D4N 2024
DELIVERING FOR NUTRITION IN SOUTH ASIA
CONNECTING THE DOTS ACROSS SYSTEMS
December 4, 2024 • Colombo, Sri Lanka

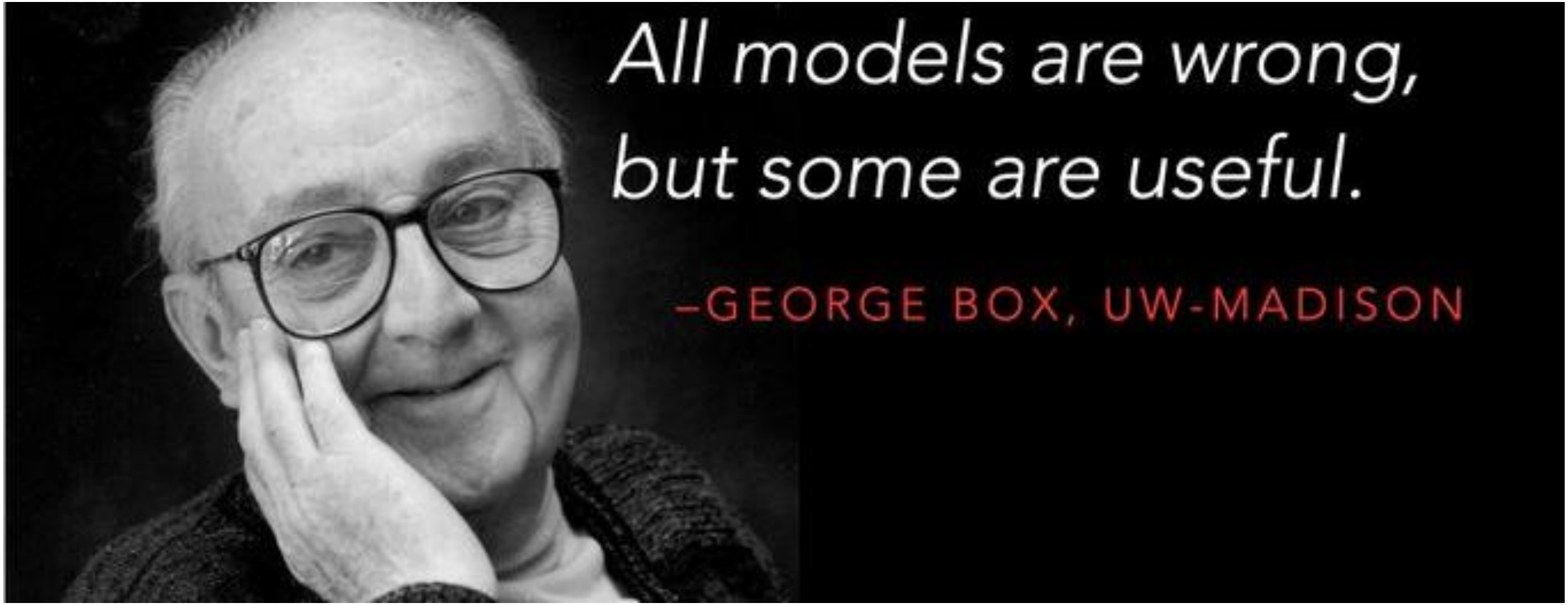
An inclusive agri-food systems transformation pathway for India

Vartika Singh
Natural Resources and Resilience
International Food Policy Research Institute

Acknowledgements

Prantika Das, Miodrag Stevanović , Benjamin Leon Bodirsky, Felicitas Beier, Florian Humpenöder, Debbora Leip, David Meng-Chuen Chen, Michael S. Crawford, Patrick von Jeetze, Edna J. Molina Bacca, Bjoern Soergel, Marco Springmann, Jan Philipp Dietrich, Alexander Popp, Ranjan Kumar Ghosh and Hermann Lotze-Campen

Key takeaway!



Agri-food systems in India from 35000 feet

- Strong dependence on the agricultural sector
  - Food demand
  - Employment
  - Livestock feed requirements
- 14.5% of India's population is **under-nourished**, high rates of stunting (38%) for pre-schoolers and underweight (23%) among adult women
- Healthy diets **not affordable** for over 2/3rds of the population
- Agriculture sector (including livestock) emits **18% of Greenhouse Gas Emissions** (causing global warming)
- **80% of freshwater** used for production of cereal crops (rice and wheat)

Agri-food systems in India:

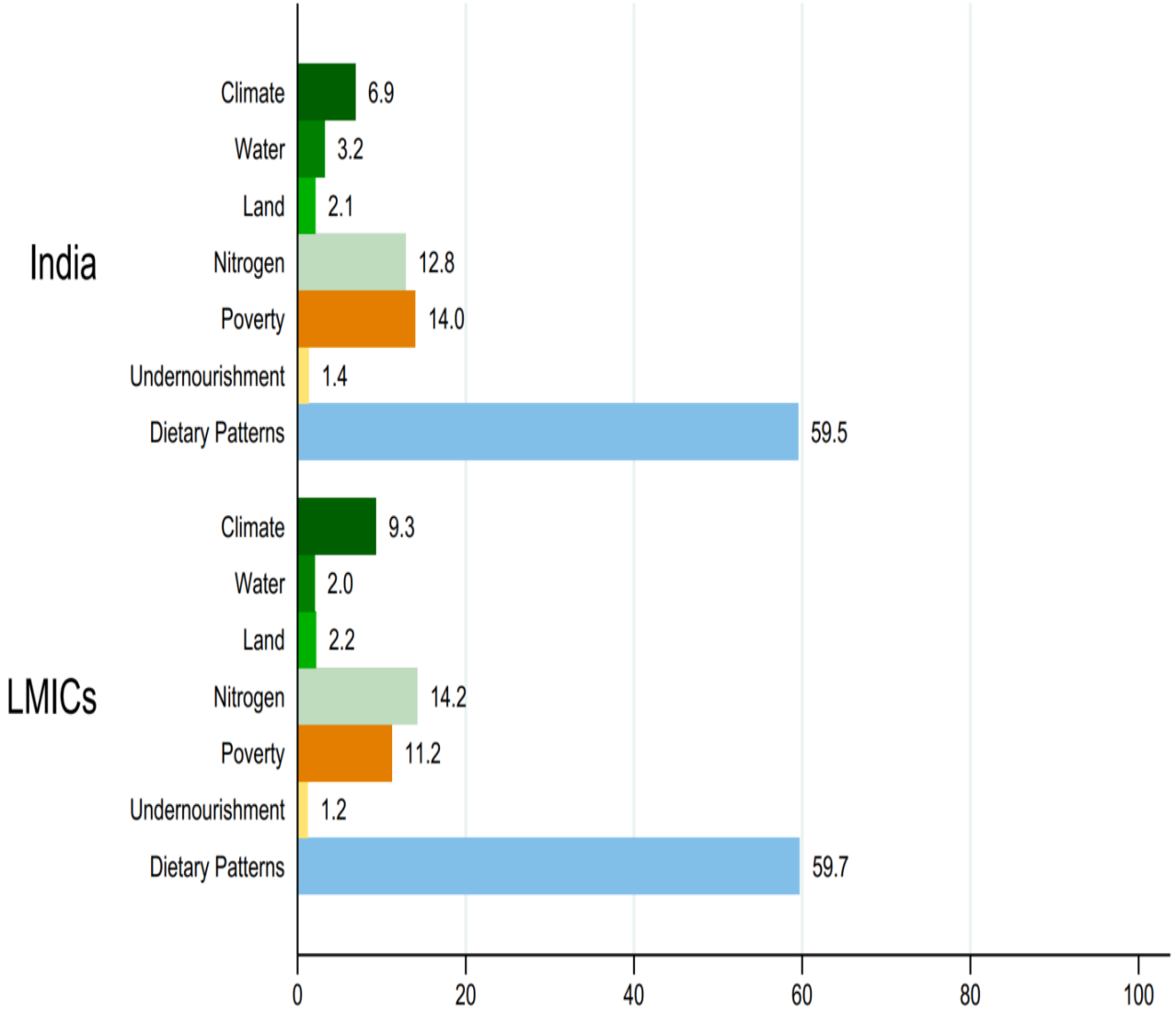
- Generate hidden economic costs to the tune of 1.17 trillion USD 2020 PPP (~220 trillion INR)
- Social, Economic, Environmental and Health costs
- Largest share due to **health costs (0.73 trillion**)
- Total PDS budget was 2.42 trillion INR in 2020-21

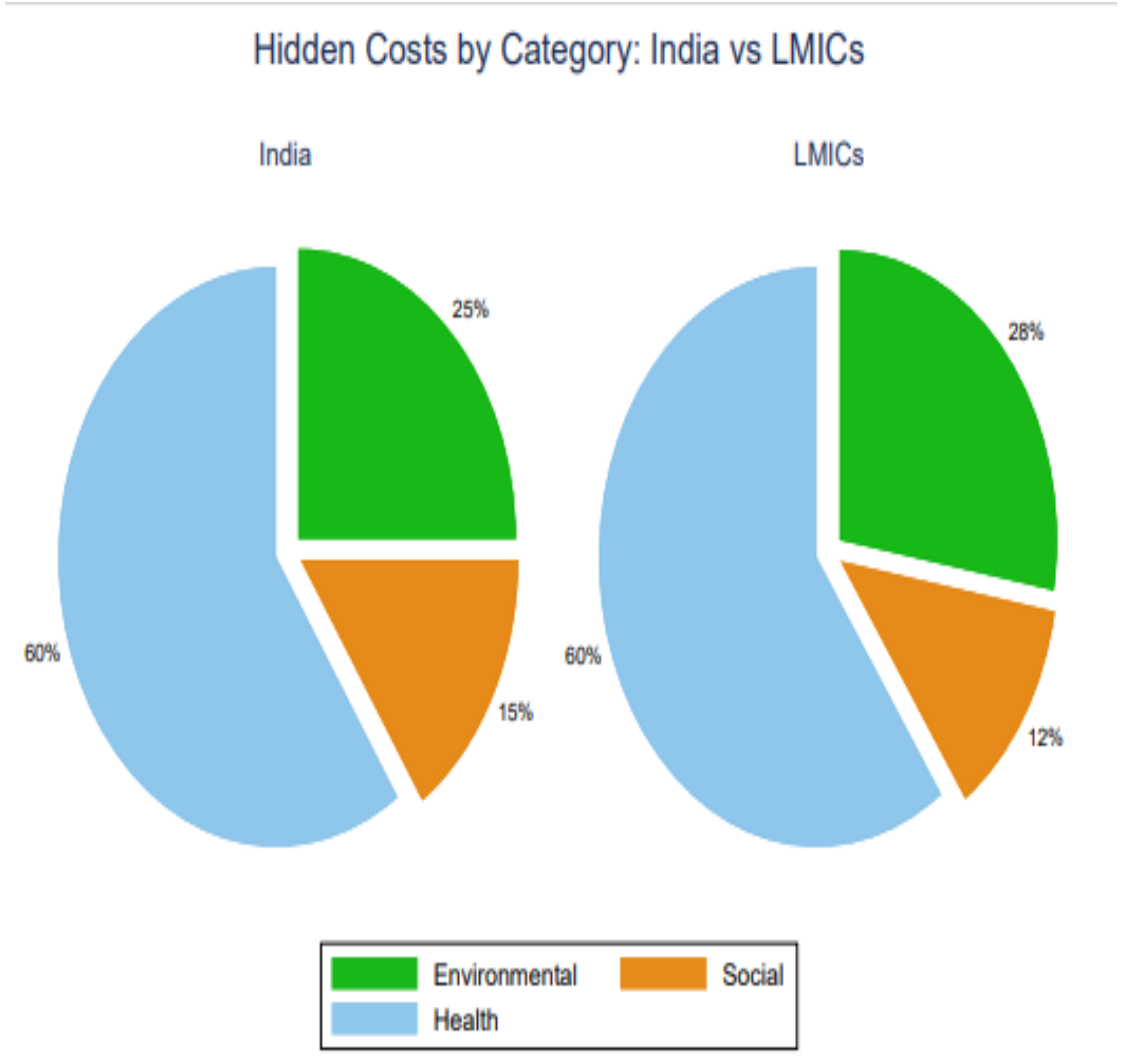
Additional challenges ranging from

- increasing pressure on natural resources (soils, water, air, forests)
- climate change
- fragmenting land holdings,
- increasing urbanization,
- and high rates of malnutrition amongst children

Agri-food systems in India:

- Generate hidden economic costs to the tune of 1.17 trillion USD 2020 PPP (~220 trillion INR)
- Social, Economic, Environmental and Health costs
- Largest share due to **health costs (0.73 trillion**)
- Total PDS budget was 2.42 trillion INR in 2020-21





Source: FAO, 2023

Burden of disease – India

DALY (Disability Adjusted Life Year) = *Years lived with disability + Years of Life lost compared to expected life years*

What risk factors drive the most death and disability combined?

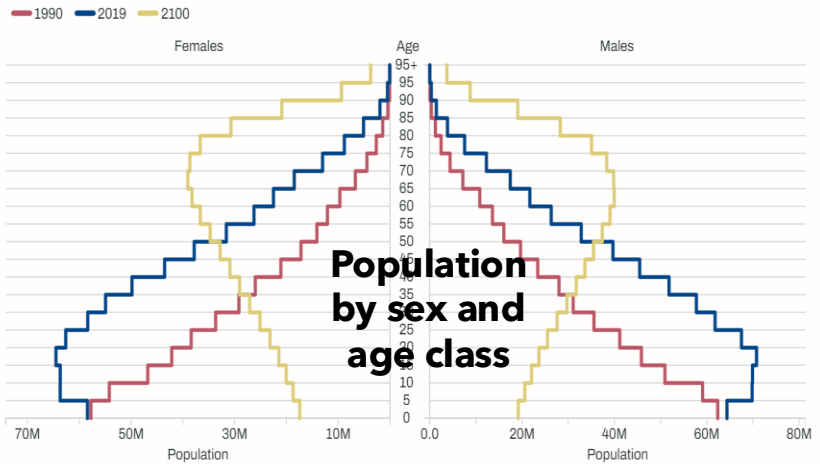
Risk factor exposure by age, sex, and location

Population dynamics

Life expectancy

	Past	Past	Forecasted
	1990	2017	2100
Females	60.4	70.2	80.7
Males	58.9	67.8	78

The Global Burden of Disease (GBD) estimates disability-adjusted life-years (DALYs) for 87 risk factors and combinations of risk factors for 204 countries. This is led by the Institute for Health Metrics and Evaluation (IHME) at the University of Washington, Seattle (USA).



Population by sex and age class

What risk factors drive the most death and disability combined?

- Metabolic risks
- Environmental/occupational risks
- Behavioral risks

Risk	2009 rank	2019 rank	Change in DALYs per 100k, 2009–2019
Malnutrition	1	1	↓ −4,477.9
Air pollution	2	2	↓ −941.4
High blood pressure	4	3	↑ +189.9
Tobacco	5	4	↓ −27.2
High fasting plasma glucose	7	5	↑ +682.9
Dietary risks	6	6	↑ +255.6
High body-mass index	10	7	↑ +537.0
WaSH	3	8	↓ −1,486.2
High LDL	8	9	↑ +146.2

Can an agri-food systems' transformation reduce some of these impacts?

Food Systems Economics Commission (FSEC)

FSEC

The Commission

3 Co-chairs

Responsible for strategic and scientific leadership

15 Commissioners

Provide input to research direction,
content development

Secretariat, Research & Analysis

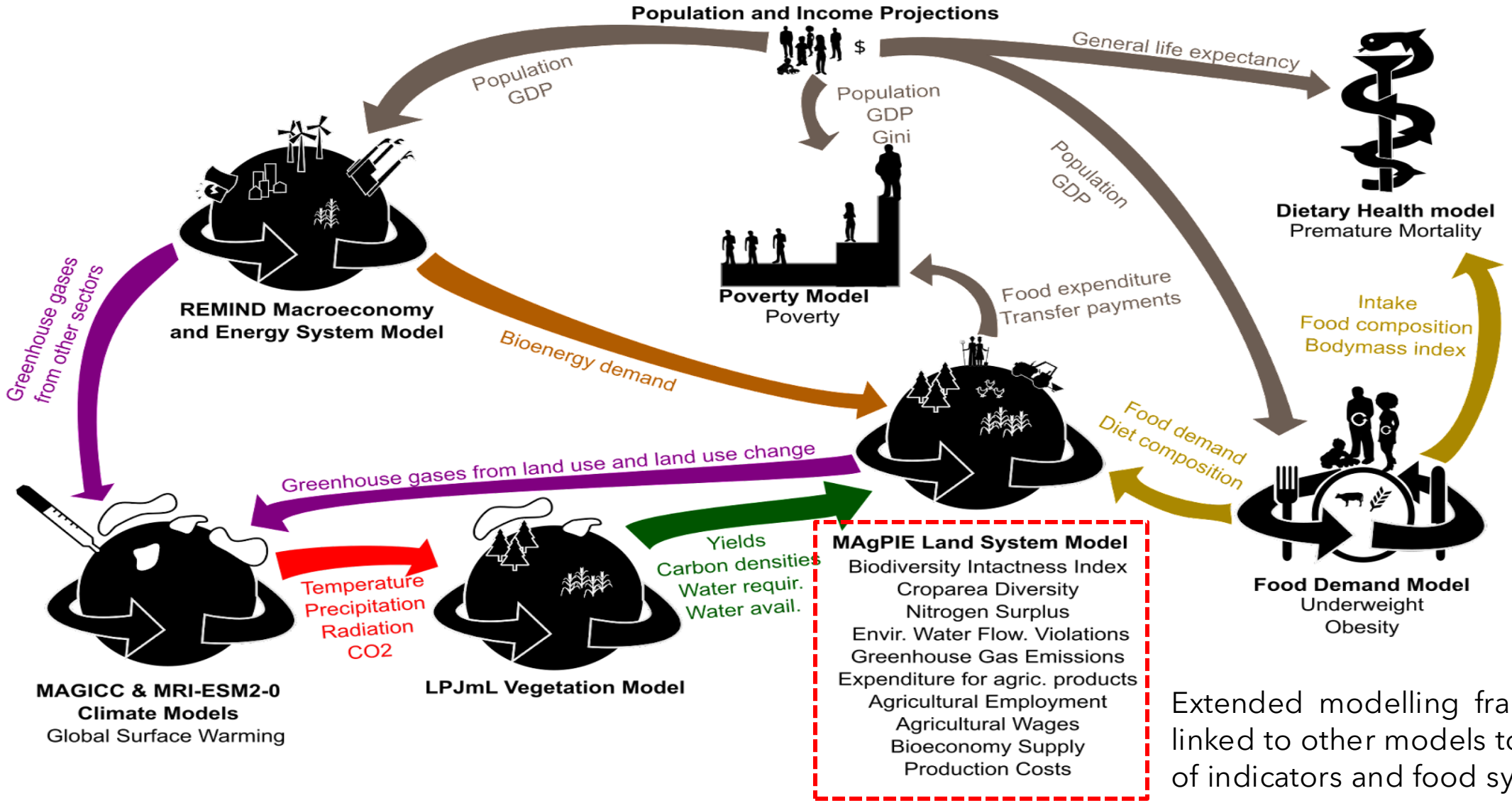
EAT runs the Programme Management Office, responsible for 1) coordinating activities of the commission, and 2) communications and engagement.

PIK leads the technical workstream on integrated economic
assessments and the costs of action/inaction.

Food and Land Use Coalition leads the technical workstream on policies and political economy.

Foodsystemeconomics.org

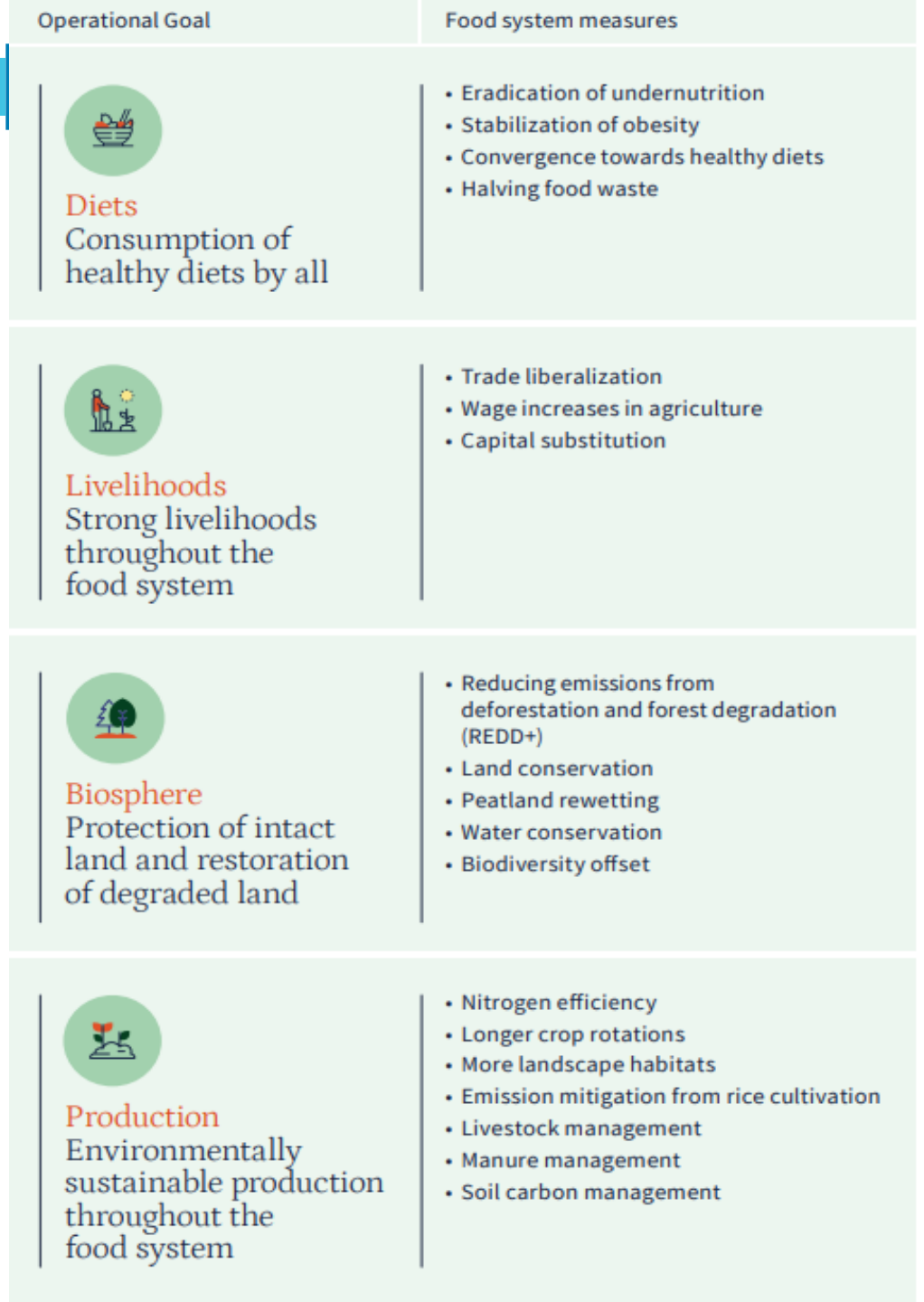
Methodology



Extended modelling framework – soft linked to other models to answer multitude of indicators and food system goals

Food system measures

- Demand and supply side measures
- 23 Food System Measures (FSMs) and 5 transformations outside the food system
- Each FSM is evaluated individually and in packages
- 5 packages align with the UNFSS Action Tracks - diets, livelihood, biodiversity protection, agriculture management, and cross sector transformation



Operational Goal	Food system measures
Diets Consumption of healthy diets by all	• Eradication of undernutrition • Stabilization of obesity • Convergence towards healthy diets • Halving food waste

Healthy diets in this case is the EAT Lancet Recommendations. NIN recommendations have also been tested

Dimensions and indicators of food system transformation evaluated

Total 14 indicators evaluated

Health

H :

- **Underweight population (in million people)**
- **Obesity (in million people)**
- **Premature Mortality (million years of life lost)**

Social

S :

- **Expenditure on food products (USD/person/year)**
- **Poverty (Million people below 3.20 USD/day)**
- **Agricultural employment (million people)**

Environmental

E :

- **Nitrogen surplus**: (Mt Nr/year)
- **Crop diversity (Shannon index)**: agriculture/ unmanaged grassland an agriculture / forest conversions (ecosystem services)
- **Biodiversity Intactness Index**
- **Water environmental flow violations:** from agriculture (e.g., irrigation) (in km3/year)
- **AFOLU GHG emissions**: N2O, CO2, and CH4 emissions from farms, pre-and post- production and land use change

Economic

E :

- **Bioeconomy supply (in billion USD 05/year)**
- **Production costs (in billion USD 05/year)**

Health H :

- Underweight population (in million people)
- Obesity (in million people)
- Premature Mortality (million years of life lost)

Results

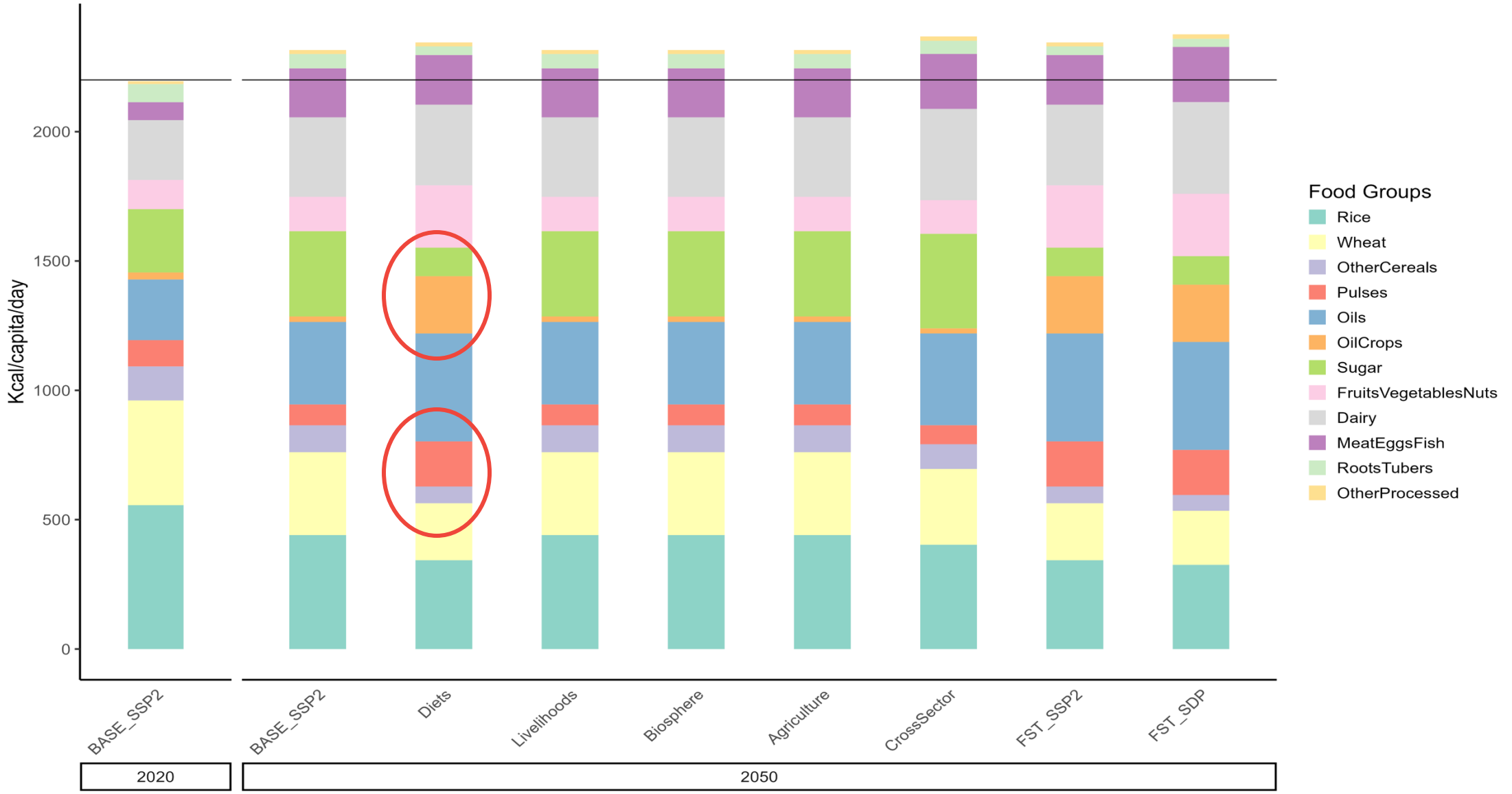
Scenario and Main Results heatmap

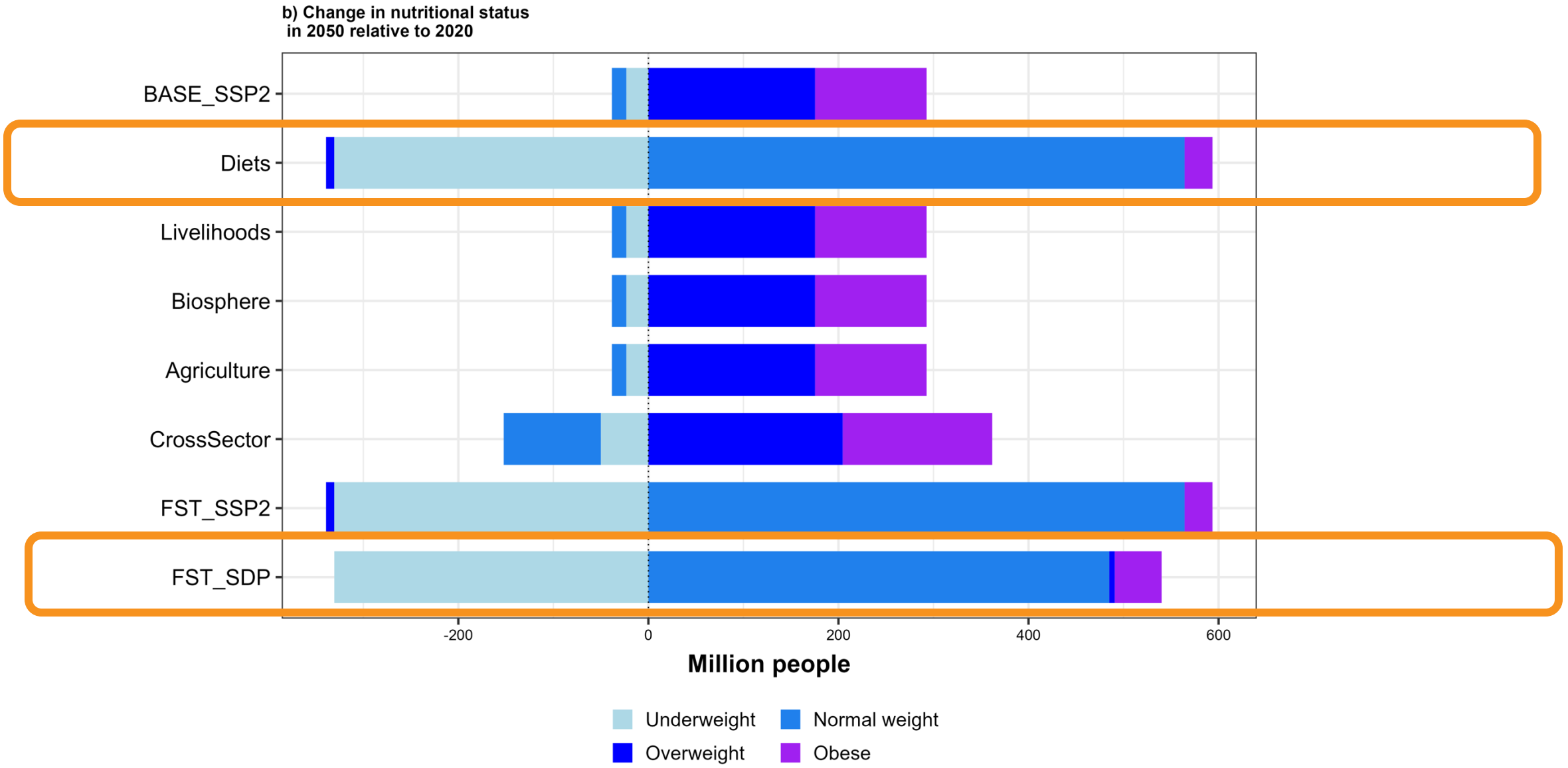
Relative change: best, better, none, worse, worst

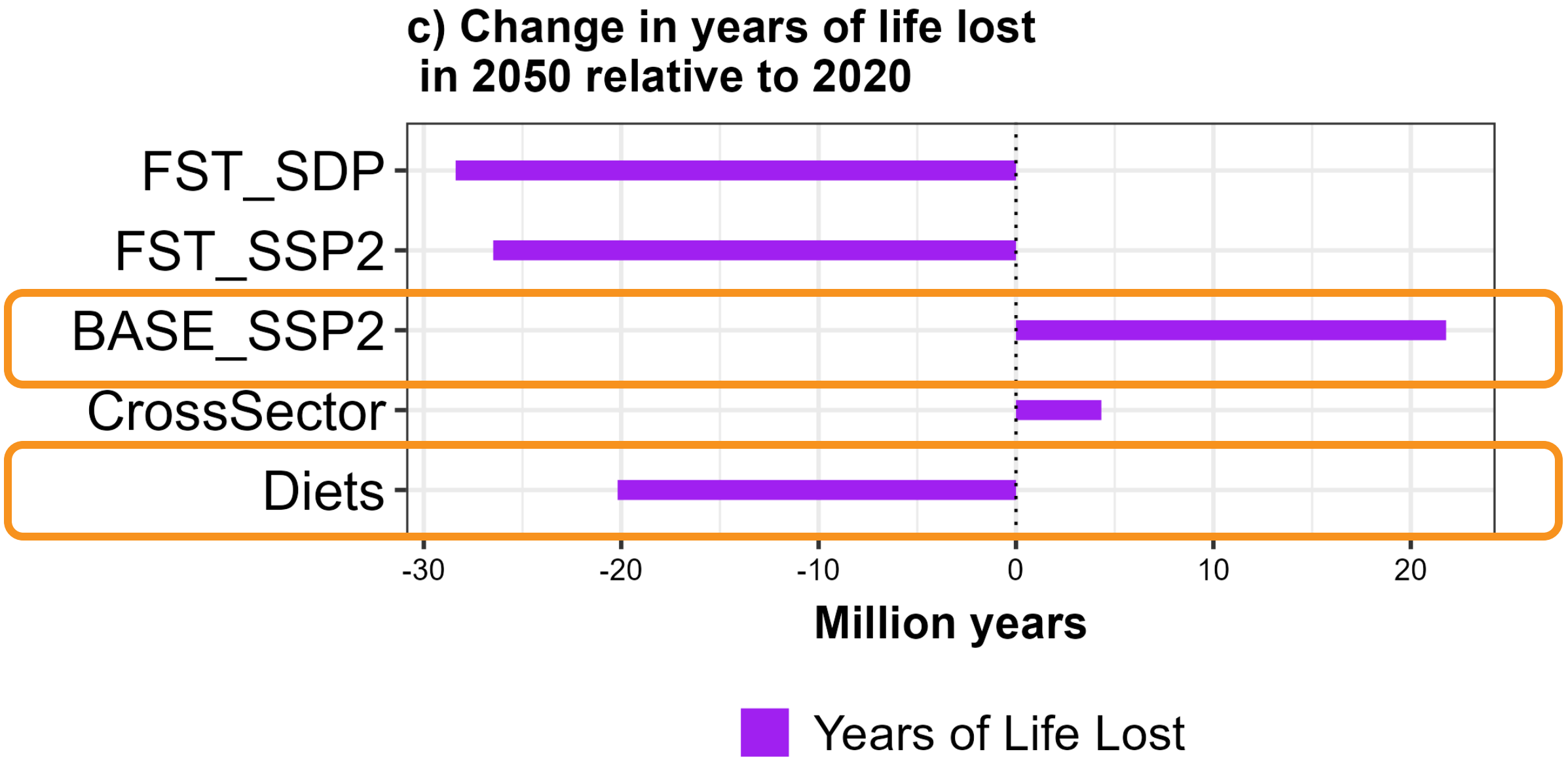
Diets	Health			Environment						Inclusion				Economy	
	Underweight Mio people	Obesity Mio people	Premature Mortality Mio years of life lost	Cropland Landscapes Biodiv. Intactness Index	Hotspot Landscapes Biodiv. Intactness Index	Croparea Diversity Shannon Index	Nitrogen Surplus Mt N/yr	Env. Water Flow Violations km3/yr	AFOLU GHG Emissions GtCO2eq/yr	Expenditure on Ag. Products USD/person/yr	Poverty Mio people below 3.20$/day	Ag. Employment Mio people	Ag. Wages Index rel. to 2010	Bioeconomy Supply Billion US$05/yr	Production Costs Billion US$05/yr
BASE_SSP2	307	176	72	67.68	85.73	2.28	32	7	1.5	531	189	96	3.54	31	660
Diets	0	88	30	67.62	85.47	2.39	31	27	1.4	581	192	107	3.54	31	713
LowProcessed															
HighLegumes			70	67.64	85.67	2.21	31	6	1.5	548	190	97	3.54	31	674
HighVegFruitsNuts			62	67.33	85.79	2.37	33	14	1.5	606	195	113	3.54	32	748
HalfOverweight	307	88	65	67.81	85.71	2.3	31	5	1.5	522	189	94	3.54	31	643
NoUnderweight	0	176	41	67.94	85.26	2.24	32	14	1.5	556	193	99	3.54	31	691
LowFoodWaste			72	67.84	85.69	2.37	30	7	1.4	492	187	90	3.54	30	612

a) Diet compositions by food groups across scenarios

Solid line represents 2200 kcal




b) Change in nutritional status
in 2050 relative to 2020
BASE_SSP2
Diets
Livelihoods
Biosphere
Agriculture
CrossSector
FST_SSP2
FST_SDP
-200
0
200
400
600
Million people
Underweight
Normal weight
Overweight
Obese


c) Change in years of life lost
in 2050 relative to 2020
FST_SDP
FST_SSP2
BASE_SSP2
CrossSector
Diets
-30
-20
-10
0
10
20
Million years
Years of Life Lost

- Food choices in India are heterogeneous and largely driven by cultural factors(Custodio et al., 2021; Samaddar et al., 2020)

- PMR and YLL reduce most due to consumption of fruits, vegetables, and nuts, pulses and reduction in high fat, salt and sugars

- Measures that only focus on total calorie intake may not result in improved dietary quality – need to target protein-energy malnutrition (also suggested in Chaudhary et al., 2022; Meenakshi, 2016)

Conclusion

Takeaways

- Gains are to be had when both science and policy siloes converge
  - **Co-benefits with 10 indicators (**health, environmental, agri employment and wages, economic costs)
  - Trade-offs in 4 indicators (high food expenditures, high economic costs)

- Food systems transformations also need nudges from the outside

  (e.g., population growth, income driven socio-economic developments, energy transition including bioenergy)

- Development of tools and methods that conduct such integrated analysis are the need of the hour

Limitations

- High-level datasets used due to lack of spatially explicit high-frequency data at lower resolutions
- Inability to disaggregate results at sub-national levels
- Nations are considered more homogenous than they are! (modelling limitation)
- Policy priorities may not be adequately represented all sectors, some may have been excluded (such as organic farming etc..) due to lack of data
- Analysis suggests what will happen when a policy measure is implemented, but not how the measure will be implemented or the costs of implementation of those measures

This work has been supported by the Food System Economics Commission (FSEC), funded by the IKEA Foundation. The Indian Institute of Management Ahmedabad (IIMA) and Potsdam Institute for Climate Change Research (PIK) jointly coordinate activities under this project for India. We also acknowledge support from the CGIAR Initiative for Nexus Gains

Find me here

Vartika Singh