„Climate-resilient innovations in smallholder agriculture – Theory and practical implications for farmer-led research”

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Humboldt-Universität zu Berlin

Padjadjaran University, UNPAD, Faculty of Agriculture
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Introduction
Objectives of the session

Participants

• Get an overview on the climate-resilient investigation and innovation project (CRAIIP)
• have gained understanding on innovative practices in the context of smallholder climate change adaptation
Content

- Our centre (SLE)
- Our Indonesian-German research project
- Climate change vulnerability
- Smallholder farmers
- Climate resilience
- Innovation

Albrecht Daniel Thaer 1752-1828: the „founder“ of agricultural science in Germany, first Professor of Agriculture: CROP ROTATION FIELD TRIALS
Centre for Rural Development (SLE)

SLE
- Founded in 1962
- 1,000 alumni
- ~20 employees
- belongs to Faculty of Life Sciences in Humboldt-Universitaet zu Berlin

SLE- Working Fields
- **SLE STUDIES**: “International Cooperation for Sustainable Development”
- **SLE TRAINING**: Trainings for international specialists
- **SLE ADVISORY SERVICES**: Cooperation with universities in Mozambique, Brazil, Columbia, Mali
- **SLE RESEARCH**: Applied research: value chains, climate change adaptation, rural transformation, urban farming, knowledge transfer: Kenya, Mozambique, South Africa, Indonesia

Our approach to teaching emphasizes experience-based learning in teams.
CRAIIP

Climate resilient agriculture investigation and innovation project

Smallholder farmers South Sulawesi and West Java

Ikatan Petani Pengendalian Hama Terpadu Indonesia (IPPHTI)

Gereja Toraja Motivator Kondoran

UNPADD Bandung

UNHAS Makassar

Humboldt SLE

Farmer researcher

Students farm research

Process, statistical analysis, review of papers, best practices
Smallholder farmers
Smallholder farmers are very important

- Many people: 570 million farms and small-scale: less than 2 hectares
- Use family labour for production and marketing (efficient)
- Produce the bulk of the household’s staple foods (IFAD 2011) and 80% of the food in developing countries
- Many smallholders belong to the hungry poor due to remoteness and exclusion

Table 4. Top five countries by number of ag

<table>
<thead>
<tr>
<th>Agricultural holdings (in millions)</th>
<th>Most recent estimate</th>
<th>Share of the world’s agricultural holdings (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>201</td>
<td>35</td>
</tr>
<tr>
<td>India</td>
<td>138</td>
<td>24</td>
</tr>
<tr>
<td>Indonesia</td>
<td>25</td>
<td>4</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>23</td>
<td>4</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>15</td>
<td>3</td>
</tr>
<tr>
<td>World total</td>
<td>570</td>
<td></td>
</tr>
</tbody>
</table>

Source: Authors’ compilation using FAO, 2014a.

Source: Lowder et al. (2016)
Smallholders are the Hungry Poor

- >50% of people suffering from chronic hunger are smallholders, or 80% of rural dwellers

- 570 million Smallholders (50%)
- Landless people or people with little land (20%)
- Fishermen, pastoralists (10%)
- Poor urban dwellers (20%)

Less land available/person

migrant
Climate change vulnerability
climate change vulnerability is a function of 3 elements

“$V$ is composed of the character, magnitude, and rate of climate variation to which a system

- is exposed
- its sensitivity
- its adaptive capacity” (IPCC, WGII, 2007)

How does an element effective “adaptation measure” fit in here?

Sources: Field et al. 2013; adelphi, EURAC 2014
climate change vulnerability

Sources: Definitions: Field et al. 2013; Parry et al. 2007; Graph: adelphi, EURAC 2014
Vulnerability — Increased frequency and intensity of rainfall in Northern Laos

<table>
<thead>
<tr>
<th>Element</th>
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<tr>
<td>Exposure</td>
<td>?</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>?</td>
</tr>
<tr>
<td>Adaptive Capacity</td>
<td>?</td>
</tr>
<tr>
<td><strong>Vulnerability</strong></td>
<td>?</td>
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Source and image credit: S. Stöber; adapted from UNCC:Learn: The One UN Climate Change Learning Partnership
Vulnerability — Increased frequency and intensity of rainfalls in Northern Laos

<table>
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<th>Exposure</th>
<th>Sensitivity</th>
<th>Potential impacts</th>
<th>Adaptive Capacity</th>
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<tr>
<td>• More heavy rainfall events</td>
<td>• Degraded soils</td>
<td>• Harvest losses on degraded soils</td>
<td>• Limited off-farm income generation</td>
</tr>
<tr>
<td>• Wind breaks the upland rice varieties</td>
<td>• poverty</td>
<td>• Loss of income</td>
<td>• Low availability of more resilient rice varieties</td>
</tr>
</tbody>
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Source: own example based on UNCC:Learn: The One UN Climate Change Learning Partnership
Vulnerability — Increased frequency and intensity of rainfalls in Northern Laos

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Source: Silke Stöber

Source: own example based on UNCC:Learn: The One UN Climate Change Learning Partnership
smallholders’ climate resilience
A Laotian climate-resilient innovation smallholder farmer story.....

Picture source: LIWG
Galangal price per kg/Laotian Kip

Picture source: CARE Laos
What can we learn from this example?
1. Adaptation must be climate-resilient

Three pillars of climate-smart agriculture (FAO)

Yield-smart
Market-smart
Community-smart

Water-smart
Knowledge-smart

Carbon-smart
Energy-smart
Nitrogen-smart
Resilient = To bounce back

Source: http://www.conservationofchange.org/resilience/
2. Sustainable Adaptation is ecosystem-based to increase capacity of ecosystems for natural hazard regulation.
3. Develop solutions with NOT for farmers

Picture source: Helvetas Kirgistan
4. Combine, disseminate & don’t compare knowledge

Indigenous knowledge
- Local
- Informal
- Intuitive, accidental, continuous
- Vertical

Scientific knowledge
- General (empirical basis)
- Formal (scientifically tested)
- Planned, rational
- Horizontal
Innovation
“An innovation is an idea, practice or object that is perceived as new by an individual or other unit of adoption”
(Rogers 2003, p.12)

Technology, process or policy: i.e. hard- and software
4 Elements of diffusion theory

- Diffusion = a process, in which an innovation through communication via certain channels within a given time disseminates among the actors of a social system.
  
  1. Innovation = new product, new behaviour, new process;
  2. Communication channels = from mass media to personal communication (means)
  3. Time = innovation decision making process from awareness, interest, evaluation, trial, adoption or awareness, persuasion, decision, implementation, conformation
  4. Social system = norms and values, opinion leaders (who one is, what one knows, whom one knows)
Innovativeness (normal distribution) and Rate of Adoption (S curve)

Source: www.ondigitalmarketing.com
Dissemination of hybrid corn (Iowa study)

Source: Ryan and Gross (1950)
Factors that influence the adoption process

1. Characteristics of the innovation

Relative advantage
Are there any improvements of the innovation over the previous generation?

Compatibility
How consistent is the innovation with existing values, norms, and needs?

Complexity
How complicated or difficult to understand and use the innovation is perceived?

Trialability, risk
How easily an innovation may be tested? Can be tried on partial basis?

Observability
How visible is the innovation to others?
Quinoa (Chenopodium quinoa)

- Native to the Andes region, new to rest of the world
- Stress tolerant crop with extraordinary ability to adapt to different agro-ecological conditions
  - From sea level to 4000 m altitude
  - Tolerates -1°C to +35°C temperatures
  - Facultative halophyte – some varieties cope with salinity as high as seawater (50 dS/m)
  - Drought resistant – grows with 200-400 mm rainfall
- Highly nutritious – Seeds provides high-quality protein (10-18%) with all essential amino acids and minerals, also gluten free

Source: Nanduri (2016)
Assessment of innovation to adapt to salinity

<table>
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<tr>
<th>Characteristics</th>
<th>Quinoa</th>
<th>Saline-tolerant rice variety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative advantage</td>
<td>Marketable?</td>
<td>Lower yields compared to farmer variety</td>
</tr>
<tr>
<td>Compatibility</td>
<td>Low</td>
<td>High? Taste?</td>
</tr>
<tr>
<td>Complexity</td>
<td>Medium, Low</td>
<td>low</td>
</tr>
<tr>
<td>Trialability</td>
<td>Yes, but seed suitable for low altitude and saline soils available?</td>
<td>Yes, seed available</td>
</tr>
<tr>
<td>Observability</td>
<td>visible</td>
<td>Not visible, needs signboard</td>
</tr>
</tbody>
</table>
3 Phase Model of behaviour modification

<table>
<thead>
<tr>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
</tr>
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<tbody>
<tr>
<td>Inhibiting forces</td>
<td>Shift to new equilibrium</td>
<td>Stabilisation of modified behaviour</td>
</tr>
<tr>
<td>Driving Forces</td>
<td>Disturbance of former equilibrium</td>
<td>Solution to problem or relapse</td>
</tr>
<tr>
<td>Perception of problem</td>
<td>Stages of implementation</td>
<td></td>
</tr>
</tbody>
</table>

Practical examples
Underground low tech low cost micro-irrigation

Picture source: Lucas Zahl and CSHEP
Banana stem pot

Vertical gardening
Charcoal fridge – evaporative cooling in hot dry regions

Picture source: CSHEP Kiserian Kenya
Take home message
Climate-resilient innovations

1. Must be affordable and profitable
2. Pro-poor: also poor farmers can implement it
3. No regret measures (seed of early maturing varieties higher?)
4. Avoid maladaptation (e.g. more pests and diseases, more pesticides)
5. Advocacy: disseminate ideas and advocate for smallholder adaptation to speed up innovation power
End
Graphs

Picture Diffusion curve: www.ondigitalmarketing.com
Pictures from Laos: Silke Stöber ans LIWG
Pictures from Kenya: Esther Kagai, Lucas Zahl
Picture Farmer, Researcher: Agridea Kyrgyzstan
Picture SLE trainees: SLE
References

- PROVIA (2013): Guidance on assessing vulnerability, impacts and adaptation to climate change. UNEP.
- Simpson (MEAS): Extension Practice for Agricultural Adaptation (2016)
Thank you for your attention
www.sle-berlin.de