1st ASEA PhD Days

Virtual meeting

1st - 2nd December, 2021 | 14:00-17:00 GMT+7
Agroecological performance and sustainability of crop-livestock systems in Northern Vietnam

PhD proposal by: Khanh Thuy Dinh

Supervisor: Prof. Dr. Mizeck Chagunda
Co-supervisors: Assoc. Prof. Dr. Le Thi Thanh Huyen
Dr. Juliet Kariuki
Dr. Christoph Reiber
• Contribution to the SC22:
Methodological framework for assessing performances and impacts of innovations and transitions (SC2.2) of ASSET project “Agroecology and Safe Food Systems Transitions in Southeast ASIA”.
Outline

1. Introduction
2. Objectives and research questions
3. Materials and methodologies
4. Expected outputs
5. Tentative schedule
Problem statement

- Monocropping of maize, rice, cassava is predominant on sloping lands
- Small-scale livestock production depends on crops products and natural grasslands
- Increased deforestation, intensive mono-maize production

=> increased synthetic fertilizer, soil erosion, degradation, loss of biodiversity=> soil fertility=> decreasing profit of monocrops

- Decreased natural grasslands and fodder, undeveloped policy for communal grassland => reduced cattle feed

- Livestock growth put burden on land use, environment footprint, pollution, food insecurity

➔ Unsustainable production systems
Research statement

• Agroecology is an alternative, using ecological services in design and management

• Mixed crop-livestock systems:
  ▲ Productivity of crop and livestock
  ▼ Diversity of feed resources, soil fertility
  ▼ Reliance on synthetic fertilizer

• Agroecological practices in crop production:
  ▲ Soil fertility, ▼ soil erosion
  ▼ Reliance on synthetic pesticides, fertilisers

Design: Diversification and integration => agroecology

Management practices
Literature reviews and knowledge gaps

- Interventions based on agroecology and CSA in Northwest
  (e.g. Mulching cover crops, intercropping, minimum tillage, agroforestry)
- Provided evidences on positive effects by adopting these practices on reduction of soil erosion and improvement of economic benefits
- Structure of cropping systems have changed due to some provincial policies

**BUT**

Understanding on the agroecological performance and sustainability of current crop-livestock-tree systems as an impact of interventions is unknown

- Previous studies on livestock systems:
  Management practices, inputs and outputs of animal systems
  Management, resource use, economic success of different pig farming systems; Sustainability of different pig farms
- Previous researches on cropping systems:
  Dominant cropping systems and agroforestry at different elevations and evaluated the economic performance

**BUT** : Underevaluation of diversified farming systems

- Self-sufficiency of resources from complementary of sub-systems
- Potential of exchanging resources between different farming systems
- Few studies assessed influencing factors and constraints of adopting agroecological practices
- Understanding on agroecological practices in livestock production is missing
Objectives and research questions

Objectives

- Evaluate methodological framework (tools) for assessing performances and impacts of agroecological transitions;
- Characterize the current crop-livestock-tree systems regarding resource endowment and resource management
- Identify influencing factors and constraints of adopting agro-ecological practices;
- Evaluate the performance of agroecological practices and their impact on household livelihoods
- Assess the sustainability of different smallholder crop-livestock-tree systems
Research questions

- What is the suitability of existing methodologies in evaluating the performance and impacts of agroecological transitions?
- What are current agroecological crop-livestock-tree systems in the area?
- How internal and external resources are managed in these systems?
- What types of agroecological practices are adopted in crop and livestock production? What are influencing factors and constraints of farmers to adopt these practices?
- How are the current systems performing in terms of agroecological performance, and impact of crop-livestock diversification on sustainable livelihoods?
- What combinations of crop, livestock, tree systems improve biodiversity and economic benefits?
Materials and methodologies

Study sites

- Provinces: Son La and Dien Bien provinces
- Districts: one district/province (Tuan Giao and Mai Son districts)
- Communes: 4 communes/district (2 in highlands and 2 in lowlands), with innovations in agroecology
- Households: smallholder farmers keeping livestock (ruminants, pigs, poultry), crops, trees; less than 2 ha of land.
# Materials and Methodologies

**Objective 1: Evaluate methodological framework (tools) for assessing performances and impacts of agroecological transitions**

<table>
<thead>
<tr>
<th>Materials</th>
<th>Methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tool for Agroecology Performance Evaluation (TAPE) developed by FAO</td>
<td><strong>Information &amp; methods</strong>&lt;br&gt;Literature reviews on studies on sustainability assessment of innovative farming systems</td>
</tr>
<tr>
<td>Sustainabilitiy assessment of Food and Agricultural systems (SAFA) developed by FiBLE</td>
<td><strong>Source</strong>&lt;br&gt;Google scholar Science Hub Scopus Research gate</td>
</tr>
<tr>
<td>IDEA methodology (Farm Sustainability Indicators)</td>
<td><strong>Criteria Evaluation</strong>&lt;br&gt;Strength in assessing the current performance of innovations and Progress towards sustainable agriculture</td>
</tr>
<tr>
<td>Monitoring tool for integrated farm sustainability (MOTIFs)- developed by Marijke Meul et al. (2008)</td>
<td><strong>Methods</strong>&lt;br&gt;Reviews on methods, methodology comparison</td>
</tr>
<tr>
<td></td>
<td>Feasibility, utility, scientific soundness Reviews on methods, methodology comparison</td>
</tr>
</tbody>
</table>
### Objective 2: Characterize the current crop-livestock-tree systems regarding resource endowment and resource management

<table>
<thead>
<tr>
<th>Data collection</th>
<th>Methodology</th>
<th>Data analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Information/data</strong></td>
<td><strong>Focus group discussion with farmers</strong></td>
<td><strong>Map of land uses, dominant systems will be generated</strong></td>
</tr>
<tr>
<td><strong>Dominant crop, livestock, tree systems, main land use</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Resource endowment</strong></td>
<td></td>
<td><strong>2 steps of characterisation:</strong></td>
</tr>
<tr>
<td>Natural, physical, human, social, financial capital</td>
<td></td>
<td>- Categorisation:</td>
</tr>
<tr>
<td><strong>Resource management</strong></td>
<td></td>
<td>Farm typology via cluster analysis</td>
</tr>
<tr>
<td><strong>Internal resources:</strong></td>
<td></td>
<td>Criteria: diversity index of livestock, trees, crops (Magarlef index), indicators of resource availability above</td>
</tr>
<tr>
<td>Land use, livestock feeding (feed types, seasonality), recycle of crops products, by-products of crops, trees on farm; Waste treatment: Recycle of crop residues; livestock manure; Labor and capital use: Time for caring livestock and cropping and tree growing; cash cycle within farm</td>
<td></td>
<td>- Characterising systems:</td>
</tr>
<tr>
<td><strong>External resource:</strong></td>
<td></td>
<td>Characterizing farming systems: descriptive and comparative statistics analysis via mean and frequency</td>
</tr>
<tr>
<td>Feed purchase from market and from exchange; Purchase of agrichemicals (synthetic fertilisers, pesticides, herbicides); Capital loans, hired labor</td>
<td></td>
<td>✓ NViVo and STATA software</td>
</tr>
</tbody>
</table>
# Materials and methodologies

**Objective 3: Identify influencing factors and constraints of adopting agro-ecological practices**

## Data collection

<table>
<thead>
<tr>
<th>Data</th>
<th>Methods</th>
<th>Data analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agroecological practices</td>
<td>Key informant interviews with extensionists</td>
<td>Qualitative data analysis, NVivo</td>
</tr>
<tr>
<td>In Crop production:</td>
<td>In-depth interviews with farmers</td>
<td>Quantitative data, STATA</td>
</tr>
<tr>
<td>• Efficiency increase; Redesign practices</td>
<td></td>
<td>• Type of practices</td>
</tr>
<tr>
<td>• Weed, pest management practices</td>
<td></td>
<td>• Adoption frequency of practices</td>
</tr>
<tr>
<td>• Management of hedges, vegetation strips</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In Livestock production:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Selection and combination of animals, breeds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Feeding strategies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Functional diversity (herd/farm level)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Influencing factors and constraints</td>
<td>In-depth interviews with farmers</td>
<td></td>
</tr>
<tr>
<td>• Influencing factors: Significance of adopting practices and reasons</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Constraints: managing and continuing practices</td>
<td></td>
<td></td>
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# Materials and Methodologies

**Objective 4: Evaluate the performance of agroecological practices and their impact on household livelihoods**

<table>
<thead>
<tr>
<th>Data collection</th>
<th>Methods</th>
<th>Data analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Performance of diversity and integration (synergy)</td>
<td>Indepth interviews with farmers</td>
<td>Using methodology of objective 1</td>
</tr>
<tr>
<td>Data obtained from Objective 2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Impact of crop-livestock diversity on sustainable livelihoods | | - Calculation of crop-livestock diversity index, crop/livestock diversity index: (Magarlef index)  
  \[ Di = (Si - 1)/\ln(Ni), \] |
| Income: Outputs of crops, livestock, trees | | |
| Production costs (livestock, crops, trees) | | - Descriptive and comparative analysis: using Mean of income, frequency of income reduction, frequency of pests, diseases |
| Revenue of main crops, livestock, tree activities; Stability of income: Reduction of income during shocks. Vulnerability: cases of pests, disease; market price fluctuation | | - Correlation between income and crop-livestock diversity, using Probit model to estimate the probability of diversity effect on income |
Objective 5: Assess the sustainability of different smallholder crop-livestock-tree systems

- The most suitable methods in Objective 1 will be used for the sustainability/impact assessment
- Sustainable dimensions: economics, environment, social dimensions
- Delphi-technique will be used to adapt the methodology to local context, using a Likert-scale from 1 (the lowest) to 5 (the highest) to choose relevant sustainable indicators/themes
  - Selection criteria:
    + Irrelevant themes/sub-themes with mean rank >= 3.5 and quartile deviation <= 0.5 will be accepted.
    + Themes/sub-themes with mean rank <= 3.5 and quartile >= 0.5 will be rejected
Expected outputs

- Categorized different crop-livestock-tree systems in the community according resource endowment, and understood management resources of these systems
- Types and frequency of adopted agroecological practices in crop and livestock production
- Influencing factors and constraints on adopting agroecological practices.
- Proposed a farming systems with better biodiversity and economic performance
## Number of samples/interviews

<table>
<thead>
<tr>
<th>Contents</th>
<th>No. samples</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Individual) in-depth interviews</td>
<td>80</td>
<td>Field visit 4 communes each in Dien Bien and Son La provinces.</td>
</tr>
<tr>
<td>Group discussion</td>
<td>8</td>
<td>Field visit</td>
</tr>
<tr>
<td>Key informant interview</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Transect walk</td>
<td>8</td>
<td>2 rounds, approx. 160 interviews</td>
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<tr>
<td>Total</td>
<td>106</td>
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Tentative Schedule

2021
- Training and proposal development in Germany
- Literature reviews and proposal writing

2022
- Field work in Vietnam
- Desk research: Objective 1
- Method completion & questionnaire design
- Data collection (objectives 2, 3, 4)
- Data entry, cleaning

2023
- Data collection Obj 5
- Data entry and analysis

2024
- Writing in Germany
- Writing paper 1
- Writing paper 2
- Writing paper 3
- Submission
THANK YOU FOR YOUR ATTENTION!