Sustainable intensification of smallholder livestock production: fact and fiction

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Context

- Livestock Revolution: 2050, 9 billion people who want to consume more eggs, meat and dairy
- FAO: Population growth 77% increase in meat and 86% in milk; income increase main contributor in only few countries
  (Pica-Ciamarra and Otte, 2009)
- Intensification of livestock production needed: low producing livestock in areas were increasing demand is expressed
- ‘Improvements in feeding can increase milk production 4 times’
- Intensive systems the least environmental damage per unit product
  (Livestock’s Long Shadow, 2006; CG policy paper, 2013)

Opinions based on facts?
Context

- Smallholder crop-livestock households: 20% of the world population producing meat 65%, milk 75% in the developing world.
- Crop-livestock farms the dominant farming system, this will not change for another 20 years.
- 900 million hungry people, 1 billion overweight people.
- 1.2 billion poor people (less than 1.25 $/d), 75% in rural areas.
- Intensification of smallholder livestock offers a unique opportunity for improving livelihoods.

Opinions based on facts?

Intensification

- Increased use of inputs and services to increase output quantity or value.
- Why?
  - Improving income of rural households.
  - Meeting the increasing demands.
  - Environmental sustainability.
- Living up to these expectations?
Intensification

Change in management, feeding system, other breeds, increase in numbers
Contributions to livelihoods

Quantification approach in $ 
Bosman, Moll, Udo, 1997

- products
- manure
- draught
- insurance
- finance
- status

Contributions to livelihoods

- Quantifying different benefits in different systems
- Understanding decision making farming households
  - allocation of resources
  - decisions not at optimum biological moment
- Smallholders more productive than often assumed
Contributions to livelihoods

Livestock ladder

Village poultry

- Three quarters of rural households keep them.

Drivers:

- 'the first and last resource of the poor'
  (Aklilu, 2007)

- promoted to improve livelihoods poor women
Village poultry  Contributions to livelihoods

- People prefer local chickens and eggs
  - better taste
  - better prices
- Production low, economic results low
- Productivity very high
- Environmental impact?
- Poverty alleviation?
- Safety net: sold when small cash is needed

Village poultry  Intensification does it work?

- Simulations of innovations
  - technical results improved remarkably, except for crossbreeding
  - often innovations negative economic impact: Ethiopia, Kenya, Mozambique, Tanzania

Diagram: Bar chart showing benefits, costs, and returns over time.
Village poultry

- Only small step, low cost improvements will work
  - NCD vaccination, predation, ...
- Local marketing networks needed
- Not able to supply growing urban markets

Commercial poultry

- Large- or small-scale?
- Needs cash inputs, feed, labour
- Market-oriented
  - competition with other farmers
  - competition with imports
  - markets easily collapse due to economic crises or imports (Brasil, Dutch inferior cuts)
- Easy to learn, local expertise available
Small ruminants

- Numbers increase, least developed countries
- Literature: small ruminants can help the poor
- Sheep and goat farmers among poorer groups in society
- Tool in poverty alleviation or sign of poverty?

Small ruminants

**Indonesia**

- 4-6 animals; 4 h d⁻¹
- More animals will not match farmer’s resources
- Intensification cropping: grazing lands disappear
- Labour productivity below minimum wage
- Farmers do not consider the family labour as real costs
- A very much appreciated secondary activity
- Safety net (urgent cash needs), Manure
- Religious festivities: sheep (males of 25 kg or more)
- Local market plus market in major cities through traders
- Poverty alleviation?
Smallholder dairy Kenya

Drivers: demands, reduced land sizes, agro-ecology

Intensification: Free-grazing Zero-grazing

Change in breeds

650 000 (maybe 2 \times 10^6) households in dairying, 80% of milk production

Labour productivity higher than for crops and wage labour

Also dairy cattle have various livelihoods functions

Feed the main constraint: quality!

Milk yield about 5 kg per lactation day

Households with dairy cattle relatively well-off
Smallholder dairy Contributions to livelihoods

- Dairying gives substantial income improvement: Bhutan, India, Tanzania, Philippines, Kenya
- Not for the really poor
- Milk production 5-6 kg lactation day$^{-1}$ plus milk for calf
- Market the major pull factor
  - informal market the largest share (Staal, ILRI)
  - higher prices for farmers, lower prices for consumers
  - Kenya: 12-18 fte employment for every 1000 kg handled
- Smallholders competitive: family labour, less investments (diseconomies of scale)

Contributions to livelihoods

- Contributions hh$^{-1}$
  - + + ++ +++ ++++
- Paying back animals/loans
  - +++
- Helping the poor
  - +++
Meeting demands

- Can smallholders meet the increasing demands?
- Supply and demand
- Asia: 80% increase in demands from commercial pigs and poultry
- Livestock revolution is bypassing the poor?
- Collapse commercial poultry sector (small and large-scale) in W. Africa due to imports from Brazil and Europe (inferior cuts)

Meeting demands

<table>
<thead>
<tr>
<th>Smallholder livestock</th>
<th>Rural markets</th>
<th>Urban markets</th>
<th>Large-scale livestock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Village poultry</td>
<td>✓✓</td>
<td>✓✓✓</td>
<td>Commercial poultry</td>
</tr>
<tr>
<td>Small comm. poultry</td>
<td>✓</td>
<td>✓</td>
<td>Commercial pigs</td>
</tr>
<tr>
<td>Small ruminants</td>
<td>✓</td>
<td>✓</td>
<td>Grazing systems</td>
</tr>
<tr>
<td>Pigs</td>
<td>✓</td>
<td>✓✓</td>
<td>Dairy cattle</td>
</tr>
<tr>
<td>Local cattle</td>
<td>✓</td>
<td>✓✓</td>
<td></td>
</tr>
<tr>
<td>Dairy cattle</td>
<td>✓</td>
<td>✓✓✓</td>
<td></td>
</tr>
</tbody>
</table>

✓: small contribution; ✓✓: large contribution

- Cooperation or competition?
Impact on environment

- **Hypothesis:** intensive systems the least environmental damage per unit product  
  (Livestock Long Shadow, 2006; Gerber, Vellinga, Opio, Steinfeld, 2011; CG Policy paper, 2013)

- **Two case-studies:**
  - Integrated Agriculture-Aquaculture (IAA) systems Vietnam
  - Dairying Kenya

Impact on environment  IAA systems Vietnam

Impact farm components on environmental categories (LCA)  
(Phong, 2010)

- Impact pigs (hybrids) due to off-farm feed production
Impact on environment  IAA systems Vietnam

- Integrated Agriculture-Aquaculture systems:
  - pigs or poultry: impacts per kg similar
  - impacts 1.6 (global warming) to 1.8 (land use) higher per kg pig and poultry protein than per kg fish protein

  (Phong, de Boer, Udo, 2011)

- Environmental comparison specialised (430 t ha\(^{-1}\)) and integrated striped catfish production (3.5 t ha\(^{-1}\)):
  - specialised systems higher impact per t for 7 out of 9 environmental impact categories
  - feed production contributed most
  - environmental performance better in integrated systems

  (Kluts, Potting, Bosma, Phong, Udo, 2012)

Impact on environment  Global studies

- FAO: Greenhouse gases and milk yields

Greenhouse gas emission and milk output per cow for different countries

(Gerber, Vellinga, Opio, Steinfeld, 2011)
## Impact on environment

### Dairying Kenya

<table>
<thead>
<tr>
<th>Farm size (ha)</th>
<th>Free-grazing</th>
<th>Zero-Grazing</th>
<th>Large</th>
<th>Very Large</th>
<th>Sub-Saharan Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td>cows (n)</td>
<td>2.6</td>
<td>3.2</td>
<td>14</td>
<td>107</td>
<td></td>
</tr>
<tr>
<td>milk (kg.d⁻¹)</td>
<td>4.5</td>
<td>5.3</td>
<td>9</td>
<td>9</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Impact on environment

- Mitigation options
  - Manure management: Yes, but effect will not be big
  - Shift from ruminants to poultry: Asia: increase in production 80% due to commercial pigs and poultry; Grains, cropland? Other functions ruminants?
  - Better diets for ruminants:
    - improved pasture management
    - legumes
    - improved fodder technologies
    - supplements, concentrates: Possible?
Better diets

- Global studies, impact better diets: ‘productivity increase will satisfy increasing demands and offers a mitigation option’
  
  (Gerber, Vellinga, Opio, Steinfeld, 2011)

- FAO e-conference 2010: why improved feed technologies not adopted?
  - weakness of transfer/extension services
  - top-down research approaches
  - research has failed to demonstrate the economics

- Technologies too expensive, not meeting labour and land resources

- Global studies overestimate opportunities, underestimate constraints

Impact on environment

- Feed assessments needed
  - also future smallholder production will be based on resources

- Small step feed improvements
  - Gujarat: modelling and field studies indicate 20% increase in milk production possible by optimal use local feeds
    (Patil, 2006)

- Feeding has to be done every day in contrast to other innovations
### Impact on environment

- Be careful in generalizing global data
- Impacts and trade-offs should be assessed at local level
- Trade-offs: impacts per unit product vs impact per unit area; biodiversity; water footprint
- Allocation method will influence mitigation options recommendations
- Livelihoods lens needed

### What will happen?

- Dorward (2009), strategies:
  - stepping up
  - hanging in
  - stepping out

- Stepping out: labour scarcity outside agriculture needed
Sustainable intensification

Drivers: increasing demands, policies, climate change
    reducing land sizes, intensification cropping, competition

- labour, capital, land, feeds, health;
- family situation

- credit services
- institutions
- farmers' groups
- knowledge
- research support
- policy support

Smallholder crop-livestock systems

Developments outside agriculture

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