be minimised by producer/consumer education. This includes short storage (maybe in a community cooler or by fast turn-over), separation of chicken and human accommodation, instructions about basic hygienic measures such as washing the hands before entering the house and eating, and of course, adequate cooking of food.

Chicken parasites and human health: There is no evidence so far that any of the common chicken endoparasites (e.g. coccidia, capillaria, ascaridia, syngamus, tape worms) are transmissible to man. Tapeworms usually require intermediate hosts before reaching the chicken as final host. The situation with ectoparasites is different. Mites, the chicken soft tick and the chicken flea can all attack humans and lead to unpleasant bites. Strict separation of human and chicken houses is therefore also necessary. A useful review of the parasitic diseases in Indonesian poultry was carried in the Jan 2001 issue of Poultry International, pp44-49 and summarises sensible control measures for parasites in caged poultry, and especially the periodical removal of droppings.

The application of NDV vaccine can be another (minor) risk because the vaccine virus can cause transitory conjunctivitis in humans, however, leaving no permanent damage. Staff and farmers handling the vaccine must be instructed accordingly.

The role of campylobacter from chickens in cases of severe human campylobacter enteritis is an area of considerable dispute between human and veterinary medicine. Campylobacter organisms are not uncommon in chicken intestines but they are not found in the egg. Rather, infection of the meat occurs after slaughter and campylobacteriosis is a problem of slaughter and processing hygiene.

Avian chlamydophiliosis (formerly chlamydiosis) is a serious zoonosis, but is an infectious problem in ducks and turkeys, rather than in chickens.

General Comment: Being alive carries daily risks for any human being, risks and almost no food item - be it of animal or plant origin-will be sterile i.e., free of bacteria in its original state. Nonetheless, the content of a normal egg is usually sterile, thanks to various bactericidal substances in the egg white. But to eat, cook them!

Contrary to the undernourished individual, a well-fed body with fully functional primary and secondary defence mechanisms can usually cope with this situation. Furthermore, an adequately fed child will have a much better chance to develop its physical and intellectual capacity, and to find a way out of poverty than an undernourished child will have had. The benefits of better nutrition for people living in impoverished circumstances will therefore, by far outweigh the risks of sporadic food-borne infections which might (and in almost all cases are not!) being spread by migratory chickens in villages.

Mamadou Sangare (Mali) - Comments are clear about the low hazard with chicken manure, how is it with ducks manure? Excuse my ignorance, but we have an old saying in Mali “Duck farms prosper on the tombs of children in the household.”
Krishna Kaphle and J. H. Lin (Nepal) - I would like to see some comments on sanitation, as it is a neglected area in small-scale poultry raising. As we are aware about the alarming scale of arsenic content in drinking water source of Bangladesh, the available safe sources of drinking water have to be preserved. Besides the outbreak of diseases like IBD, ND finding their way into such farms and ways and means to protect the investment of these poor farms need to be highlighted.

ETHNOVETERINARY PRACTICES

Krishna Kaphle - Ethnoveterinary is and plays a crucial part in backyard poultry raising. I personally feel that it should also be given a permanent place whenever we discuss about small-scale poultry/livestock farming. I would be interested if fellow participants could shed some light from their experiences to help other audiences like me. I would also like to know the strategy that the designer of such a model has regarding the continuity of ethnoveterinary medicines incorporated with judicious use of synthetic medicines for better and sustainable results.

Oluyinka Olukosi (Nigeria) - The discussions about the impact of poultry on human health have opened up my eyes into an area I have not considered very seriously before. I only wish to add, in this regard, that simple ethnoveterinary practice may reduce the impact of cross infestation of ectoparasites from chickens to man if it is combined with strict hygiene codes which are, of course, the tenets of any sound system.

Krishna Kaphle (Nepal) - I would again like to draw the attention of the participants to ethnoveterinary medicines and like recently developed medicinal egg rich in monoclonal antibodies, we may work out to enhance the medical and nutritive value of the traditional products with out risking complication of non-acceptance. I feel we should think of every option available and judge how best it can fit to the model for its improvement.
Inputs for sustainable family poultry production

FEED AND OTHER RESOURCES
Lylia Rodríguez (UTA Foundation www.utafoundation.org) - Which are the feed ingredients and where are they coming from? Which are the main sources of protein in the system?

Hans Askov Jensen (Denmark) - In the first phase, interalia, field trials and full-scale village test, we use normally balanced commercial feed. After that we use what is locally available or we encourage the farmer to grow protein crops like soya. However, the main part of the feed consumed has to be scavenging feed. I know that University of Tropical Agriculture (UTA) do a great work to develop methods to produce animal feed from waste such as worms, larvae, and duck weeds, but I have not seen a possibility to integrate these methods into the first phase of the model development.

T R Preston (Cambodia) - The Bangladesh model is a sociological and organizational success but has few novel features from the technological viewpoint. This is very clear from Han’s reply regarding the feed inputs. Hans proposes encouraging the families to grow “soya” which is somewhat at odds with the concept of local resource use. Out of interest I quote recent (2000-2001) yields from inter-cropping immature rubber trees on the best soils in Cambodia. Two crops of soybeans and one of mung beans totalled 2.4 tonnes/ha of seed in 13 months growth period, containing about 500 kg of protein. The comparison crop was cassava grown for forage which produced 56 tonnes/ha fresh foliage containing close to 2500 kg of protein - five times as much.

Of course you cannot feed cassava foliage to chickens, which is of course the big constraint in the Bangladesh model in its present form. Bangladesh has large water surfaces, not very good for cassava (and less so for soya) but ideal for duckweed and water spinach (Ipomoea acuatica), with yields equivalent to 4 to 5 tonnes of protein/ha. Both these feed resources are consumed by chickens, but with 90 to 94% moisture they present major constraints to incorporation into “balanced” conventional feeds. This highlights the inflexibility of the model as it functions at present, and casts doubt on its long-term sustainability. It also emphasises the need for research into alternative feeding and management systems, which make efficient use of the natural tropical resources.

Harm de Vries (Venezuela) - On other places the type of supplementation (still restricted, making use of the comparative advantages of scavenging) could be the most important factor. It will be quite a challenge a find an optimal system.

Oluyinka Olukosi (Nigeria) - The greatest attraction of scavenging chickens enterprise is it’s making good use of the scavengable feed. As Roberts (2000) pointed in the Tune workshop, it is essential to know the capacity of the feed resource base in an environment before embarking on scavenging chickens developmental work. It is a good sight seeing
that scavenging chickens are improving the living standards of impoverished people. I am just afraid that if one does not take care of the feed resource base, the population might soon overgrow the carrying capacity of the feed resource base. The supplemental feed requirement of the chickens will experience a hike in such a situation. Maybe, it is an unjustified or premature fear, those with experience in the field might wish to enlighten me.

**Frands Dolberg (Denmark)** - A visit a couple of years ago to Papua New Guinea as member of an IFAD mission left me with questions. You find plenty of local feed resources and there is - at least in FAO - plenty of knowledge about these feed resources. Yet, feed, even for village level poultry production was imported from Australia.

**Asifo O. Ajuyah (Fiji)** - My point is that for sustainable utilisation of feed and non-feed resources, product output must be quantitative (higher yield per unit) and not numerical. Based on the classical concept of double conversion being more efficient in resource utilisation than triple conversion; i.e., soil nitrogen to plant nitrogen (double) versus soil nitrogen to plant nitrogen to animal protein (meat, egg and milk) [triple], the livestock industry in developing countries must encompass efficiency of production per unit.

Some overlapping activities in the model, which are duplicated within Enterprises for example, Government farms and Enterprise-3 (in supply of stock), also Enterprise-4 with Enterprise-5 (procure table eggs) may be considered.

**Thabani Maposa (Zimbabwe)** - The Philippines paper says that the farmers have noted how mortality reduces the viability of their enterprises and have taken on confinement as the solution. I have found or always thought that it was the solution to mortality reduction. But alas farmers kill chicks due to starvation and will more often give supplement that are far from nutritious for instance in Zimbabwe they would give mealie meal and besides this being too fine it is not nutritive.

**Tran Dinh Tu (Vietnam)** - The village chickens obtain feed mostly from their natural environment by scavenging. 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.

**Filomina dos Anjos (Mozambique)** - I am interested in raising earthworms. Please send for me the technology.

**Tran Dinh Tu (Vietnam)** - The simple technology used to raise earthworms in Vietnam is as follows:

- The earthworm species raised is Perionyx excavatus
- The best feed for earthworms is a mixture of bovine manure and decayed rice strain with ratio 1:1
- Earthworms may be raised in brick blocks, or wooden cases or woven bags with the sizes varying according to the production scale. At family level we often recommend the farmers to make simple small size wooden cases (50x50cm) or to use animal feed bags.
- Earthworms are fed every two days with the amount of mixture varying according to the quantity of earthworms raised and their hunger.
- The cases or bags are put under thatch houses and their surfaces are covered by carton or old cloths to be protected from sunlight and watered once a day to ensure the humidity of mixture to be 60 - 70%.
- The biomass of earthworm would double after four weeks raised according to such technology and can be harvested every week to feed chickens.

**Rene Benackaert (France)** - cautioned about raising earthworms based on the following facts;
- Certain earthworm species (Eistenia fetida and Dendrobaena sp.) contain an anti-nutritional component (anti-thiamine factor) which seems to be destroyed if the worms are sun dried.
- Worms represent intermediate hosts of several parasites
- Worms can accumulate important amounts of heavy metals

**Robyn Alders (Mozambique)** - The extension material on Newcastle Disease (ND) control also includes recommendations on improved housing and supplementary feeding with locally available feedstuffs, especially for chicks. There is still much work to be done in the field of supplementary feeding. The work will need to cover both technical and social issues as we need to ensure that the recommendations are formulated in such a way that farmers are likely to adopt them and that they are cost-effective. Introducing interventions in addition to ND control usually requires a little more effort and a little more time. (ND control is lovely to work with because all you need is one outbreak to clearly demonstrate the effectiveness of vaccination). When dealing with village chicken owners, who are also mixed farmers, we must also accept that not all of them will want to adopt every new intervention. Each new intervention requires more time and more investment and some farmers will prefer to put their efforts into other activities.

In my work on the village chicken production systems of Africa in the FAO Animal Health and Production Paper No. 42 of 1998, I emphasised on the importance of step by step poultry improvement in rural areas; an idea first brought up by Dr. W. Bessei. Four years later and after having an opportunity to look into the rural poultry sector of more African countries I would still say emphasis should first be on use of the local resources (breed + feed) and improve on management first if we want to reach the poor of the poor. Then let the rural community move into improved breeds on their own initiatives.

**M.G.S. Yongolo (TANZANIA)** - This has a reference to the communication of Thomas Kaudia and Aichi Kitalyi on village Poultry Production in Kenya.

My first observation refers to the table entitled “Productive characteristics of a good hen”, which is missing. The one referred to as Table 1 is about Income projection from village chickens under improved management.

I would like to know whether the data on the number of eggs and clutches were obtained: through interviews only or by physical counting? If by interview, how reliable was the memory of farmers? In most rural households, farmers do not keep records. What was the level of literacy of the selected farmers interviewed? This could reflect the reliability and accuracy of the data. If physical counting was made, could similar results be found?

Secondly, in Tanzania the average number of chickens per household depends on the time of the year when the data are recorded and whether the farmers consider chicks as chickens when responding to question like, “how many chickens do you have”? The flock structure also changes with time. What is your experience on that from your study?

Referring to Characteristics and parameters of family poultry production in Africa: Results of a FAO/IAEA Co-ordinated Research Programme, my third comment is on the
age stratification. It looked like you had only two groups (Adult and chicks), what about growers? What was the age limit for chicks? This information if available would help us to compare your results and what some of us are experiencing here in Tanzania and probably elsewhere.

I am delighted to see the high level of supplementation in your study area. Taking a quick calculation they are supplementing about 137.5 gms of carbohydrates and fishmeal per bird per week. This to me is very high compared to where you have no supplementation at all. What I do not understand is why with such a supplementation level the productive parameters on flock size and number of clutches are the same with what we are observing in our flock where no supplementation is practised! Does that mean that the scavengable feed resource base (SFRB) is very low or do the management practices deliberately restrict scavenging in the area? Or there are other environmental factors and diseases, which influence feed intake from SFRB and the supplements.

Marco Cisneros (Ecuador) - We can profit a lot by the experience from Asia and Africa. Each project has its reality, in each territory, Our Ecuadorian case is similar in the general aspects, but it’s different for the particular topics: such as feed, genetics, cultural approaches, economy, and others. Biosecurity and criteria from poultry industry are important to develop a family poultry project. In this way the industry agrees part of the financial support for this kind of project.

I have two questions:
1. I would like to know if the poultry industry is somewhere giving support to develop this kind of project? How are they working?
2. What about the poultry genetics banks? Are there regional Banks, or World banks?

Keith Hammond (FAO) - I am appreciating the many informative contributions to the Conference to date, and looking forward to reading future contributions.

Have been stimulated by today’s informative paper by the Moroccan team to make a special request of all participants: without moving away from the important theme of course.

We are in process of developing a decision support system for use in-country to assist in the planning and implementation of more sustainable genetic improvement activity WITH-IN the livestock development effort as a whole; with the system de-emphasising genetic theory and focus almost exclusively on application! The system will address all areas of programme development, the policy (local community to national), operational and technical elements of planning, getting started and further development, in the context of the development of the livestock as a whole (i.e. highlighting the need to also consider other elements of improved husbandry, feeds and feeding, disease management, marketing, etc; and at particular points in time some of these other elements being more important to address). The importance of involving local communities and structures and also of further developing capacity will certainly be included.

NOW: To best configure all areas of the decision support guidelines are useful, we need as many experiences (the good and the bad! such as mentioned by Drs Ben Abdeljalil and colleagues) as possible, and indeed also more detailed documentation for background. So we would greatly appreciate receiving from all participants both short and longer documentation covering (both the good and bad experiences of participants with planning,
getting started and further developing genetic improvement activity AS AN ELEMENT OF chicken + development. By way of definition, by ‘genetic improvement’, we mean breeding systems which cover ALL types of genetic manipulation of local and introduced livestock populations - straight-breeding, crossing and replacement.

INDIGENOUS BREEDS

Christophe Chrysostome (Benin) - What are your opinions on the use of local chickens in a smallholder development model?

Hans Askov Jensen (Denmark) - The use of local chickens is an essential element of the concept (comparative advantages) and I know that in Cambodia and in Indonesia there is a smallholder poultry program in the development phase and based only on local breeds. A local hen can in best case produce 30 saleable pullets and cockerels per year and often to a price between one and two US$ per chicken. However, the chickens have to be protected against predators, vaccinated against prevailing diseases and provided with supplementary feed especially during the first 6 weeks of life.

Asifo O Ajuyah (Fiji) - The sustainable utilisation of feed and non-feed resources, product output must be quantitative (higher yield per unit) and not numerical. For example hybrid chickens should grow better and produce more eggs using less feed compared to the unimproved. I will therefore presume that the driving force for using improved breeds (RIR, SCWL, F) in the model is for improved production, also in future local breeds with good performance traits might be used in the model to benefit from their indigenous traits. The future of livestock industry in developing countries must encompass efficiency of production per unit. For example there is no use to have improved breeds in model without benefiting from their genetic potentials.

HATCHING / BROODING AND PREDATORS

Thabani Maphosa (Zimbabwe) - What is synchronised hatching, tell us how this is achieved? It is a good thing that would reduce management huddles but could also create bottlenecks in terms of food provision.

There has be no response to the above question.

Thabani Maphosa (Zimbabwe) - The Philippines paper mentioned the use of basket system for brooding with the hen. My comment is if your brooder is properly designed there is no need to keep the bird with the chicks and literature says the parental link is not immediately established after hatching for a maximum of three days (Sharp et al. 1979). It may be wise to remove the bird during this period then.

Peder Lund (Denmark) - I do not think the idea is fully appropriate under village conditions. The hen is to play a dual purpose that cannot be replaced by human or simple technologies. First of all the mother hen has to teach the chicks the skills of scavenging. If they do not learn to scavenge the cost of rearing them becomes too high. Secondly the hen is still required to protect the chicks against predators. Though the chicks may have the ability to flee, the mother hen will often be prepared to battle with or distract the predator to save her chicks.

Krishna Kaphle (Nepal) - I would like to draw attention of participants concerning the fear of predators that may be attracted by the presence of free scavenging birds. The
predators ranging from mongoose, jackals, fox, jungle cats and others beside domestic cats do present a potent threat, especially to chicks in their free range. What are the currently employed techniques to minimise the loss and what is the success?

Frands Dolberg (Denmark) - There is often an age aspect in the bird's capacity to survive predators. This is one of the reasons why the young ones are confined the first 6 - 8 weeks in the Bangladesh model.

Predators are a serious problem especially for small chickens. However, in Sri Lanka they have developed a creep feeding system, also known as the ‘basket system’. This has proven to be very effective in decreasing the mortality rate. You can find a guideline on using the basket system on www.poultry-development.dk

Anders Permin (Denmark) - The beauty of the small holder model is the improved management including taking care of the chicks the first two months avoiding predators of taking the animals.

**LOAN FOR STARTING FAMILY POULTRY**

Please also see the Contribution from DANIDA/social-economic case study from Bangladesh

Hans Askov (Denmark) - In the concept is it compulsory to use the first loan to a poultry activity?

I have mentioned earlier, that the small flock of hens shall in the first year have a positive cash flow in order to repay the loan and all investment in stock and production facilities. Especially, in the first phase of adapting the Bangladeshi model to the prevailing conditions in another country.

Is it important to simplify all the components and to secure, as far as possible, a positive cash flow?

It is both more secure and simpler to use commercial feed in the first development phase. If a simple technology is available and gives the same security for a positive cash flow the first year of operation, then it should be applied from the very beginning. I know at University of Tropical Agriculture and others are involved in developing such technologies, but is not easy to incorporate them in the model from the very beginning. However, I see these technologies as an option for the second and following loans, but then the farmers have a free choice to select the income generating activities and our obligations are to make viable technologies available and attractive for the smallholders.

Edward Mallorie (Denmark) - There is some evidence from an earlier project that some women took up poultry production primarily to get credit, and did not continue to with poultry production for very long. It also seems that poultry may not appeal to all very poor people. They need a full time occupation away from the home to survive and may be unwilling to take the risk involved in taking credit for livestock investment (especially at the initial stage).
Outputs of family poultry production

**EGG PRODUCTION UNDER SEMI-SCAVENGING SYSTEM**

**Harm de Vries (Venezuela)** - Some comments and a few questions on the Semi-scavenging poultry flock model.

Although I have heard before of the programme I am so happy to hear again about this concept. It has never been my direct job description, but sideways I always have been working with improved birds in the scavenging system. I have been confronted with a lot of scepticism, so it is good to hear from the success of the project.

I am convinced the system of scavenging has comparative advantages. The model can be a base to work with at many other places. However, many times there might not be a need to copy the complete model. In several countries, the purchase of day old chicks from a commercial farm can be a good alternative. In Guyana pullets were available on the market, and in Bhutan pullets were made available by the government. My experience in Zambia was, that chick raising executed by government officers was more sustainable. Sometimes they do have more possibilities to cope with the organisational difficulties involved in purchase and marketing.

I expect that this could be the same in some other African countries. And instead of credit also systems of exchange with local poultry could be applied. But for sure, I think that the scavenging system with improved birds implies economic benefits for the poorest of the poor. The most persistent problem with the scavenging system is that the extension service in many countries advises farmers to build nice sheds an keep the chickens confined. If Bill Gates had to pay the salary of all these people, even he would get poor. The mission of this network should be that extension departments get aware of the comparative advantages of improved birds on free range, and that the advantages get lost as soon the birds are confined. Finally, I have a question:

- Are there data available of the egg production of improved layers on free range?

**Frands Dolberg (Denmark)** - To Harm de Vries question, whether there are data available of the egg production of improved layers on free range? Please have a look at http://www.cipav.org.co/lrrd/lrrd9/3/bang931.htm where you will find the results of a trial comparing 6 exotic lines under semi-scavenging conditions in Bangladesh.

**Abdul Jalil Ambar (Bangladesh)** - The findings of an applied research in Bangladesh on the performance of different breed combinations under semi-scavenging system (receiving about 30% of feeds from the homestead compound) the egg production of improved layers SONALI (a crossbred between RIR male with Fayoumi female) is 156 eggs in 12 months as against a hybrid layer Lohman Brown that produced 140 eggs only.

Rearing of improved birds on free range was practised in Bangladesh a few years ago. The objective of free range rearing was that the birds would collect feeds available in the...
homestead compound or backyard. But with the increased number of rural households, the opportunity of poultry birds to collect feeds from the surroundings have decreased and the birds were emaciated due to malnutrition and the egg production was poor.

In the circumstances free range system of rearing of improved birds was discontinued and semi-scavenging (model) system in being practised with the main objective of economic profit through minimising feed cost as compared to confinement. It is to be noted that semi-scavenging system of rearing involves the following conditions:

- Use of appropriate breed because of genetic x environment interaction.
- Involvement of poorest to the poor class people who have no facilities to rear the hybrid stock in confinement.
- Use of low cost accommodation and minimising feed cost with cafeteria system of feeding is advocated.
- Age of the birds should be more than 2 months onwards.

**Hans Askov Jensen (Denmark)** - When we are talking about the egg yield and improved breeds in the semi-scavenging system we have to reverse our mind. Normally, we measure the efficiency in productive parameters, especially the egg yield. However, in the semi-scavenging system the efficiency is measured in the cost of supplementary feed to produce an egg. It is relatively easy to obtain a high egg yield by providing supplementary feed ad libitum, but often it will not be viable. The efficiency has to be measured as the supplementary feed cost per egg produced, which implies traits related to both the egg yield and scavenging abilities.

A comprehensive trial has been carried out in Bangladesh and, as informed by Jalil Amber, the SONALI hens were superior to e.g. the Lohman hybrids. A similar trial conducted in Malawi, even smaller in size, revealed that the Hy-line breeds (Another hybrid) were superior to both Black Australorps and the local breed. Unfortunately, very little attention has been give to scavenging ability in describing different breeds, even that this may be the most important trait in scavenging and semi-scavenging systems.

**Ziauddin Ahmed (Bangladesh)** - The word semi-scavenging is used for small poultry flocks under partly controlled management conditions and where the scavenged feed accounts for a substantial part of feed consumed. Under this semi-scavenging system the poultry model production chain (PMPC) has been developed for the target beneficiaries, particularly women in rural areas for their higher income and self-sustained employment.

The poultry model concept was started with a joint effort of DLS and BRAC at field level from early part of 1983 with some support from world food programme (WFP). At the initial stage, intensive vaccination drive against Ranikhet disease and day old chick rearing was introduced through the women beneficiaries. With the growing demand, other support services were gradually introduced as Key rearer, Feed seller, Model rearer and Mini hatchery to transform into poultry model production chain.

**Tran Dinh Tu (Vietnam)** - Approximately 75% of poultry population is kept in small households with local breeds. The size of chicken herd is about 10-20 chicken per family that consumes mainly locally available feed. The local laying hens produce 70-80 eggs per year. More than 10 indigenous and native poultry breeds have been raised in different parts of Vietnam.
The most popular breed is the Ri, raised in the North and South provinces. They are dual-purpose breeds, slow growing but adapted to scavenging and hot climate. They have high resistance to diseases and parasites. The 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 - 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.

**Murray Maclean (Vietnam)** - In Cambodia the farmers commonly recognise two types of local chickens, the ‘jai’ and the ‘kok’. The breeds are well adapted to minimal input village scavenging conditions, where nutrition is poor, and parasitic and infectious diseases are common. Cambodian village chickens begin producing eggs at around 6-7 months of age. They begin by going through a laying period of 15-20 days, during which they lay about 11-13 eggs. Village chicken are free range scavengers that are fed supplements, which are primarily energy supplements of white rice or paddy which is usually cast over the ground in the yard of the house. Young chicks may be given a supplement of white rice equivalent to 250 grams/day/10 chicks and that an adult hen with her chicks may be given from 50-250 grams paddy/day. Some farmers give nothing to the chicken from November to April, considering that there is sufficient rice in the rice fields.

**MARKETING OF FAMILY POULTRY PRODUCTS**

**Asifo O. Ajuyah (Fiji)** - An attraction yet to be exploited by rural farmers is the production of organic poultry meat and eggs which has niche markets in the cities and export potentials to developed countries who will pay premium prices.

In Cambodia, traditional village-level chicken raising is carried out by nearly all-farming families. The emphasis is on meat production for sale and home consumption but eggs are sometimes collected and sold instead being hatched. Very few traditional raising units at village level have been elevated to semi-intensive level.

Based on the paper from Vietnam, apart from providing animal protein, the village chicken seems to have other novel uses i.e., spiritual (yellow feathers), sports (cock fighting) and medicinal (production of tonics). My questions are two fold:

1. for each type are there same or different breeders and relative importance in terms of commerce.
2. major traits or characteristics of the Ac or “tonic breed“ and is the efficacy or benefits historical?

**Tran Dinh Tu (Vietnam)** - To your questions I try to answer as follows:

- Each type of chicken was often produced by the same breeders. Vietnamese farmers were relatively conservative. They wanted to keep their traditions and habits and often lived in isolated community. So in their region there was their own type of chickens. But recently the situation has been changed due to the impact of the market economy. The different breeders can produce the same type of chickens if this type can be sold easily at higher prices.

- Ac chicken is a specific breed raised not only in Vietnam but also in Southern provinces of China. They have white feathers, but black skin and bones and dark meat. They grow slowly, and 6 month old one may be weighted only 300 - 400 gm. Vietnamese
people often cook Ac chicken with lotus seeds and some herbs to feed sick or old people as a tonic. Its efficacy is only based on the long time traditional experience and has not been evaluated scientifically.

- There is a less feathered type of chickens in Vietnam (but not featherless as developed in Israel). They grow faster than full feather type, but in general most of Vietnamese people prefer nice yellow-feathered chickens.

**Manuel D Sanchez (FAO)** - Recognising the invaluable contribution of the poultry model in Bangladesh and its potential applications, with necessary adaptations, to other countries, I would like to recall that there is a great opportunity, yet untapped, in many developing countries to produce local, or “criollo type”, eggs and chicken meat.

If I understand correctly, the Bangladesh model is an “industrial type” model structured to involve many stakeholders, including above all small producers, in various steps in the production chain. At the end, the final product can not be physically different from the one coming from industrial production unless it is accompanied by a certification label.

The unique opportunity is to access the unsatisfied growing market of livestock products by offering a different product, the traditional product, still very appreciated (e.g. consumers willing to pay substantially more for it) in a lot of societies due to flavour, appearance, cultural value, etc. but in most places rather absent in modern market outlets.

I was in Kuala Lumpur, Malaysia, a couple of weeks ago, and I was very pleased to see in one of the largest supermarkets the “ayam kampung” or traditional chicken, nicely packed side by side with the industrial chicken. It looked somehow smaller but much more appealing, with a price about 50% higher than the commercial modern type. I have been trying to get information, yet unsuccessful, on how this traditional product has made through the modern market structure. If any of the conference participants knows something or have any contacts, I would like to hear about it. If we go for this approach, then small producers will not be competing with industrial producers but rather diversifying the offer, with a superior quality product as perceived by many consumers.

In the conference we are discussing the possible application of the Bangladesh model to other situations, however the real issue is, how can we make small producers participants of the local, regional and global market with poultry (and other animal) products. Certainly the proposed model is one option, but only one, there are many other alternatives even with other types or species of poultry (criollo chickens, Muscovy ducks, common ducks, guinea fowl, turkeys, etc.). For me one of the key issues is how to organised market chain, all the way from the producer to the market outlets or large consumers (e.g. restaurants) and for this, the Bangladesh experience and others are very valuable.

**Edward Mallorie (Denmark)** - Manuel Sanchez of FAO has suggested that producing a traditional product that can be sold at premium prices can help small producers compete with industrial-type commercial production.

In Bangladesh the classic poultry model is based on improved breeds (such as the Sonali). The eggs produced are, as far as I know, considered to be the same as those produced in commercial battery farms and fetch no price premium. However there is a premium for eggs from local (desi) breeds of chicken. Unlike in Britain, there is no premium for the method of production - free range / backyard rather than battery cage. I wonder how the economics of producing fewer, but higher value, eggs from desi hens compares with the improved backyard system.
The Bangladesh Model and other experiences in Family Poultry Development

The growing poultry commercial sector in Bangladesh is putting downward pressure on poultry meat and egg prices. In some areas, especially near markets, back-yard poultry producers are interested in moving up to small commercial units. Although they realise that, compared to the semi-scavenging system, the feed cost per hen is higher, more hens mean more profit per day. However it is more than likely that, over time, the commercial poultry sector will concentrate into the hands of a few very large integrated operations. CP of Thailand, the world’s fifth largest poultry producer, has recently arrived in Bangladesh. This may ultimately squeeze out the smaller commercial producers. Although the backyard semi-scavenging system is less sensitive to adverse movement in the feed-output price ratio, lower egg and meat prices will mean that backyard production is less effective in generating an income for poor people.

Given this scenario, the future for such small-scale producers may well be in producing traditional products to be sold at premium prices. These producers will need links with premium market sectors and production systems to efficiently produce the right products for this market.

Elwin Turnbull (Australia) - The market in Nepal gives a premium price for village poultry as you have described in Malaysia. It is especially noticeable at festival times and when families have special events such as weddings. There is no government intervention to give this premium. I agree with Manuel Sanchez of FAO and Edward Mallorie that a very useful direction for government and NGO involvement is to provide facilitation for improving marketing and efficient production in the villages. An advantage of working in the villages to find improved market channels and efficiencies is that the small funds that people have for purchasing meat remains in the local area to boost the local economies. That is, it is not attracted out to purchase inputs and pay for company profits off shore. This is very important in cases where some wealth is being generated (either from agriculture or from another sector) because the wealthier one becomes the more meat that is taken into the diet so strengthening the local economy.

This principal of involving local stakeholders to design better ways at the village and district level is being applied in the Third Livestock Development Project by the Department of Livestock Services in Nepal. One of the challenges of the approach is that we as scientists have to develop new skills in working with stakeholders and we have to learn new ways of recognising and integrating the capacities of the community members in villages and districts. This is not an easy journey when we are often more comfortable seeking out and designing technically optimum production system but the Nepal experience is showing that the benefits are there.

Krishna Kaphle (Nepal) - In line with Edward Mallorie, yes the free trade and globalization will have its impact on the small producers, it is just a matter of time. The other question to be asked is what shall be the extent of modification that this model can be stretched to keep its unique identity and at the same time fit to the changing demand of time. I feel a need to create niche market for these traditional products and a marketing channel would be the solution. Psychological advantage of traditional products and the low external input involved are a boon in disguise while at the same time vulnerability to domination by commercialised sector is a challenge. Unless ways are found out to safeguard these traditional products make them competitive or protect their opportunities, wide scale
replication of the model and its continuity remains a big question.

Khieu Borin - The premium prices for the traditional product or from local production systems with local breeds exist in Cambodia, Laos and Vietnam and it may also happen in somewhere else. The price of local chicken (live weight) is 6000-6500 riels per kg (US$ 1.5-1.65) and 3500 riels per 10 eggs (US$ 0.88) as compare with 3500-4000 riels per kg (US$ 0.89-1.0) and 2500-2800 riels per 10 eggs (US$ 0.63-0.70) of the industrial chickens. The market for the commercial chickens is mainly in restaurants and hotels where foreigners and tourists are staying. However, the products from local chickens are preferred by most of the local population. We must look into ways/strategies to improve the production of the local chickens that will bring better revenue for the rural population.

Nitya Ghotge (India) - I wish to raise the marketing issue. While ideally it may be wonderful that traditionally /“organically “ raised products get a premium price in the market, the concern always remains, are the people who raise these birds organised enough to market their products profitably. Secondly will aggressive vertical marketing compromise nutritional security at the poor household level where it is most needed. In India the dairy model has often been criticised for depriving the families of producers milk as all the produce enters the market. Should we not therefore also be considering the strengthening of local markets whereby there is movement and exchange of goods horizontally /laterally as well as vertically.

Thabani Maposha (Zimbabwe) - In Zimbabwe because eggs from village chickens are small they would fetch either an equal or lesser price compared to exotics. They are slightly expensive when sold by vendors at growth points as boiled eggs. The most expensive poultry egg is that of Guinea fowl mainly because its sold and bought for breeding purposes.

Harm de Vries (Venezuela) - Do the eggs from the scavenging system fetch a higher price than the eggs from the commercial farms?

Frands Dolberg (Denmark) - To Harm de Vries above question, I dare not say whether eggs from the scavenging system fetch a higher price than the eggs from the commercial farms, when the eggs are from exotic birds, but when the eggs are from local breeds they do - according to my own observations from several countries. The price difference we found recently in Cambodia was about 50% per egg. It would be interesting to know of more examples.

MANAGEMENT OF POULTRY WASTE (BIODIGESTOR)

Frands Dolberg (Denmark) - The core of the model is households with 5 - 10 hens, and that is too few to think of any anaerobic digestion. The appeal of the model is its capacity to reach the very poor, who may have no other animals. I am just back from Cambodia, where I have seen the same. The effect of the model may be better measured by its contribution to increased food security, i.e. by families eating 2 or 3 times a day rather than 1 or 2 times and the greater diversity of the diet. Not necessarily by the households eating more eggs and poultry meat, but through their sale of these products and purchase of other items. Thus one household in Cambodia reported that 1kg live bird could buy them 8 kg rice and they also told me that it was better to sell poultry and buy fish as fish was cheaper. This is important for household, who reported only 3 - 4 months of self-sufficiency in grain. We need much bigger units to make anaerobic digestion a matter of concern, but with bigger units, we would not reach the many poor households.
I do know the biodigesters that Horst refers to as I have followed their evolution and in one case been involved as one of the supervisors of a M.Sc that broke important new ground in Vietnam. You can find a paper on this at http://www.cipav.org.co/lrrd/lrrd9/2/ an92.htm. I was happy when in March this year in Vietnam, I was told that more than 20 000 of these digesters have now been sold in that country. I understand that a Vietnamese student is presently working on incorporating duckweed grown on the slurry from these digesters in the diets of semi-scavenging chicken. This work is led by Dr. T.R. Preston http://www.utafoundation.org/

If the work succeeds this is an opportunity to integrate resource-use as Horst mentions. Late 1970-80s I worked much on crop residues for ruminants, mainly cattle. Anyone, who wants to know, can search on my name (Frands Dolberg); www.google.com is one place to do that from.

However, my enthusiasm has always gone down when I - after some time in each case - have found out that there were still a fair number of people left out. In short, our technologies did not reach the poorer sections of the village. This is the problem with the biodigester Horst, so I do not want to insist that people have to use it. It does not make sense for a poor landless woman and her family. For some it may do subsequently, if they begin to invest in larger animals etc. Other families will have other preferences and go other ways. Most (this is at least what I have seen in many cases) will, if they begin to earn something, start to feed their children better and send the children to school (and this is much more likely to happen if the money is in the hands of the mother, which is another advantage of a poultry program). IFPRI studies above indicate this would mean a move in the right direction.

Lylian Rodríguez (UTA Foundation www.utafoundation.org) - Regarding the biodigester in the system, I think it would be an alternative for small-scale farmers and even for landless people. As Frands mentioned it definitely would not be the first step in the ladder to get out of poverty. A small plastic digester of 2 m long is linked to the toilet as a source of effluent for duckweed or any other plant that can be used for as a supplement for the chickens. 2 m biodigester with plastic of 0.94 diameter has a capacity of 1.4 m3 and it does not use so much land and will bring benefits from the point of view of sanitation and welfare through the use of toilets (I am not sure in Bangladesh but in Vietnam and Cambodia toilets are not very common).

Chicken manure can be used if it is coming from poultry housed in a high pen where there is not use of any thing as a bed (rice husk or residues from wood cleaning) so may be in some cases it would not be feasible to use the manure in the biodigester, but manure and other residues from the poultry can be used to produce larva to feed the chickens even on a very small scale, so integration can be promoted and practise even on a very small scale. Poultry cannot be seen as the unique tool for alleviation of poverty.

Asifo O. Ajuyah (Fiji) - I will presume that it is important for us to look at waste streams from the various enterprises viz. a viz. appropriate procedures to design practical waste management systems. Consequent to the table below (waste output for different species), average flock size of less than 100 birds (high side) and management system (semi-scavenging) in Bangladesh, I don’t see how waste could be managed via a biodigester within the following Enterprises 3, 4 and 5. Even within the Government Poultry Farm
where parent breeders are raised on deep litter. The characteristic of the waste stream which is usually available at the end of the breeding cycle (72 weeks may be) is not a sustainable feed stock for a biodigester which requires daily input of biological waste.

This and other considerations (C:N ratio, total solids, antibiotics in faecal droppings, etc) might explain why the concept of biodigester as a strategy for waste management is most successful with pigs and other ruminants and not poultry. I am not saying that it is not feasible, for example in Australia where broiler farmers generate large volume of waste a subsidiary and not integrated central waste management plant could be designed (appropriate configuration) to receive feedstock from all poultry farms. However, in Fiji, Philippines and Bangladesh such a system even a scale down version as proposed by a participant would not be practical for small-scale village chicken producers, whose only option may be composting. As a waste management strategy, composting is good for the environment because it precludes the use of inorganic fertilizer the production and use of which is more harmful to humans, the environment - water and air than few scavenging chickens in rural areas.

In fact in rural areas the people, natural vegetation, clean air and scavenging livestock make a better and healthier community than in cities with locked in people and livestock in brick houses, polluted air with no natural vegetation. All that the rural community require is a global outreach program that can reverse the follow of goods and services from urban to rural areas from developed to developing countries, then and only then will there be global economic, social and environmental sustainability.

**TABLE 1. LIVESTOCK DAILY WASTE.**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Dairy</th>
<th>Beef</th>
<th>Pig</th>
<th>Poultry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Live wt. (kg)</td>
<td>630</td>
<td>360</td>
<td>60</td>
<td>1.8</td>
</tr>
<tr>
<td>Fresh manure (l/day)</td>
<td>47.3</td>
<td>23.1</td>
<td>5.1</td>
<td>0.12</td>
</tr>
</tbody>
</table>

**Frands Dolberg (Denmark)** - It is interesting to hear about your experiences from Fiji and it is perhaps in situations like yours in Fiji that the biodigester Horst W Doelle (Austria) advocates is in place.

**Thabani Maposha (Zimbabwe)** - I fully agree with others that it is not worth to put up a biodigester for most of the reasons that have been put forward. My only emotional contribution to this is that remember these chickens spend most of their time scavenging and their droppings (not so many) are all over their SFRB. My question is who collects these for a biodigester? The woman, who is overloaded with house chores that go up to bedtime! To me it is not economical and after all most of the bugs if there are at all die because of exposure to the sun.

**Jonathan Bell (Bangladesh) Moderator, Asian Hall**

Asifo's last remarks have highlighted a very important asset of the semi-scavenging poultry model: its contribution to the stabilising of the village economy, and thus the slowing of migration to mega cities. Its beauty lies in not only that it can allow poor people, by making use of the scavenging feed resource base, to produce an egg at lower cost than the industrialised system does using only manufactured feed, but also in that it allows them to live in the balanced and human environment of the village, instead of the degrading
environment on the margins of cities. In other words, this sort of poverty alleviation model provides not only economic, but also social advantages.

I congratulate the pioneers of the Bangladesh model and I would say among the conditions, which made the work a success is the commitment of the scientists who worked with it. What I am not very sure of is the policy support associated with the model. I see very good prospects for adapting some of its components in the other parts of developing world. More so now has given the effects of liberalisation and globalisation on rural life. I am referring to the growing trend of forming common interest groups in rural areas to address issues best handled collectively such as marketing. In a social setting found in Western Kenya, where we have undertaken a brief study on family chickens I imagine youth groups can easily take up enterprise 1, 2, and 6, whereas women would do best in Enterprise 3 and 4 and men do enterprise 5 (The contribution of Dr. Dr. Ziauddin of May 21, 1:48pm). However, it all has to be a process; the Bangladesh poultry model concept started in 1983.
Lessons from the Bangladesh and other poultry development models

Funso Sonaiya

By now, at the close of the e-conference, the importance of poultry as a tool in poverty alleviation must be getting clearer to us.

Did we identify the essentials of the Bangladesh Poultry Model? That is:

- The minimum interrelated set of component activities and procedures necessary for its successful implementation?
- Comparison, evaluation and analysis of the 3 levels and the components of these levels as presented by various contributors especially Jensen and Dolberg?

Did we note the progress in the development and complexity of the model (e.g. the number and nomenclature of the components - model rearer, key rearer, etc.)?

Could we find the functional equivalents for these essentials in the different cultural, economic and policy contexts of the countries where we work and or live?

What similarities and differences did we find in the other models presented from:
- Asia - Vietnam, Nepal, Philippines, Fiji, etc.;
- Africa - Benin, Burkina Faso, Mozambique, Kenya, Morocco, etc.
- Latin America - Cuba, Ecuador, Nicaragua, etc?

Can we start developing a viable process of implementation in our country of concern?

This may involve the following steps:

1. Assessment of the socio-economic indices related to poverty, (e.g. UNDP’s Human Development Index) as well as the causes of poverty.
2. Location and Density of poverty (population), i.e. proportion of poor in the villages (rural), slums (peri-urban), inner cities (urban) ; relate poverty density to the administrative costs of services and supply;
3. Project Target(s): Identifying the very poor and moderately poor rural women (and the educated jobless youth, for different components?) by using, for example, agricultural land holdings, CASHPOR’s Housing Index, Participatory Wealth Ranking, etc.
4. Group Formation or Alternative Social Collateral Group size and dynamics; optimum group numbers/village Group/Participant interest exclusive or inclusive (SHP only or not) Alternative Social Collateral - matching loan to participant’s savings
5. Model Component Mix Model enterprises to be implemented, based on availability of inputs and technical services, cultural, social and economic parameters
6. Viable Credit Strategy First loan size (USD 50-100?) versus input prices (DOC, feed ingredients, pullets, vaccines and medicines, parent stock, etc.); Loan form (cash or
kind). Interest and pay back period versus production cycle for components, compared with the commercial bank interest rates and specifications.

What about the essential or enabling conditions and contextual factors related to the implementation?

1. Human and Institutional Capacity:
   - Availability of suitable GO, NGO and/or Partner Organisations
   - Availability of technically qualified human resource in GO and NGO

2. Political (policy) imperatives
   - Poverty alleviation priority
   - Freedom of entry and exit into self employment in the different enterprise components of the model especially marketing, vaccination, feed milling, breeding, etc.

3. Efficient system of marketing poultry products
   - Price, demand and supply

With these few questions, we can ensure that the end of our e-conference will be the beginning of our closer engagement with the potentials and problems of family poultry development.

These issues will be further dealt with during the workshop in Bangladesh. Plan to attend by starting early to look for funds, getting a “country team” together and attempting answers to the questions above. We look forward to your answers during the workshop.

Thank you very much for your patience throughout this long e-conference.