

Post-harvest technologies for small farmers

Martin Gummert

Senior Scientist, Mechanization and Postharvest Cluster Leader, IRRI



XIII Conferencia Internacional
de Arroz para América Latina
y el Caribe





Postharvest for small farmers?



Flat bed dryer at farmers' group
Balat village, Battambang, Cambodia
Installed 2006, still used every day



This talk

- Introduction
- Postharvest losses
- Postharvest technology and management
- Markets and business models
- Multi stakeholder platforms for adaptation
- Sustainable rice production and processing

IRRI's Global Presence

- **1,200** staff, **36** nationalities
- **600** research and development partners worldwide
- Working in **14** countries



Situation analysis

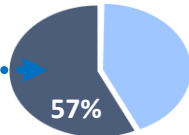
Feeding a world of 9 billion

1.2 billion more people in developing countries and in urban areas **by 2030**

- Global rice consumption increasing from **150 million to 450 million tons**
- More than **90%** of this rice is eaten in Asia, including the region's **560 million people**

Urbanization

by 2030
80% of the global middle class will live in developing countries



2 billion will live in urban slums



double today's



Women continue to face significant constraints in accessing agricultural assets, inputs, and services.

Climate change



Because of climate change, land degradation directly affects **74% of the poor globally**

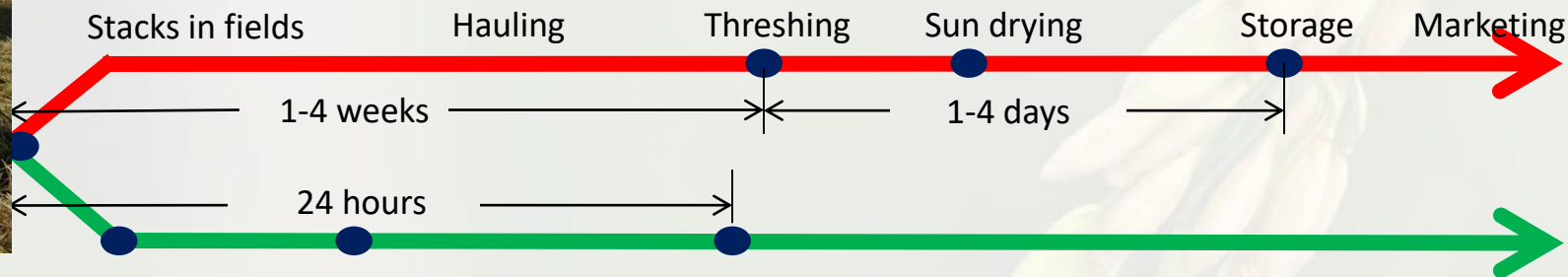
Asian Rice Farming Communities



Example: Postharvest Situation in Myanmar

High
losses and
poor quality

Farmers'
practice (FP)



Manual harvesting

Best
Management
Practice (BMP)

Threshing

Mechanical drying

Hermetic storage

Marketing



Minimized
losses and
good quality

Myanmar

Farmers' practice (FP)

Loss measurement trial, 4 seasons, 2013-2016

- Same crop, same field
- Take samples at every point (moisture, weight, quality)
- Milling after 3 months of storage

High losses and poor quality

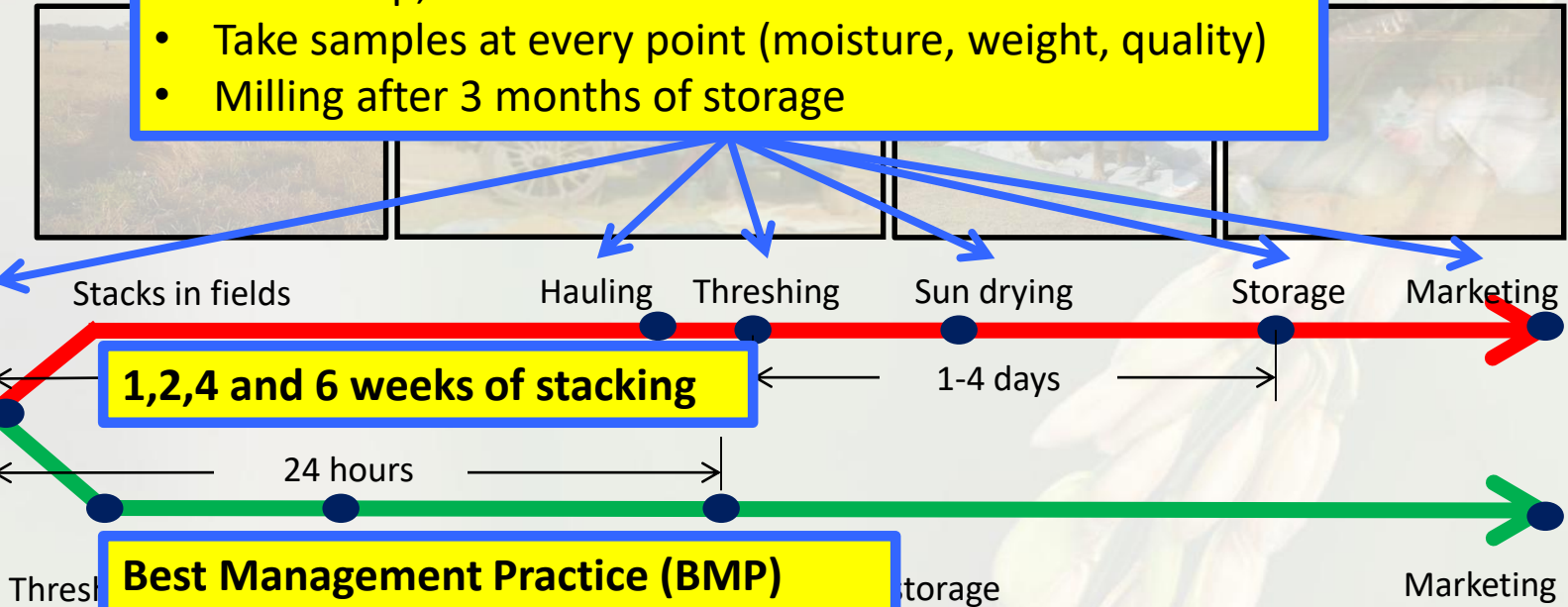


Manual harvesting

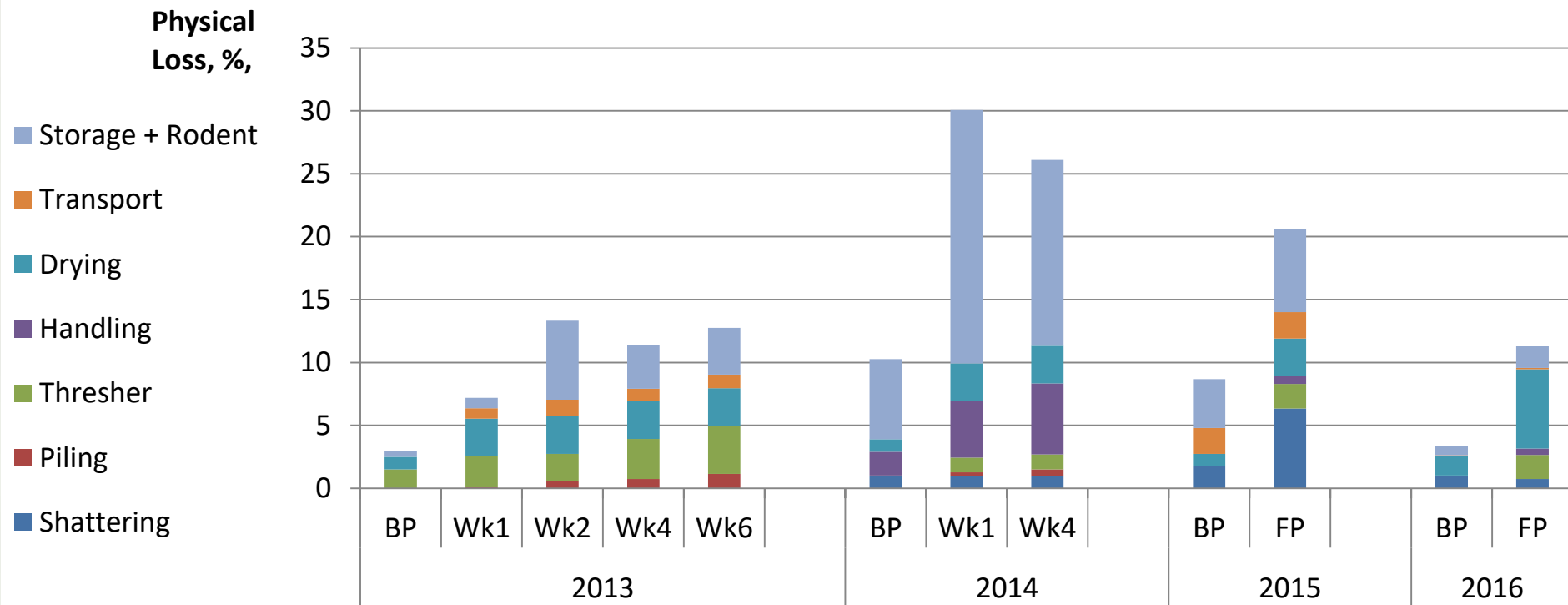
Best Management Practice (BMP)



Minimized losses and good quality



Postharvest loss measurements, Myanmar



BP – Best Practice; FP – Farmer Practice; WK(x) - Farmer Practice with (x) weeks of field stacking

Quality losses

Paddy quality



Sample taken from farmer's granary,
Myanmar, 2015

Milled rice quality



Sample taken from rice mill, Myanmar, 2015

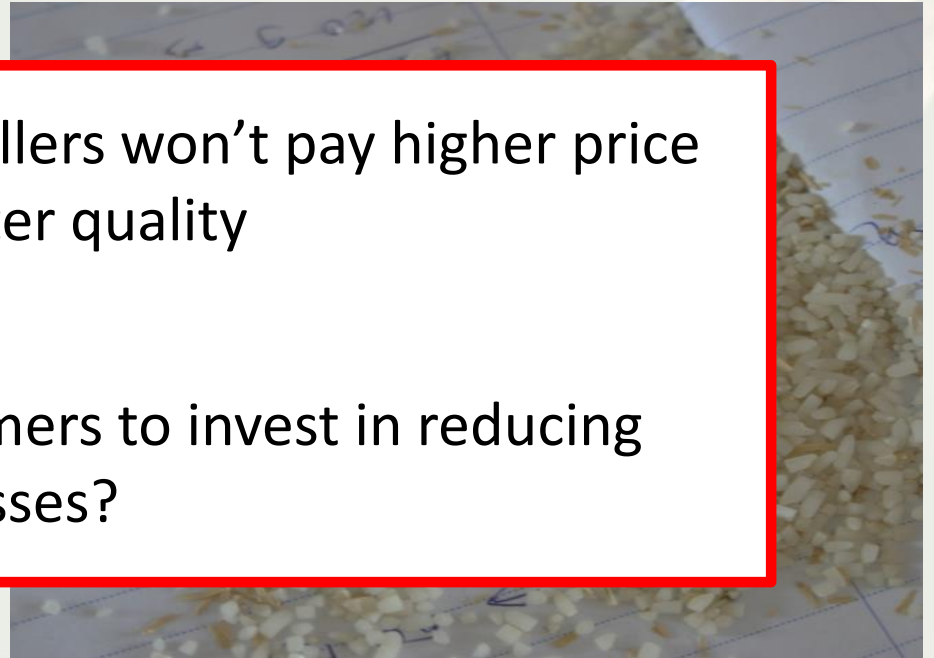
Quality losses

Paddy quality



Sample taken from farmer's granary,
Myanmar, 2015

Milled rice quality



Sample taken from rice mill, Myanmar, 2015

But: Local traders and millers won't pay higher price
for better quality

How to encourage farmers to invest in reducing
losses?

Response options

- Technology
- Business models
- Market linkages
- Strengthened value chain support services
- Multi Stakeholder Platforms

Objectives

1. Minimizing losses
2. Maximizing profits
3. Sustainable rice production

Recent development in Asia: Combine harvesting

Advantages

- Labor saving
- 2 instead of 34 persons / day / ha
- Potential to cut harvesting losses to 1-2%
- Cutting harvesting cost up to 50%



Key challenges in Asia

- Small farm sizes (average 2ha)
- Small field sizes (0.1-0.5ha)
- Wet fields during wet season
- Difficult field access
- Poor road network
- Predominantly bag handling
- Poor support services
- Open field burning of straw

Combines - shift to bulk handling
Traders shift to buying directly after harvest
Postharvest for
small farmers?



Drying



Labor



Spillage, mycotoxins



Loss, contamination



Weather risk, spoilage



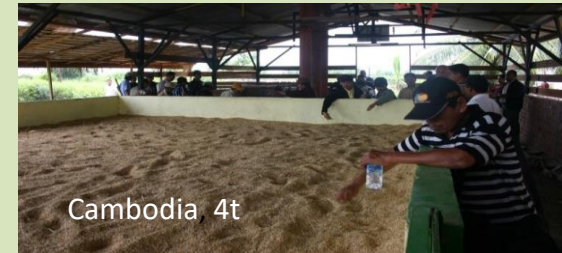
Damage, spillage
traffic hindrances

Sun drying

- Estimated 80-85% of paddy sun dried in S- and SE-Asia
- 2-5% physical losses and 10-15% lower head rice
- Lack of market driven incentives for use of dryers
- **Effect of combine harvesting**
 - Paddy harvested at higher moisture content
 - Larger amounts of grains in shorter period of time

Flat bed dryer

- Rice husk furnace
- Capacity 2t..20t
- Introduced by IRRI + Nong Lam University in 2006.
As of 2016
 - Myanmar: > 1,500
 - Indonesia: > 400
 - Lao PDR: > 100
 - Cambodia, Philippines: several 100
 - Few units in Bangladesh, Nigeria, ...



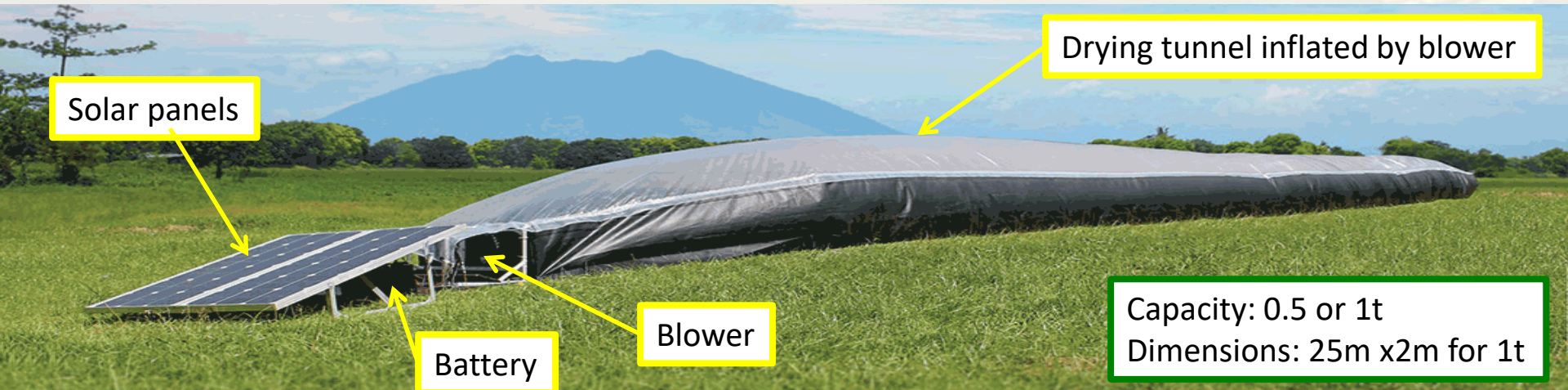
Cambodia 4t



Myanmar, 4t

A new technology for the village level

The Solar Bubble Dryer



- 270 units sold in 2016-2017 (Source: GrainPro), around 450 by 2018
- Uses only solar energy, no operating cost except for labor
- Drying time similar to sun drying during sunny days; protection from rain, animals
- Energy optimization and cost reduction ongoing (GIZ funded)



CIAT-IRRI cooperation in GRISP: Technology transfer to Latin America (2015)
Picture: Santiago Jaramillo testing the SBD with CIAT target groups

Verification with farmers in Myanmar

U Saw Kenndy, Tar Pet Village



Problems with Version 1

- High price
- Some condensation
- Mixing of paddy
- Space requirement

Optimization

- Modeling drying process $f(\text{weather, grain MC..})$
- Dryer management
- Optimizing blower
- Reduce cost

Results

Energy optimized Mark 2 currently being designed, release in second half of 2018

Storage issues in Asia



Farm level: Myanmar, Cambodia, Lao PDR
High losses, indebtedness – farmers store less



Silos: Mostly failures
Technical and management problems



Large, commercial scale

CAP storage in India in the open, covered by LDPE plastic sheets (left, source Indiamart);

Wheat spilling out of damaged sacks at a CAP storage facility of the Food Corporation of India, Haryana (right: The Hindu, February 12, 2014)

Hermetic Sealed Storage Systems



Local containers



50 kg
“Super bag”



1t GrainSafe™

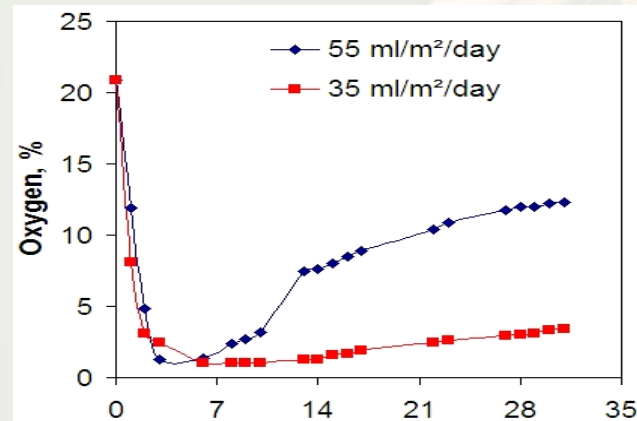


5t Cocoon™

Principle

- Airtight enclosure
- Biological activity reduces O_2
- Insects die or become inactive
- Plastic controls moisture

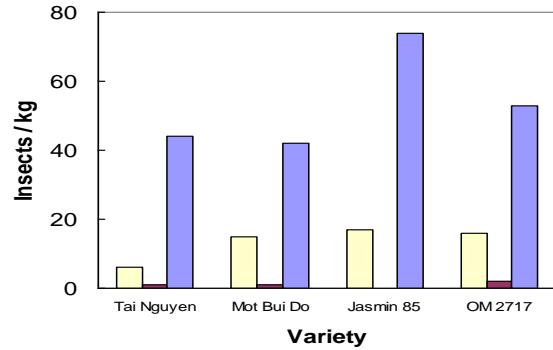
Save storage without pesticides



Drop of oxygen
over time (days)
in plastic bags
with different
oxygen
permeability

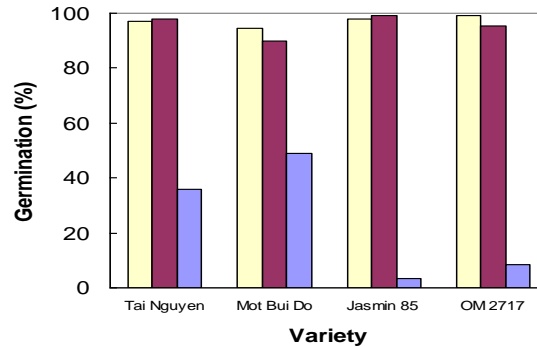
Benefits of Hermetic Storage

Insect control



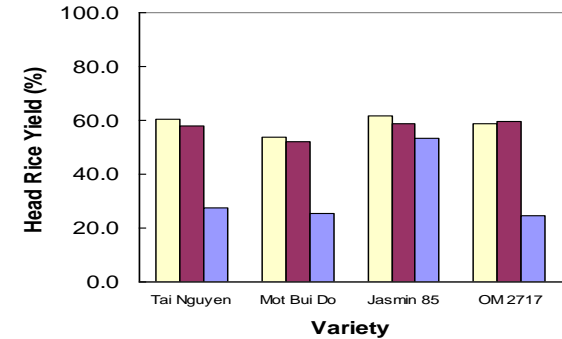
No pesticides / fumigation
(farmers often store inside the house to avoid theft)

High germination rates



Farmers in SE Asia use around 80% own seeds and use high seed rates to compensate for low germination -> **more grains to sell**

Higher milling returns



More grain to sell
Also controls moisture content -> protection from mycotoxins

 Initial sample  After 8 months hermetic storage  After 8 months traditional storage

Source: IRRI - Bac Lieu Seed Center, Vietnam collaboration
Eight months of storage, 4 varieties, comparing IRRI Super bag with farmers practice

Industry / Group Level Hermetic Storage: Cocoons™

- 5t – 1050t
- Option for fumigation
- Can be installed outdoors
- No electricity needed




TranSafeliner™ at processing company



Opened Cocoons™ (Photo: GrainPro)



300t Cocoons™ in Peru (Photo: GrainPro)

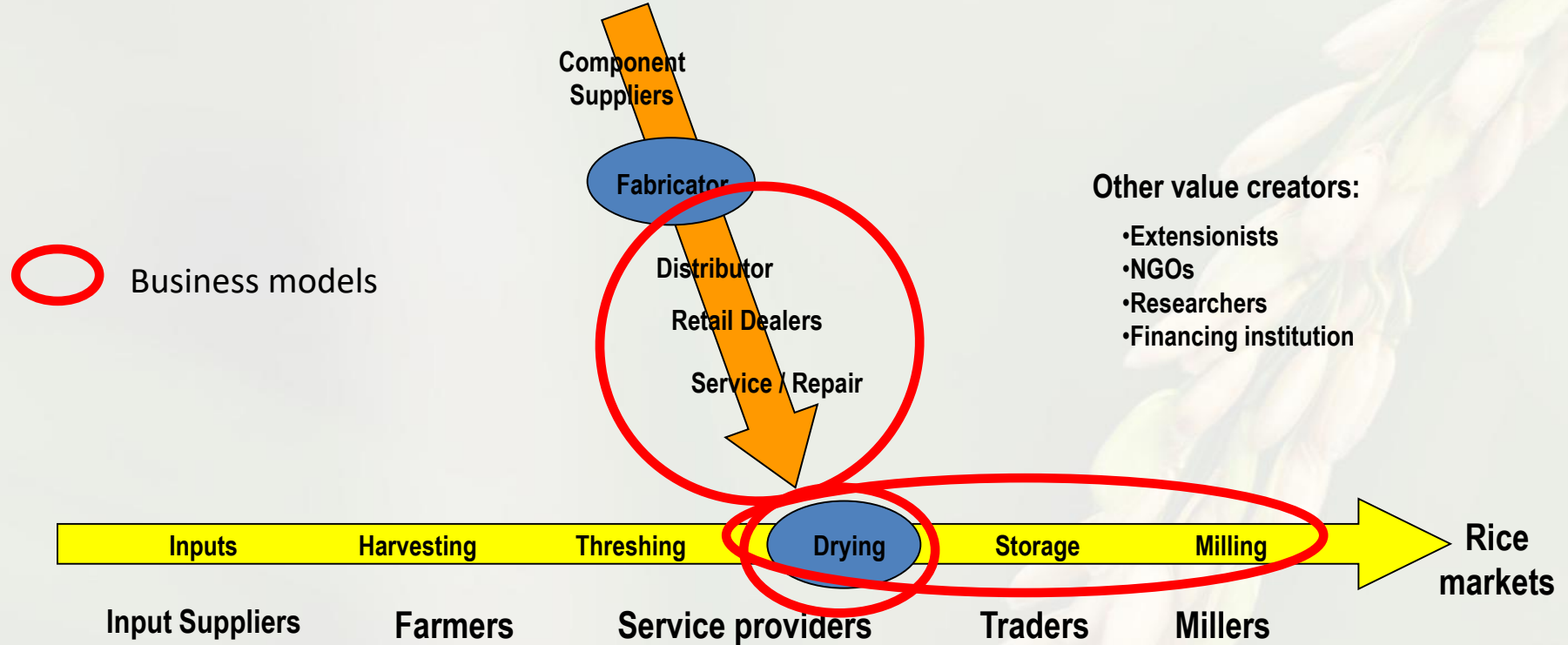


See, if you use a
mechanical dryer
and hermetic
storage, I will get
higher head rice
recovery

What's in it for me? I
have higher cost, and
he does not pay me
more for mechanically
dried paddy ...

Value chain approach and business models

Horizontal rice value chain with vertical linkage (equipment value chain)



Heirloom Rice Project, Philippines

Department of Agriculture, support from Kellogg's



- Keep farmers from the mountainous areas engaged in rice farming / maintaining the landscape and varieties
- Improved postharvest processing and handling
 - Improved milling, hermetic storage, branding
- Premium market
 - Export to the US
 - Premium market in Manila

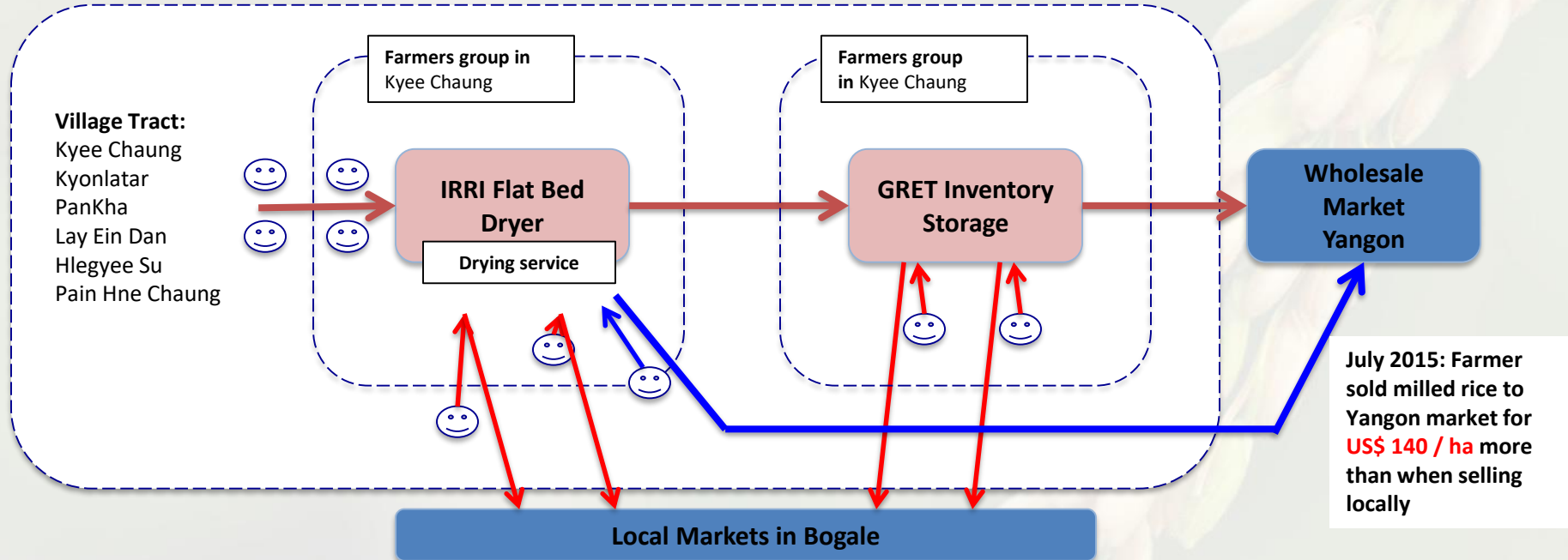


Improving Village Level Value Chains

IRRI Postharvest Site in Bogale (LIFT: 2012-2015)

Idea: Process paddy to produce high quality for joint sales by farmers to premium markets with higher prices for better quality

Rice postharvest business model for farmers group



A Learning Alliance Learning Cycle

PLAN → **ACT** → **REFLECT and CAPTURE**

Value added

Export markets ?

Support services (e.g. financing)

Milled rice wholesale Market

Dryer manufacturer

Local millers

LA established

PIPA

Participatory Impact Pathway Analysis Workshop

Farmers

Low quality, high loss

Quality increase, Loss reduction

LA, other village

DOA staff

Visit to other farmers

Business models, out-scaling

Varieties and understanding markets

Management of technology by farmers group

Improved postharvest technology

Awareness creation for postharvest losses and quality

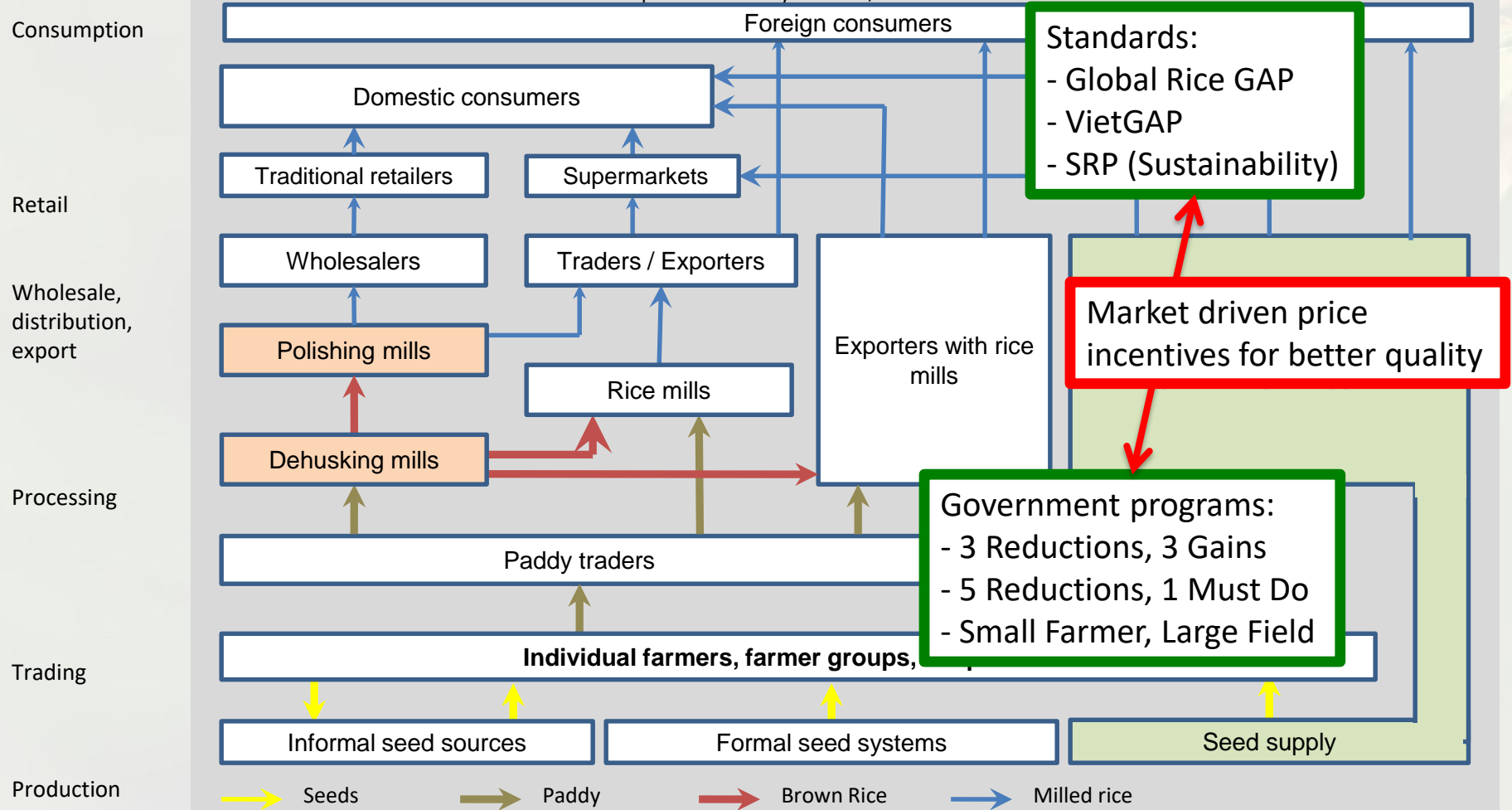
Sources: IRRI LIFT / ACIAR Projects; Douthwaite, CIAT

Sources:
IRRI LIFT /
ACIAR
Projects;
Douthwaite,
CIAT

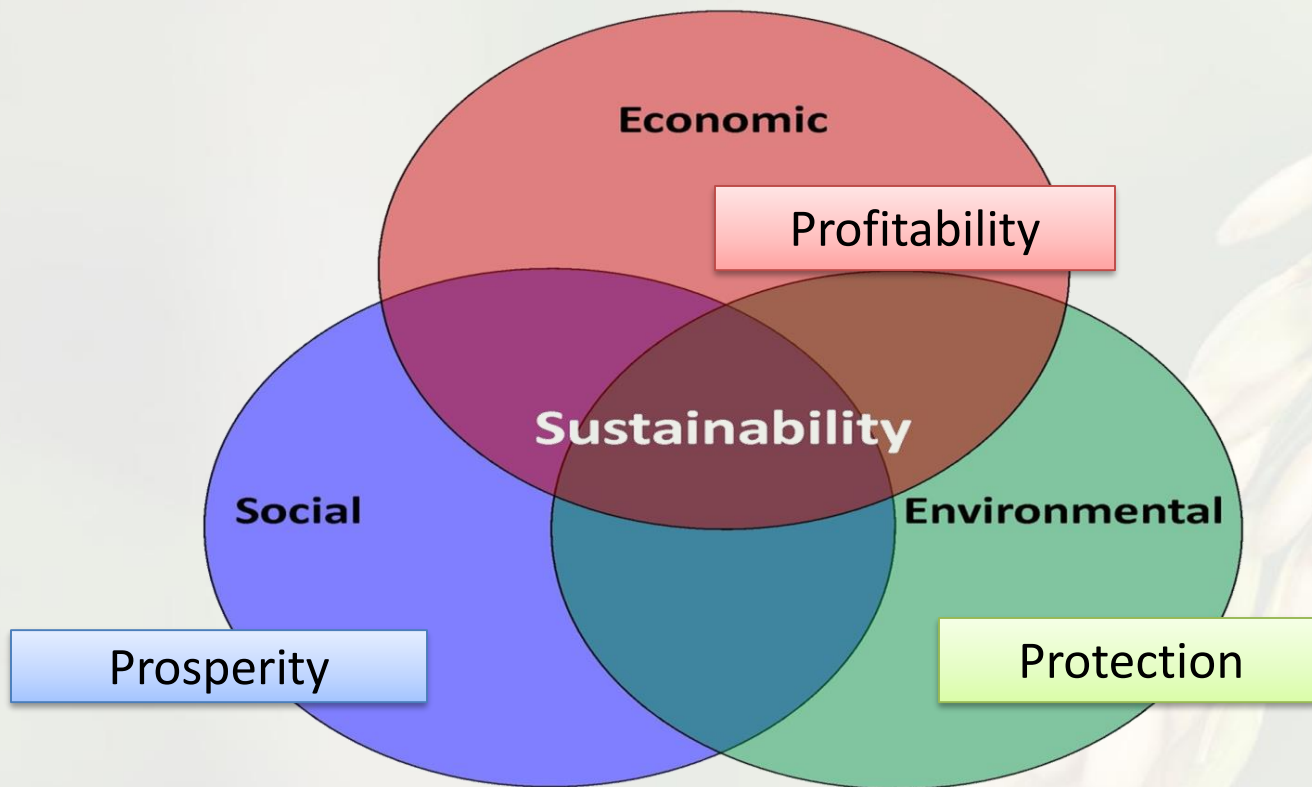
LA, other village

Example of a vertically integrated rice value chain (light green) in Vietnam

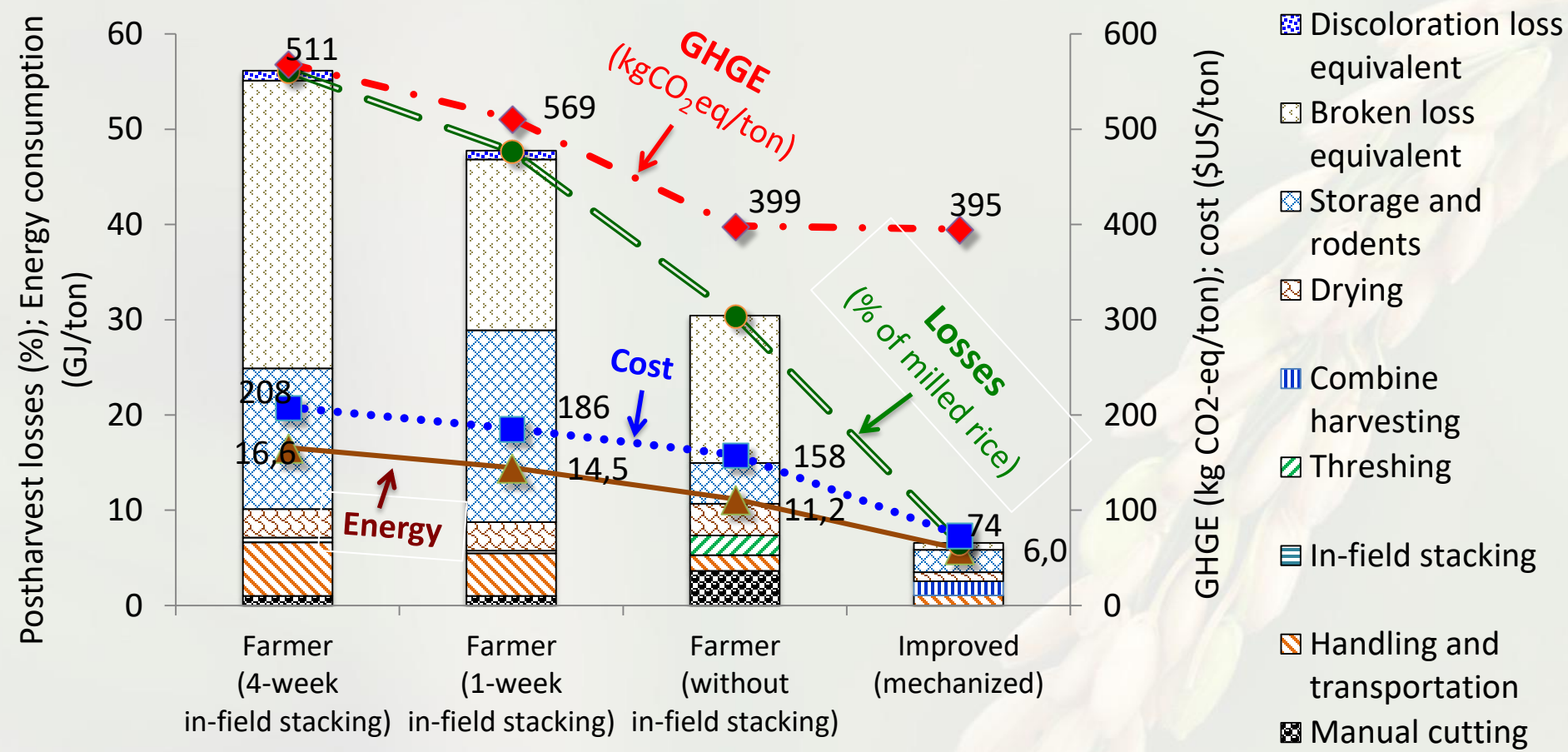
Adapted from Matty Demont, 2013



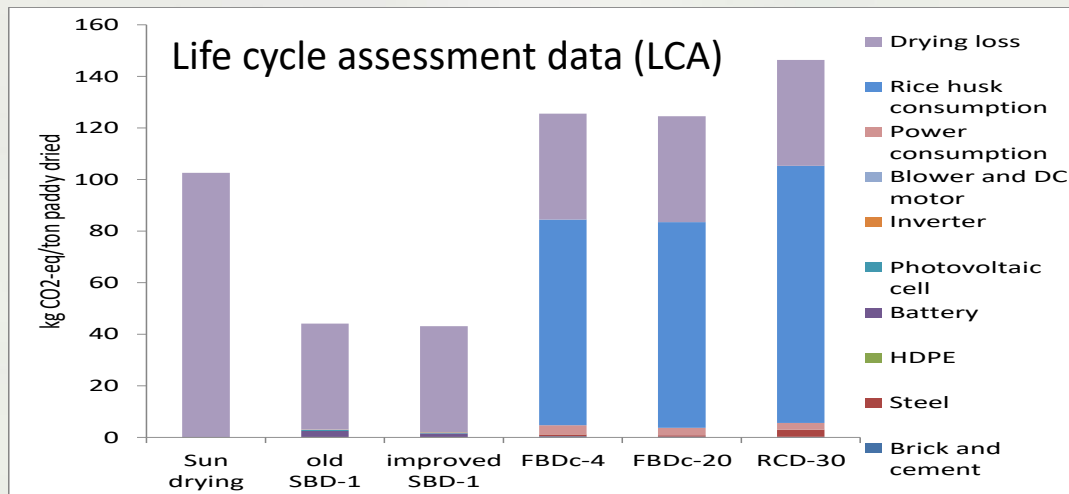
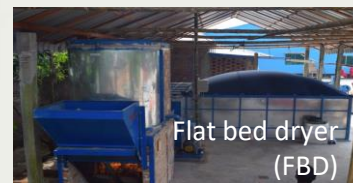
Dimensions of Sustainability



Identify best postharvest management practices – MyRice project (Myanmar)



Example: GHGE from different drying systems



(SBD-1: Original Solar Bubble Dryer with 1-ton capacity, Improved SBD-1 with 1t capacity; FBDc-x: flatbed dryer with 4t and 20t capacity, RCD: recirculating batch dryer; numbers after the mechanical dryer state the capacity per batch).

Machinery consumes energy

- Production
- Operation
- De-commissioning

Losses reduced by 60% compared to sun drying (data from Myanmar trials)



Source: "Optimization of a Solar Bubble Dryer for drying rice and other commodities" Project, 2016-2018, funded by BMZ/GIZ

Multi-stakeholder global alliance..



..among 64 institutions representing governments, private sector actors, NGOs, international research community

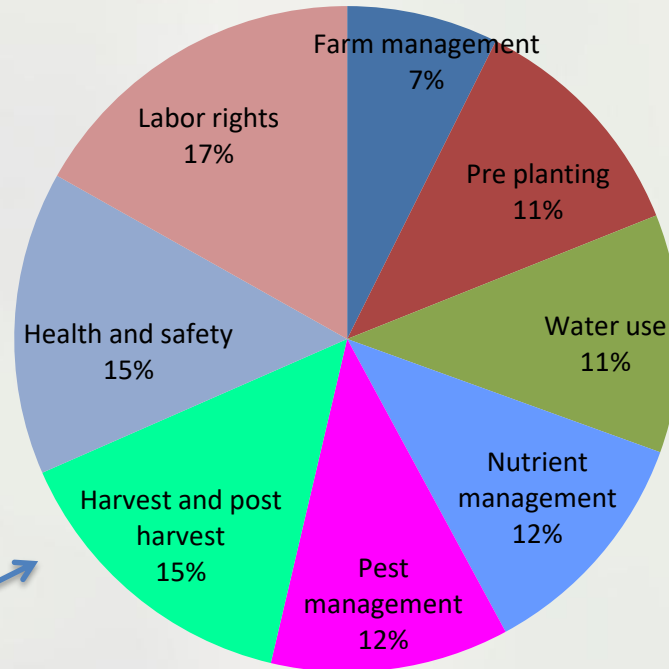
CURRENT RICE SECTOR CHALLENGES

- Stagnating yield growth
- Resource inefficiency
- Environment / biodiversity impacts
- Contribution to climate change
- Impacts of climate change

- Unique standard
- Supported by a global multi-stakeholder network
- Tailored to smallholder needs
- Aims to maintain productivity while minimizing environmental and social footprint

Sustainability Standards launched December 2015

46 requirements in 8 sustainability dimensions



Under
developed

“The soil is safe from heavy metals such as arsenic, cadmium, chromium, mercury, and lead”

“The farmer attends training or regularly seeks professional advice”

“Efficient and site-specific nutrient management is applied”

“Children living on the farm in the age of compulsory schooling go to school all year long”

NEXT: QUANTITATIVE INDICATORS

No postharvest indicators yet.
Can we create monetary incentives for non monetary benefits that allow farmers to improve their postharvest practices?



Conclusions

- Technologies for improved farm level postharvest operations are available and tested
- Little incentives for farmers to invest / use them
- Need for value chain approach that links farmers to markets and business models for economic use of technologies
- Can we create monetary benefits for farmers from non-monetary benefits of using technologies?
- IRRI is very interested in sharing experiences, technologies and in collaboration



**5TH INTERNATIONAL
RICE CONGRESS**
SINGAPORE 2018

14 - 17 OCTOBER 2018
MARINA BAY SANDS, SINGAPORE

TRANSFORMATIVE SCIENCE FOR FOOD
AND NUTRITION SECURITY
www.ricecongress2018.irri.org



BE PART OF THE DISCUSSION

Participate in the world's largest gathering
of rice scientists, industry experts, and
market players
from 14-17 October 2018.



For sponsorships, participation, and speaking opportunities,
contact us at ricecongress@irri.org
or visit ricecongress2018.irri.org for more details.

Connect with us.



@IRRI.ricenews



@IRRI