EXPERT KNOWLEDGE AND SITUATED KNOWLEDGE – A MULTI-CRITERIA MAPPING OF TRADE-OFFS IN TECHNOLOGY OPTIONS IN RICE PRODUCTION IN INDIA'S SEMI ARID TROPICS.

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OBJECTIVES OF OUR RESEARCH :

To develop methods to measure variation in a **system of production and distribution (consisting of capital, labour raw material commodities and waste) so as** to understand where, how and why **physical social and economic variables interact.**

METHODS: LIFE CYCLE ASSESSMENT FUSED WITH SUPPLY CHAIN ANALYSIS

Main parameters measured:

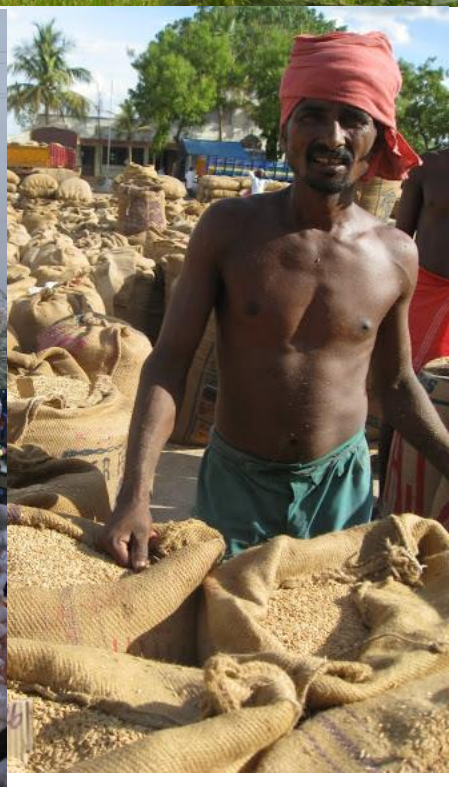
physical **: water, fossil energy, animal and human energy, greenhouse gases ('agrarian question of waste')**

economic/social: **costs and returns, quantity and quality of labour**

RICE AS A CASE STUDY – HERE -1

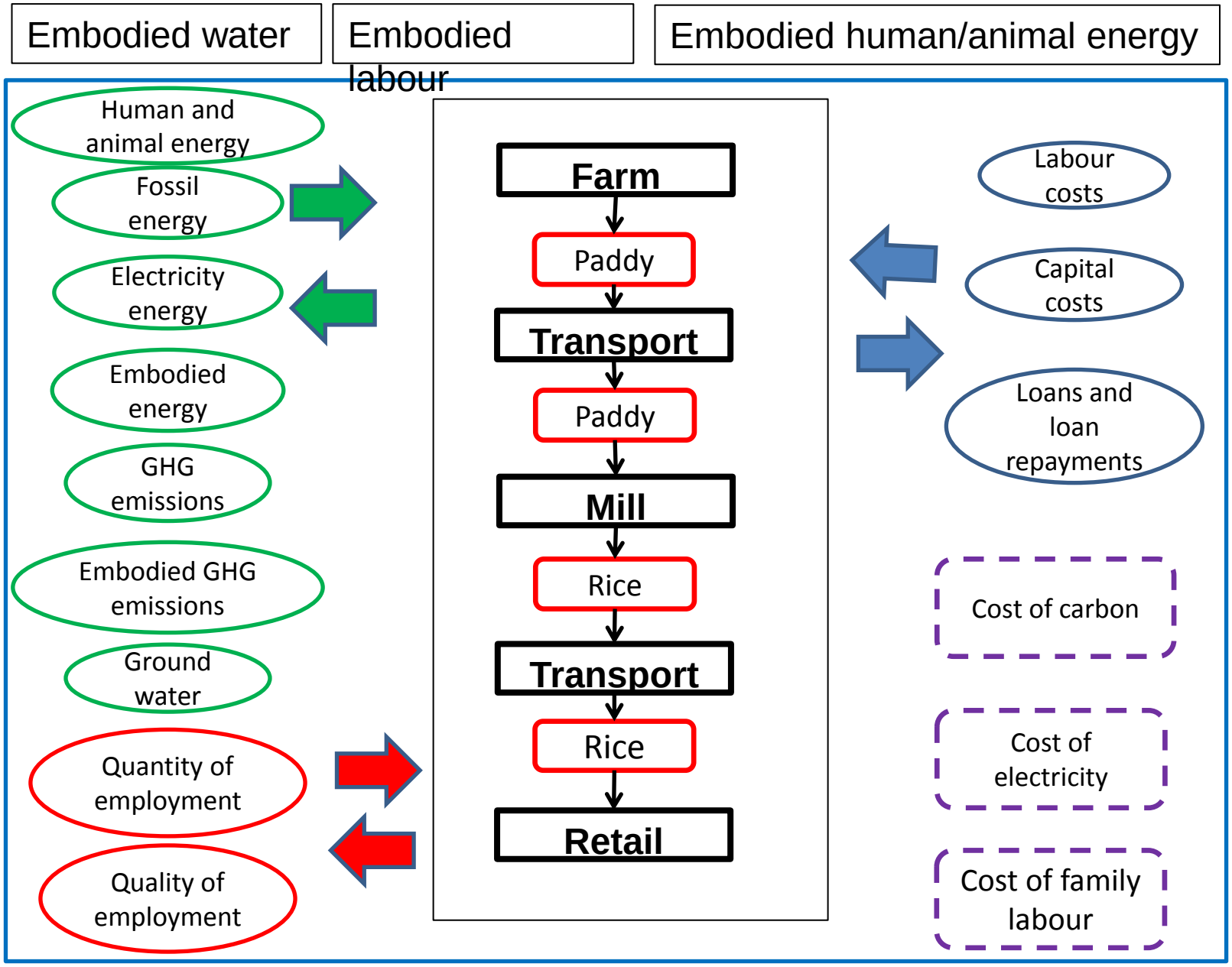
- **NOT** because a big polluter- though food system and land-based activity thought to account for up to 45% GHG - part of the envtl crisis - BUT
- Rice is **bio-physically complex** – emitting various GHGs as well as sequestering them – so **scientifically interesting**
- Rice is **socio-technically complex** – 4 production systems **(RAINFED; SRI; ORGANIC; INTENSIVE/HYV)** plus varied marketing systems **(SUPERMARKET, SMALL RETAIL, PDS)** –> **social scientific interest**

idea



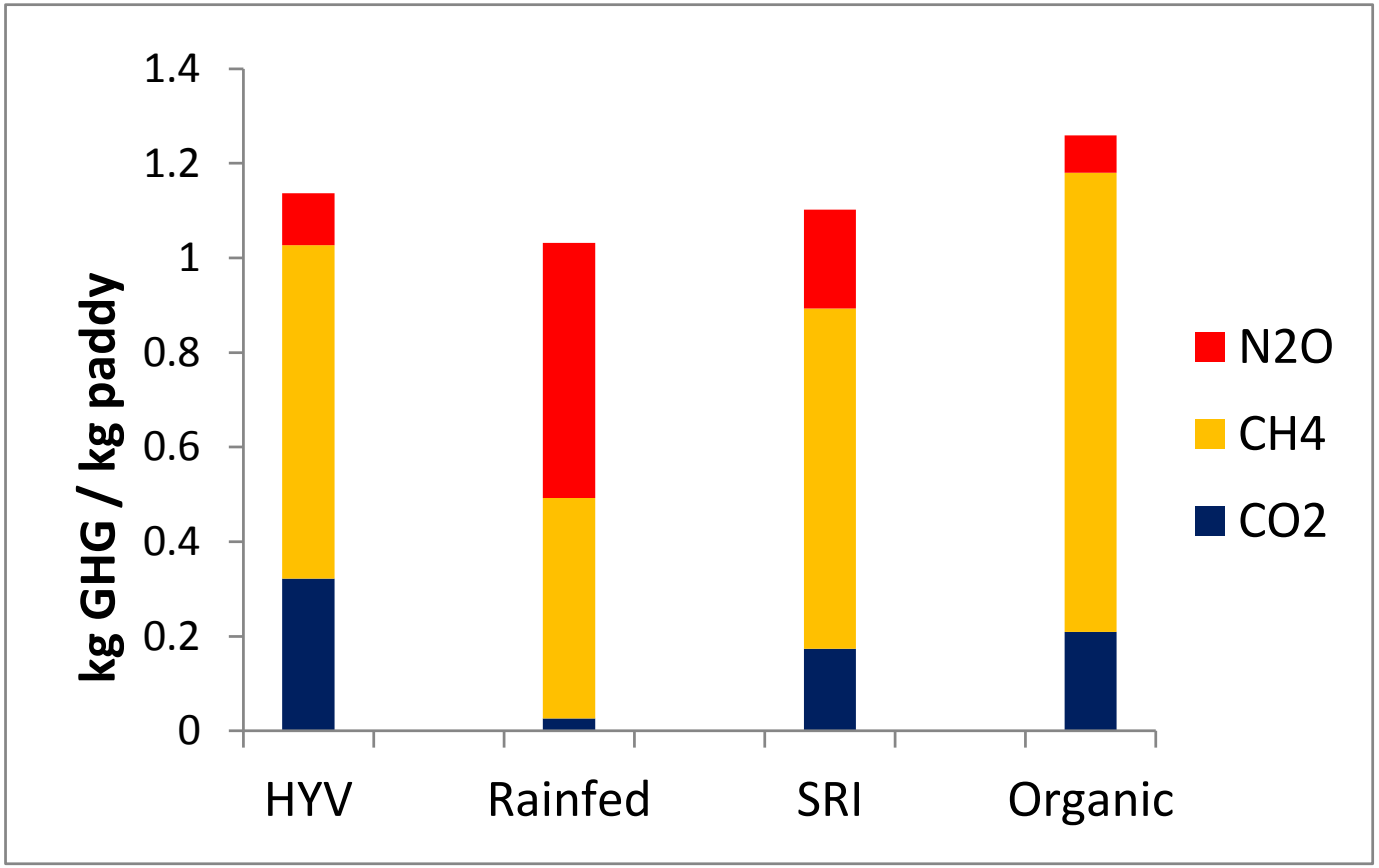
RICE AS A CASE STUDY - 2

- **Resources, employment and poverty** are entwined in production-distribution systems –>**policy interest**
- Production and distribution weave in and out of **the informal economy** (latter is out of direct state / policy control) **–> theoretical and policy interest**
- Food is generally exempt from the scenarios lowering emissions (Anderson/Royal Society 2011) i.e. a **political special case** – but how special; can we mainstream it **?**


Embodied water
Embodied labour
Embodied human/animal energy
Human and animal energy
Fossil energy
Electricity energy
Embodied energy
GHG emissions
Embodied GHG emissions
Ground water
Quantity of employment
Quality of employment
Farm
Paddy
Transport
Paddy
Mill
Rice
Transport
Rice
Retail
Labour costs
Capital costs
Loans and loan repayments
Cost of carbon
Cost of electricity
Cost of family labour

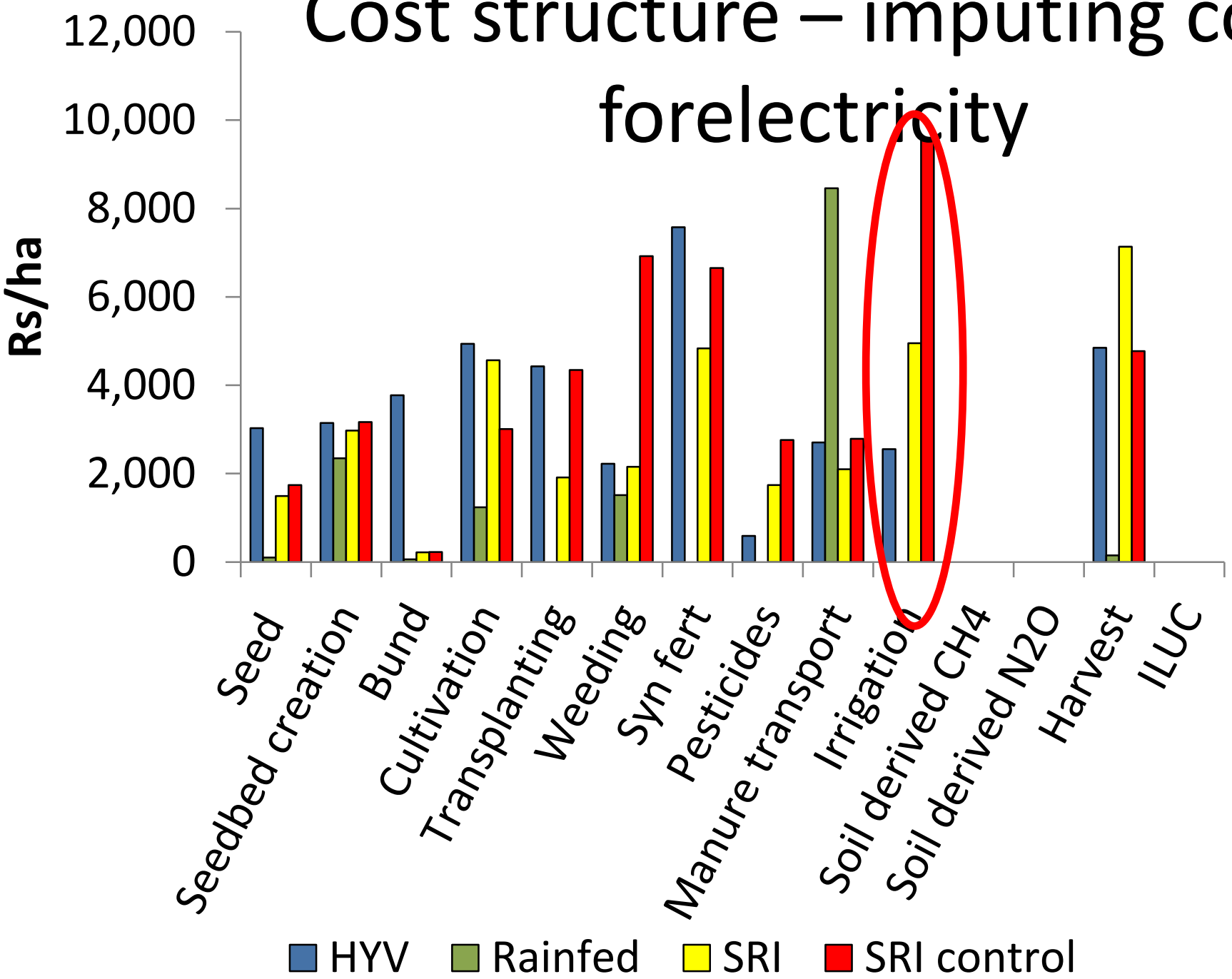
RESULTS – INTENSIVE RICE – production-distribution

Approximate constituent emissions

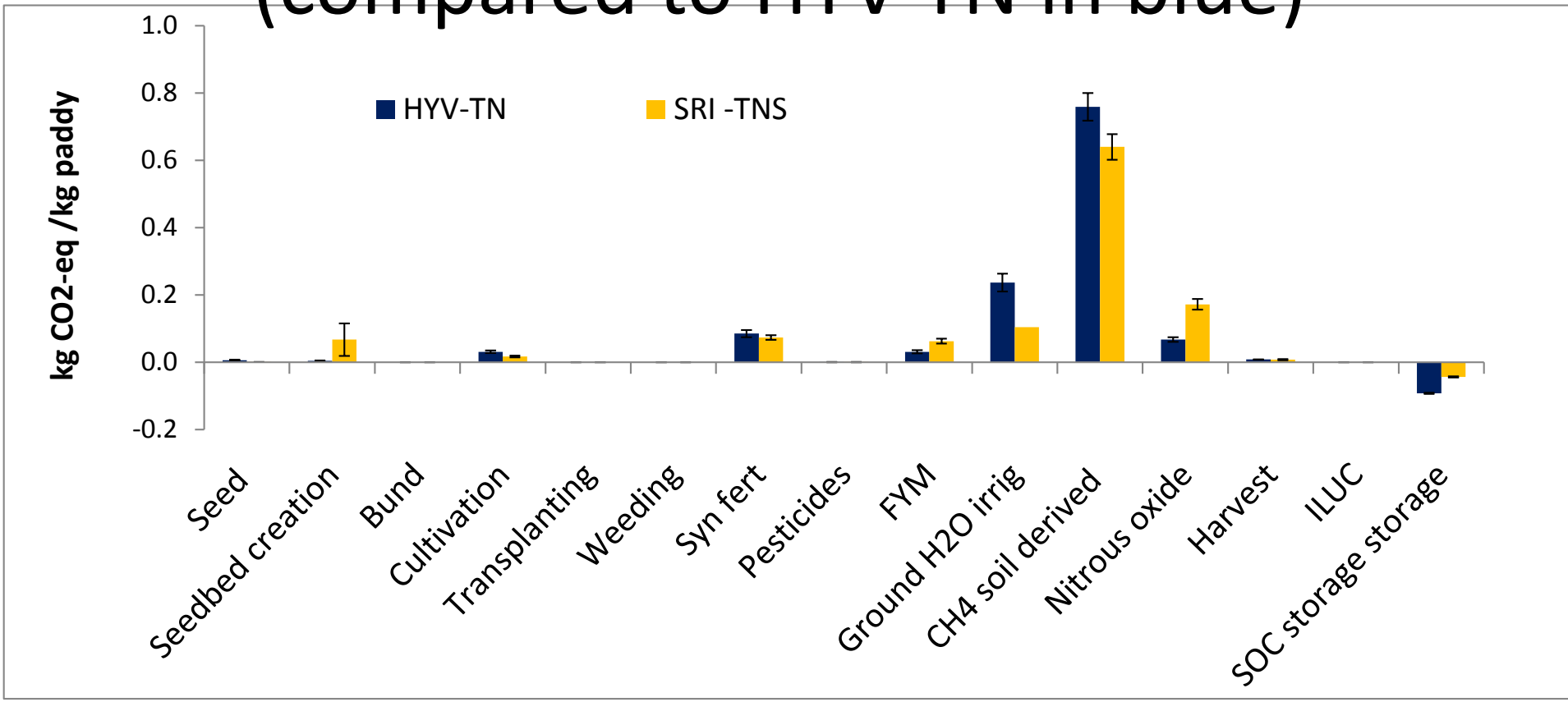


- Methane from HYV, SRI and Organic from **soils.** Rainfed methane from **draught animals.**
- Very little CO2 from rainfed as no irrigation and minimal use of tractors (some tractors were used for manure transport in rainfed, but most cultivation and harvesting did not use tractors/harvesters)

Cost structure – imputing cost forelectricity

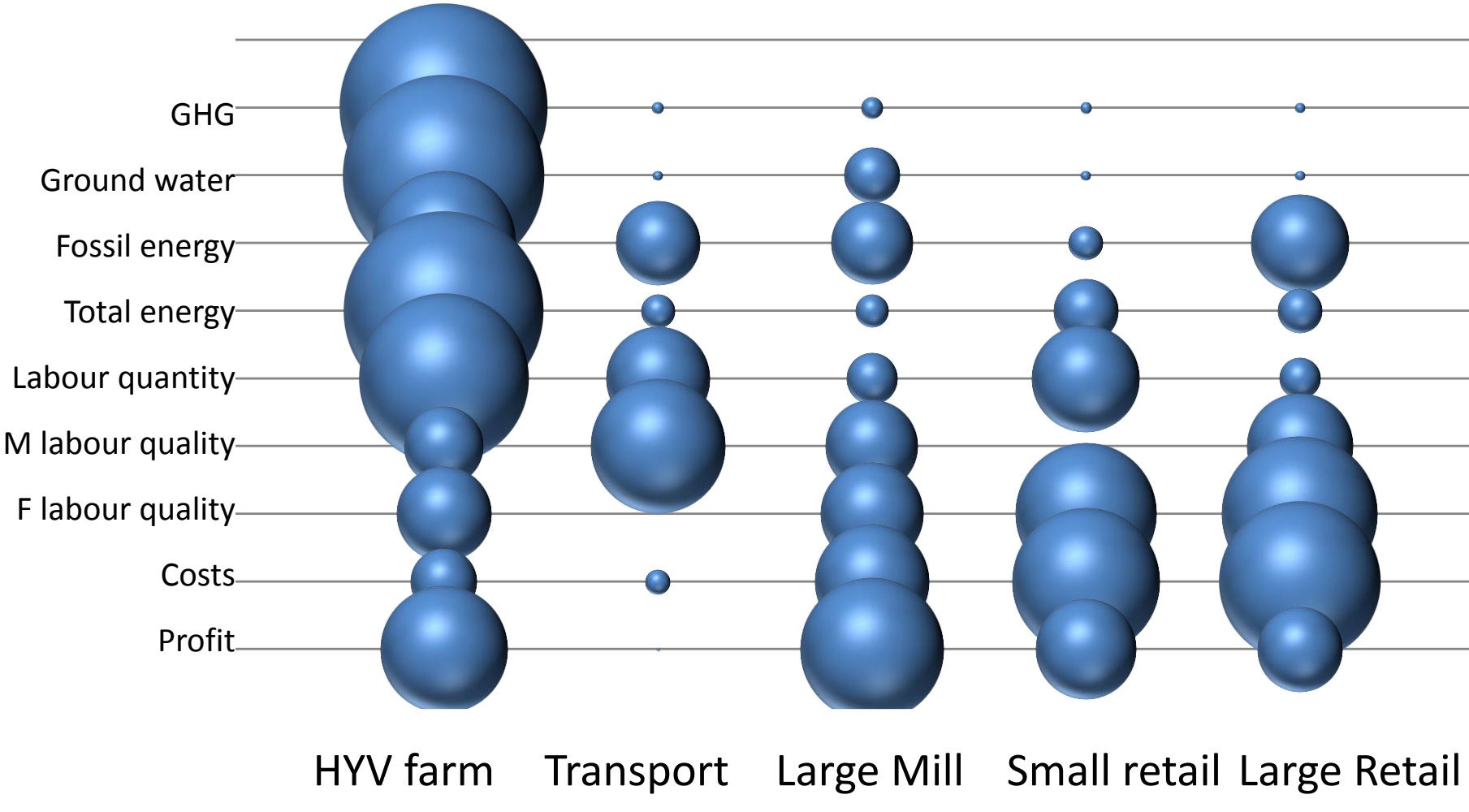


Constituent emissions SRI (compared to HYV TN in blue)



- **High methane emissions due to very high use of manure.**
- **Much lower irrigation based emissions.**

The role of each stage in the supply chain for each criteria



NEXT STAGE

- Mission accomplished with VCA-LCA -> methods developed; most profligate production technology and stages in the production-distribution system identified;

- Next questions: what to do with the substantive results; scoping alternatives as policy / public action – but how?

ECONOMISTS' METHOD: Social Cost Benefit Analysis

- Real costs to society of technological choices

- Stream of costs and benefits (weighted for social goals) and discounted from future to present by a rate representing the real cost of capital to society

SCBA – CRITICISMS

- Creation of an equilibrium that does not exist
- Technicised parameters that are political
- Narrow comparisons - in any case: no way of globally scoping alternatives
- Social diversity eschewed and dissent suppressed
- All values to be money values

Multi-Criteria Analysis: MCA

- Range of social agents deploy different decision parameters when evaluating choices
  e.g. for a car: cost, colour, shape, mpg, emissions, quality and safety
- A given technology may not perform equally well on all criteria
- Criteria may be non-commensurable, unreducible to $ e.g. those above
- A ‘Market in methods’ has developed in engineering/psychology over 5 decades…

MULTICRITERIA MAPPING

- Framing – what (multiple) objectives / trade-offs ?
- Options – whose? how scoped?
- Criteria – whose?
- Stakeholders- how theorised?
- Narratives – standardised info - what language? how visualised?
- Numerical scores for options, criteria and weighting of criteria – cognitive problems - directions - sensitivity analysis

MCM - Comments / Criticisms / Developments

- Tyranny of the policy decision vs the policy process – take the process to the field
- Sectoralisation of policy/technology fields–> 'implications'- engage in deliberation /dialogue – open out to wide discussion unrestrained by discipines
- Dynamic nature of the 'option' and their 'multipliers' and effect on the 'decision' – allow stakeholders their say
- No theory: role of expert consensus for stakeholder identification and expert choice of options – re-define the expert /expand concept

EXPERIMENT (1)

- **Framing:**
- **Importance of rice in food supply for cities**
- **Importance of rice for livelihoods**
- **Rice cultivation – environment interactions**
- **Rice and climate change – adaptation/mitigation**
- **Question of possibilities for rice production to reduce GHGs, s.t. livelihoods and costs**
- **Experiment: to evaluate options for producing a given quantity of food - according to subjective evaluations based on incommensurable data; also to suggest other options and other criteria**

EXPERIMENT (2)

- ‘ALTERNATIVES’ = Options – from LCA

i) pro-poor, rain-fed rice; ii) SRI; iii) solar pumping; iv) halving T and D losses v) own

- Criteria – from project

i) GHGs; ii) costs; iii) labour/livelihoods iv) own

- Stakeholders – theory? inclusivity ? language ? literacy ?

STAKEHOLDERS (1)

- SCOPING? AVOIDING BIAS? **population of stakeholders in Rice:** -**farmers, labourers, machine providers, cattle industry, wholesalers, rice millers, their labour, lorry owners, supermarket owners/managers, their labour) – market creators / advertisers – educators – insurance – planners – policy makers (IAS officers (finance, agriculture, labour, environment, industry, PDS), lobbies and business associations: CII, chambers of commerce, rice industry organisations) – politicians - NGOs and think tanks – labour – journalists**

->

- EXPERT KNOWLEDGE / English medium / individual interviews / mostly urban
- SITUATED KNOWLEDGE / Tamil medium / individual-small group interviews/mostly rural

STAKEHOLDERS (2) = 40

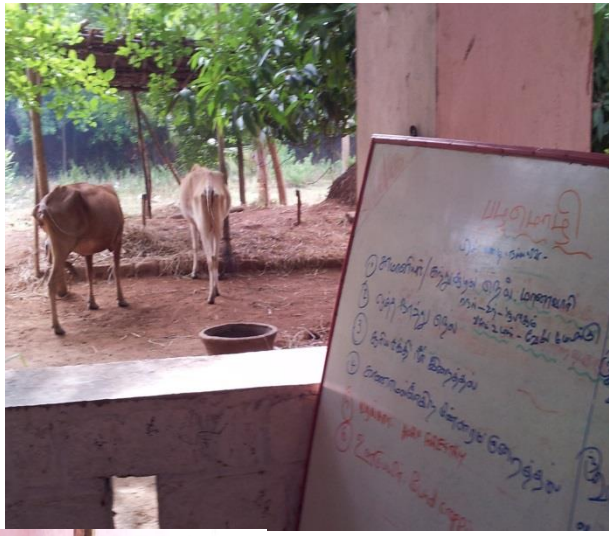
- EXPERT KNOWLEDGE
- **Rural/envtl science 8**
- **Rural NGOs 4**
- **Rural journalism 2**
- **Food/water industries 2**
- **Banks 2**
- **IAS policy/admin 2**

- **35% women**
- **+/- 2 hour dialogue each**
- **Selected through networks**

- SITUATED KNOWLEDGE
- **Big farmer 1**
- **Small farmer-labourer 9**
- **Landless labourer 10**

(4 = illiterate of whom 2 = also innumerate)

- **55% women**
- **1 -2 hour dialogue each**
- **Selected through NGO**




உற்பத்தி மற்றும்
உபயோக
செலவு
உலகை
சூடாக்கும்
வாயுக்கள்
குறைத்தல்
வேலை வாய்ப்பு:
பயிற்சி பெற்ற /
பயிற்சி இல்லாத
ஊழியர்கள்

ALTERNATIVES – identified through life cycle assessment

- **PRO-POOR, RAINFED RICE**

- SRI

Alternatives- contd

- SOLAR PUMPS

- REDUCING T AND D LOSSES

OPTIONS

OPTION	COSTS	YIELDS	GHGs	LIVELIHOODS/LABOUR
RAINFED RICE	33% of HYV/ha 90% per HYV/kg	2 t/ha (compd 5.2/ha HYV) (implcns for ILUC)	20% less than HYVs / kg	2.3 times more labour than HYVs per ha; 6 times more labour / kg
SRI	84% of HYV/ha 60% per HYV/kg	7 t/ha	<45% less than HYVs / kg	1.3 times more labour than HYVs per ha; Approx. same per kg
SOLAR PUMPS	High capital costs: but 86% subsidy	-	15-30% less depg on water table depth	Less unskilled labour but new repair/maintenance skills
T AND D LOSSES	Public cost recouped through reduced elec losses	-	14% reduction	No change in agriculture – more skilled labour for grid

CRITERIA

- COSTS : the option's impact on costs and returns/profitability of options - private versus social
- GHGS - the option's impact on waste in the form of gas – carbon di-oxide, methane and nitrous oxide;
- LABOUR – the option's impact on the quantity and quality of jobs – we split labour into 'unskilled' and 'skilled'

Scale: 0 = no good / worst ; 10 = best

Evaluating options by criteria: mean values (provisional)

OPTION	KNOWLEDGE GROUP	COST	GHGs	LABOUR unskilled	LABOUR skilled
RAINFED RICE	EXPERT	7.0	6.7	7.5	4.5
	SITUATED	7.7	8.3	6.3	3.5
SRI	EXPERT	6.9	6.0	5.6	6.9
	SITUATED	6.8	7.0	6.0	7.3
SOLAR PUMPS	EXPERT	4.2	7.2	3.9	6.6
	SITUATED	6.5	8.0	5.6	5.9
T AND D LOSSES	EXPERT	6.3	7.0	3.8	6.4
	SITUATED	7.2	6.8	4.9	6.9

WEIGHTING CRITERIA (provisional)

- KNOWLEDGE ECONOMY EXPERTS
- PRACTICAL EXPERTS

(Distribution of 100 'importance points')

KNOWLEDGE GROUP	COSTS	GHGs	LABOUR
EXPERT	25	32	43
SITUATED	37	28	34

MORE ON OUR WEBSITE

- http://www.southasia.ox.ac.uk/resources-greenhouse-gases-technology-and-jobs-indias-informal-economy-case-rice

Appendix – evaluating options by incommensurable criteria

Ranges and Modes

OPTION	KNOWLEDGE GROUP	RANGE/MODE/M	COST	GHGs	LABOUR UNSKILLED	LABOUR/ SKILLED
RAINFED RICE	EXPERT	RANGE	3 - 9	2 - 9	4 - 10	2 - 8
	SITUATED	RANGE	6 - 10	6 - 10	3 - 10	1- 8
	EXPERT	MODE	8	8	8	7
	SITUATED	MODE	9	10	7	3
SRI	EXPERT	RANGE	5 - 9	2 - 9	4 - 9	3 - 9
	SITUATED	RANGE	5 – 10	5 - 10	4 - 9	5 – 10
	EXPERT	MODE	6	8	5	8
	SITUATED	MODE	6	5	4	8
SOLAR PUMPS	EXPERT	RANGE	1 - 10	3 -10	1 - 9	5 -8
	SITUATED	RANGE	2 - 8	5 - 9	3 – 9	1 – 10
	EXPERT	MODE	1	7	5	8
	SITUATED	MODE	7	9	3	8
T AND D LOSSES	EXPERT	RANGE	1 - 10	3 – 10	0 - 8	0 – 8
	SITUATED	RANGE	1 - 9	6 - 8	1 - 9	1 – 9
	EXPERT	MODE	10	6	5	8
	SITUATED	MODE	7	6	7	8