Towards sustainable transitions for the global food system

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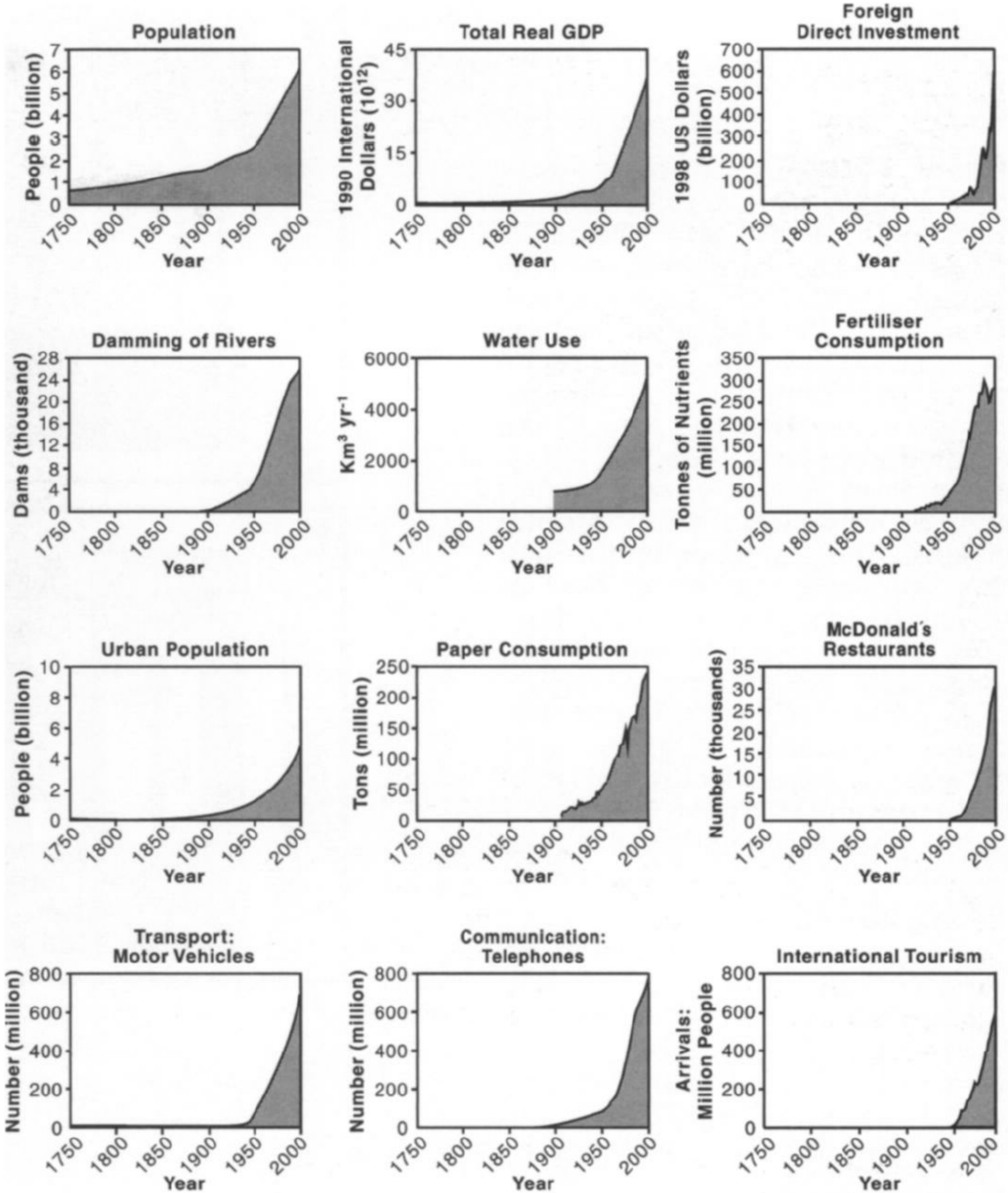
The Anthropocene…

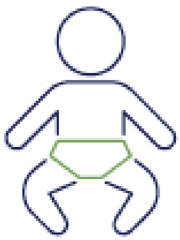
…the age of human - induced global change



Steffen et al. 2011

The key issues

Malnutrition

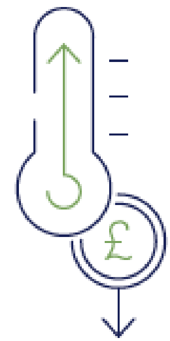


More than **200 million** children under five still face a life adversely affected by early years of undernutrition.[3]

NCDs and their costs

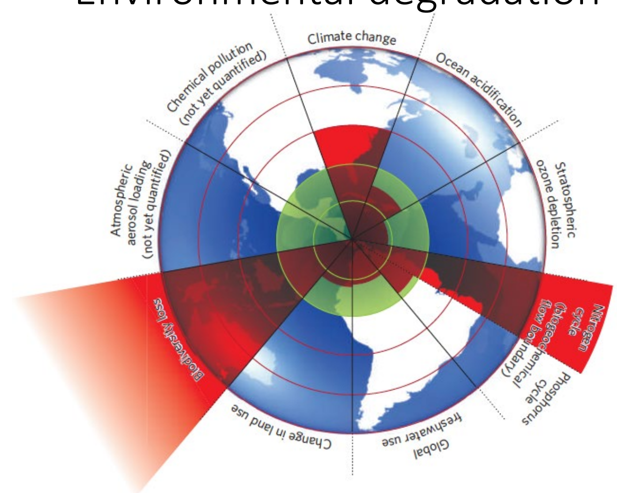
The burden of diet-related disease is highest in LMICs; for diabetes alone, by 2030 (assuming present trends) the annual economic impact for East Asia and the Pacific region is expected to reach almost **US$800 billion,** and **US$52 billion** in sub-Saharan Africa.[4]

Climate change



A low-income country with an annual average temperature today of **25°C** could see a fall in national economic growth (Gross Domestic Product or GDP) of **1.2%** for each **1°C** increase in temperature.[8]

Environmental degradation

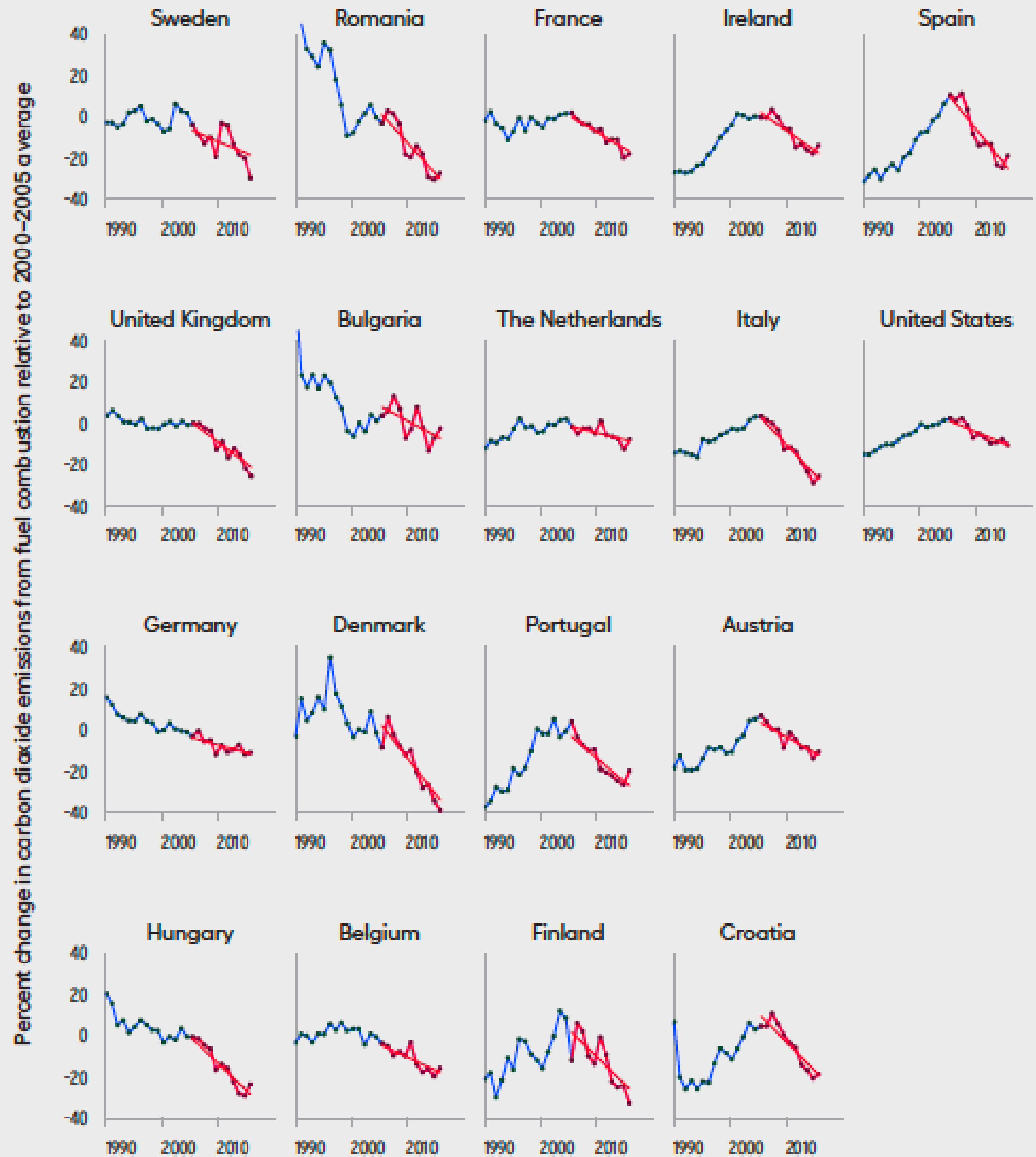


+ power asymmetries and policy distortions!

Rockstrom et al 2009, Rosenzweig et al. 2020, GLOPAN 2020

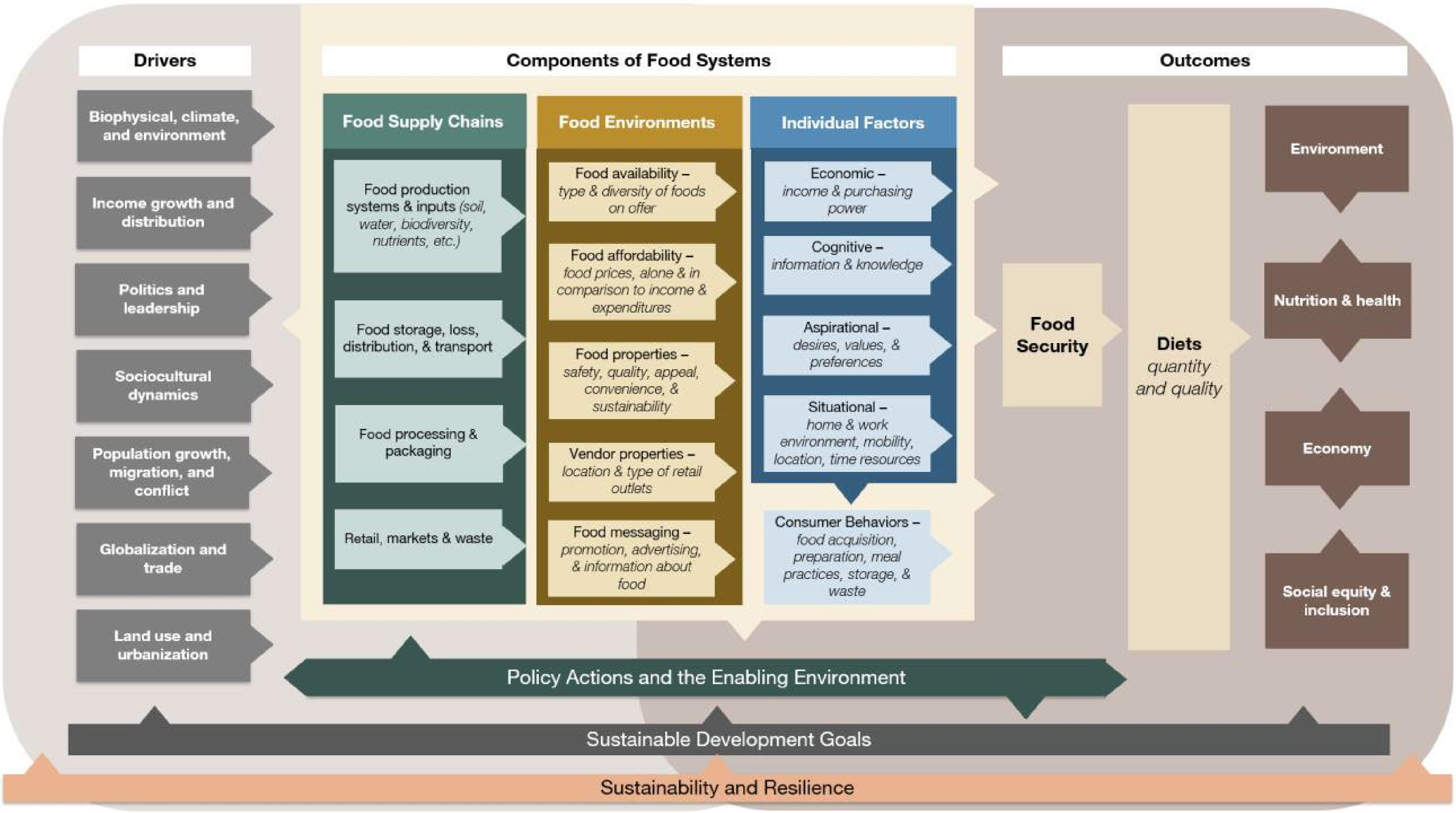
Energy transitions occurring in some countries

Investment
Legislation
Regulation
Targets
Subsidies



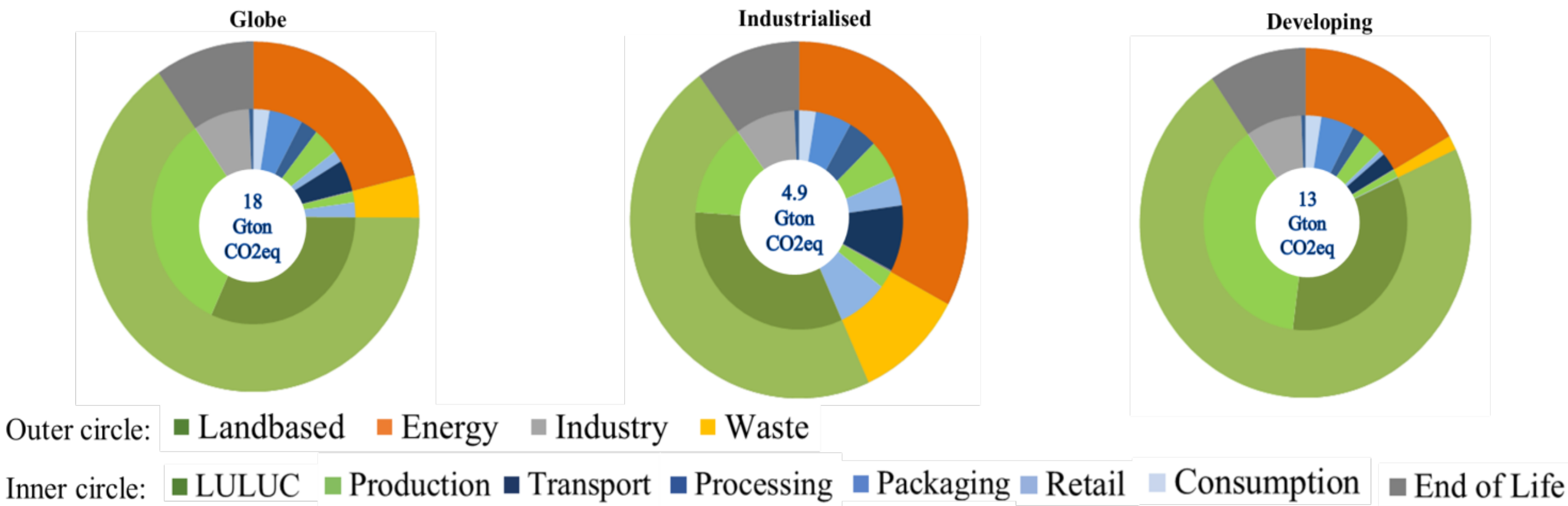
HDR 2020

The food system



Fanzo et al. 2021 Food Policy

Emissions from global food systems

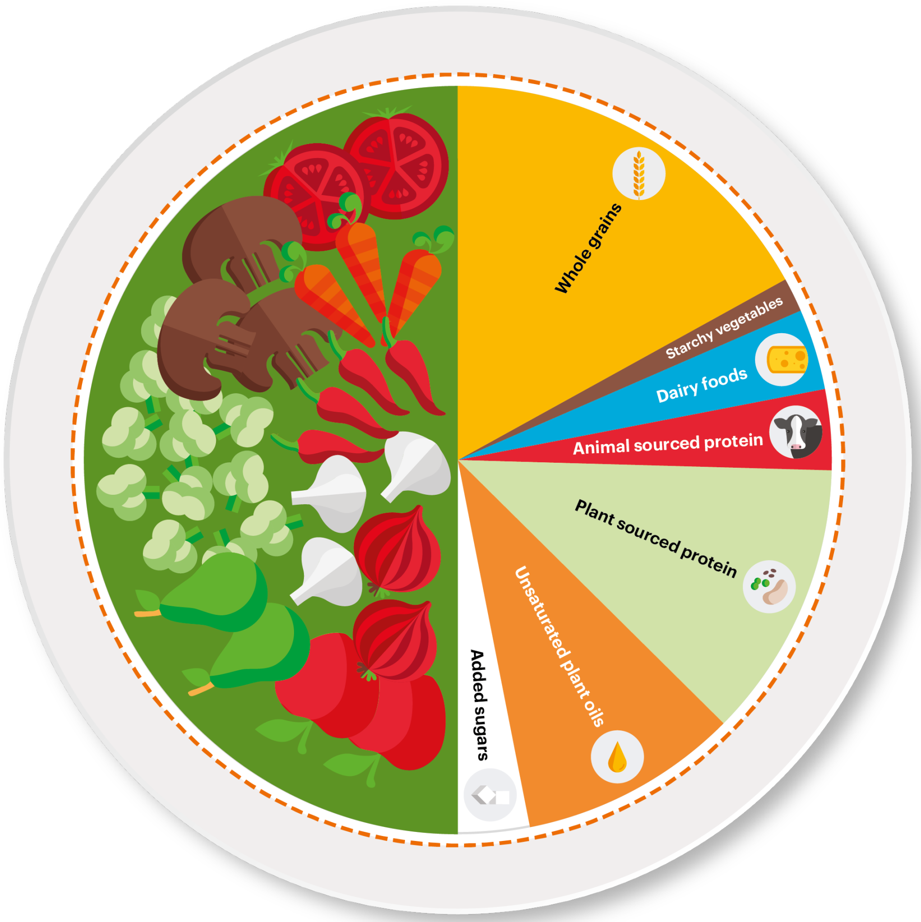


Crippa et al. Nature Food 2021

21-37% of anthropogenic emissions – Rosenzweig et al 2020
30-40% of food is wasted – SOFA 2019
70% of consumptive water use – Heinke et al 2020
Land use change major cause of biodiversity decline – Leclere et al. 2020

Target 1 – **Healthy Diets**

2500 kcal/day



EAT-Lancet: Not only about diets, increases in productivity and waste reduction essential for achieving targets

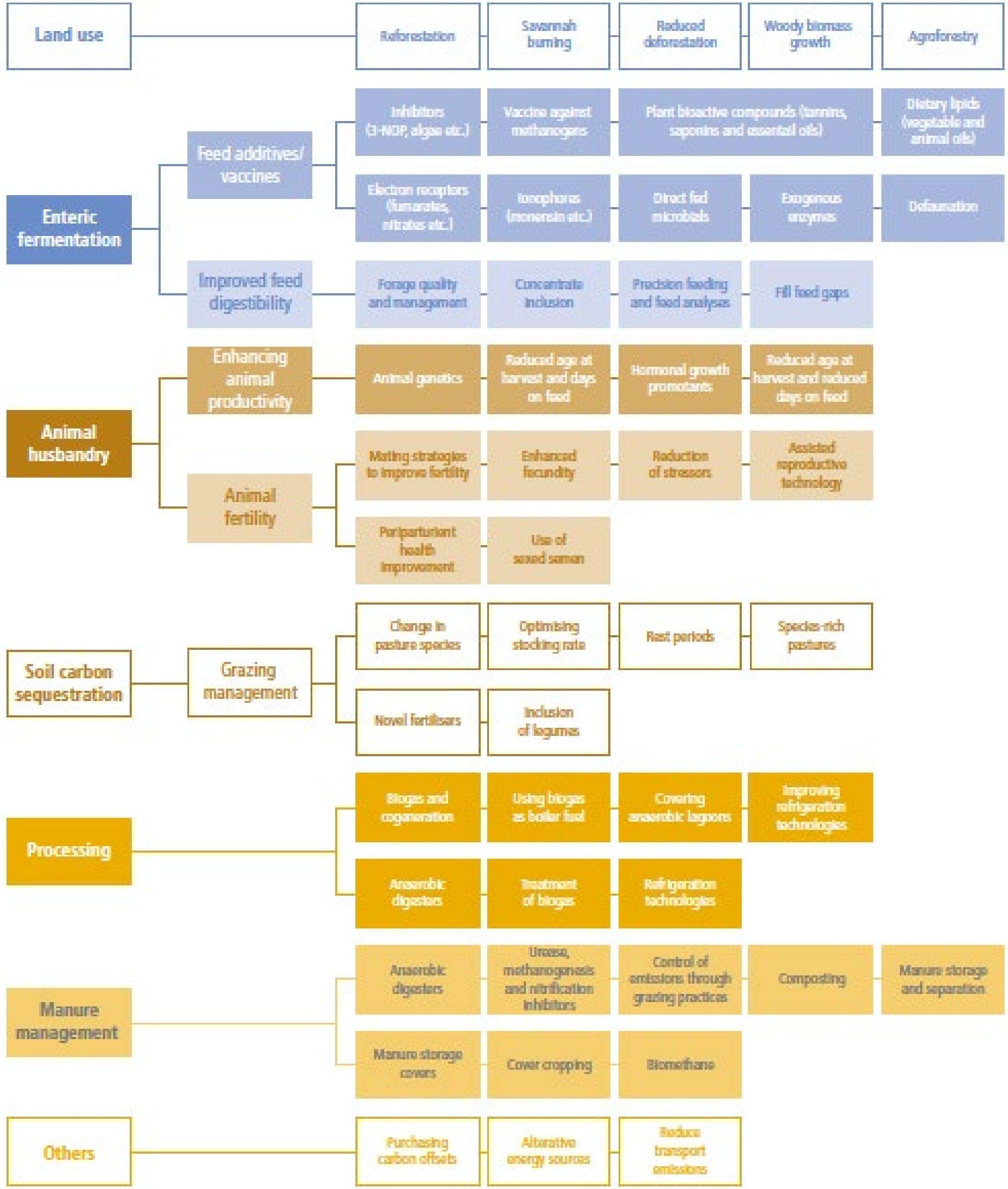
Scenarios

			GHG emissions	Cropland use	Water use	Nitrogen application	Phosphorus application	Biodiversity loss
Food production boundary			5.0 (4.7–5.4)	13 (11.0–15.0)	2.5 (1.0–4.0)	90 (65.0–140.0)	8 (6.0–16.0)	10 (1–80)
Baseline in 2010			5.2	12.6	1.8	131.8	17.9	100–1000
Production (2050)	Waste (2050)	Diet (2050)						
BAU	Full waste	BAU	9.8	21.1	3.0	199.5	27.5	1,043
BAU	Full waste	Dietary shift	5.0	21.1	3.0	191.4	25.5	1,270
BAU	Halve waste	BAU	9.2	18.2	2.6	171.0	23.2	684
BAU	Halve waste	Dietary shift	4.5	18.1	2.6	162.6	21.2	885
PROD	Full waste	BAU	8.9	14.8	2.2	187.3	25.5	206
PROD	Full waste	Dietary shift	4.5	14.8	2.2	179.5	24.1	351
PROD	Halve waste	BAU	8.3	12.7	1.9	160.1	21.5	50
PROD	Halve waste	Dietary shift	4.1	12.7	1.9	151.7	20.0	102
PROD+	Full waste	BAU	8.7	13.1	2.2	147.6	16.5	37
PROD+	Full waste	Dietary shift	4.4	12.8	2.1	140.8	15.4	34
PROD+	Halve waste	BAU	8.1	11.3	1.9	128.2	14.2	21
PROD+	Halve waste	Dietary shift	4.0	11.0	1.9	121.3	13.1	19

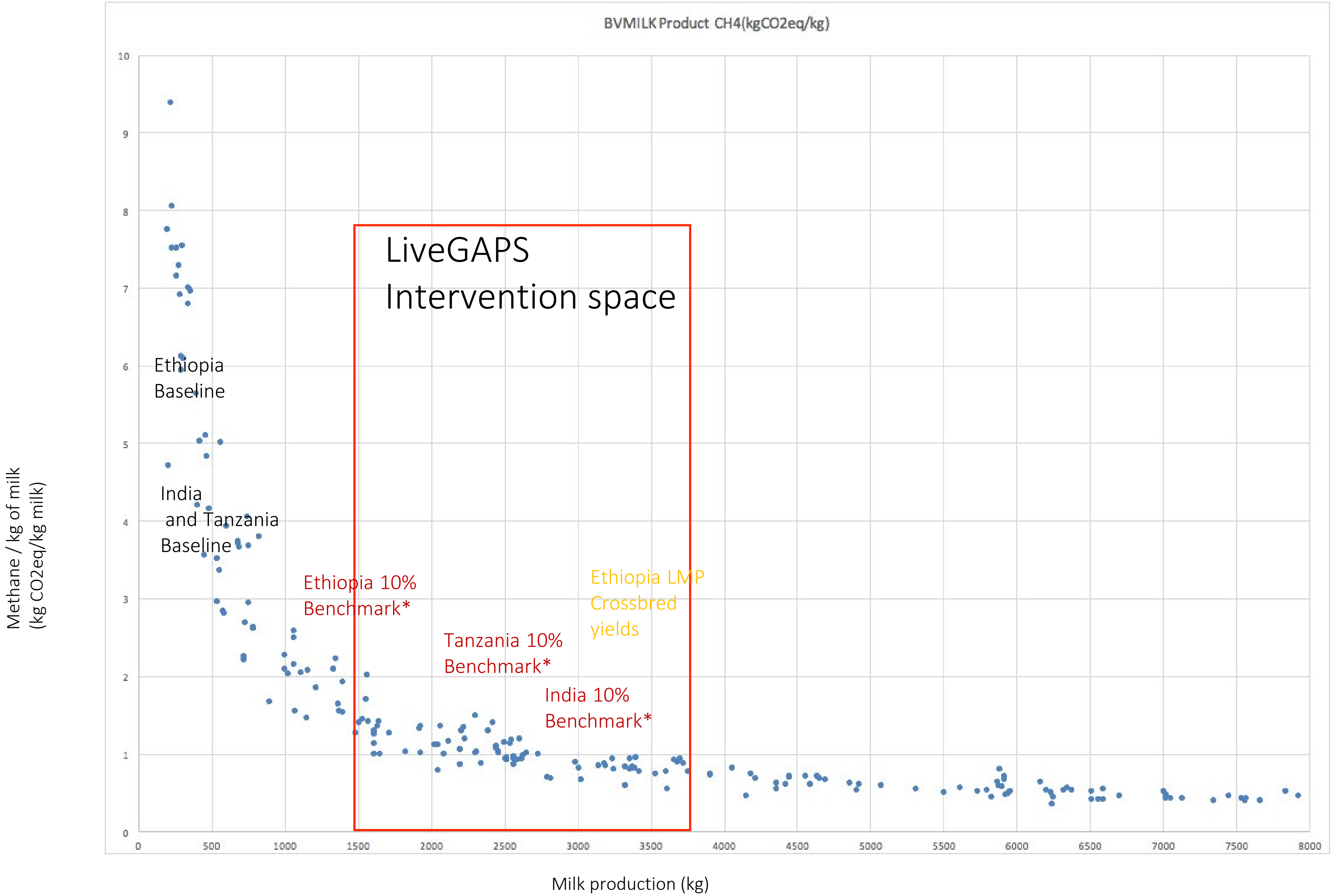
Willett et al. 2019

Mitigation practices in livestock systems

IPCC SRCCL 2020



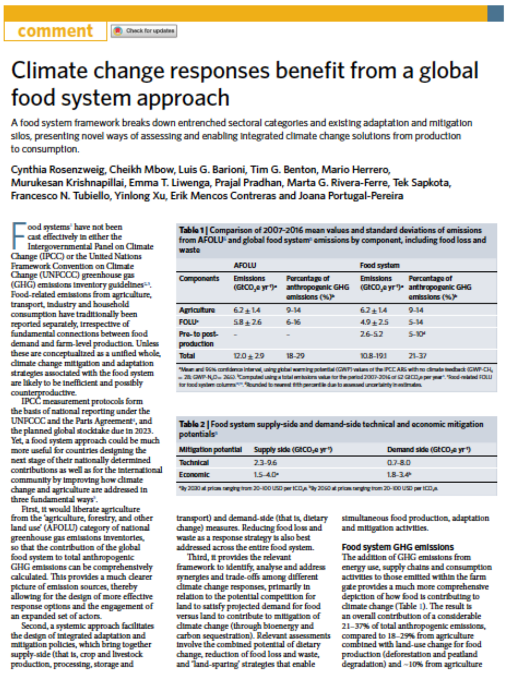
Putting it in the BMGF context - The LiveGAPS data



*10% benchmark – emissions intensities of the top 10% of smallholder producers

Herrero et al. 2019 for BMGF

Mitigation, adaptation and co-benefits of food systems responses
How fast, how soon?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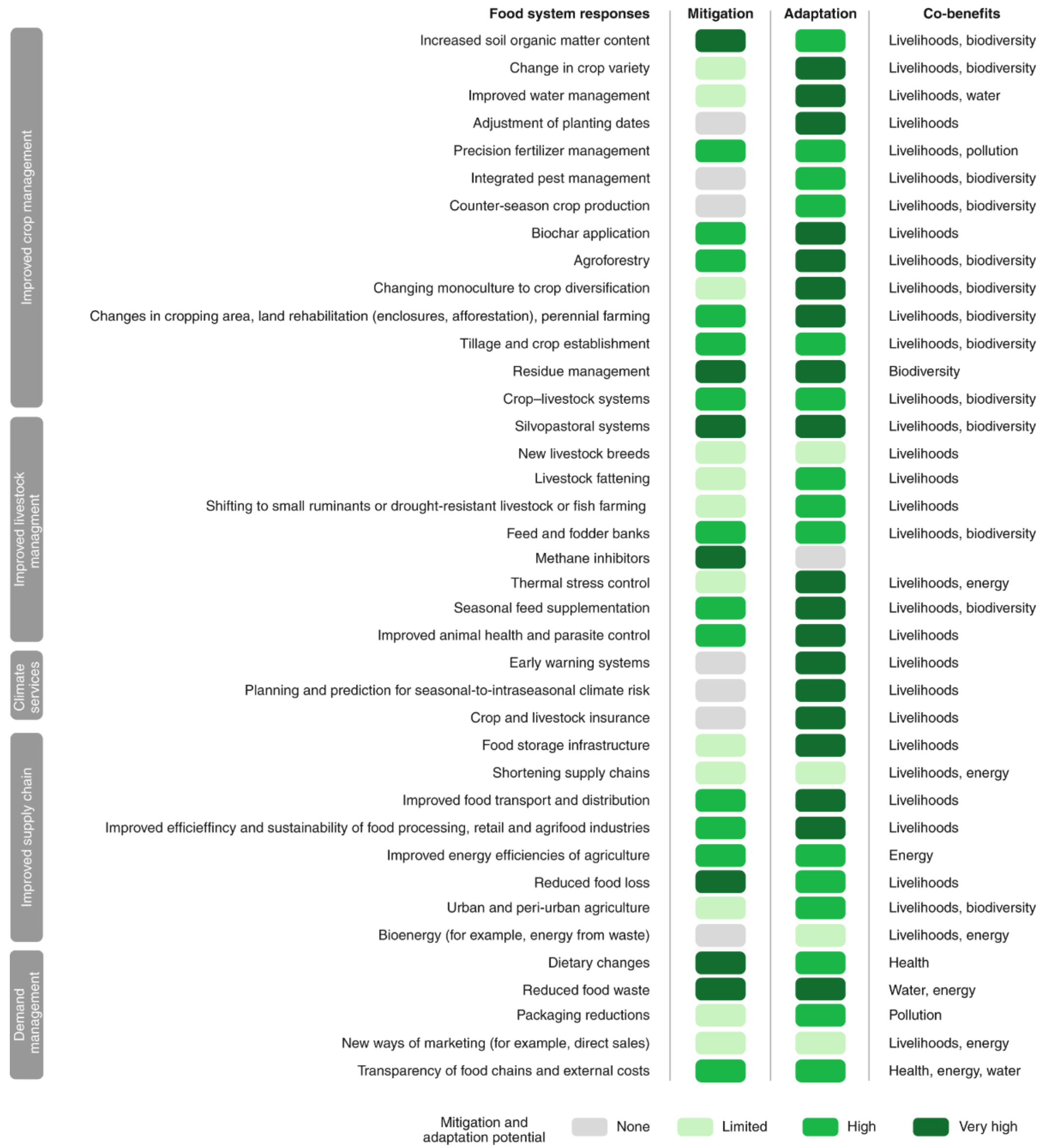
Climate change responses benefit from a global food system approach

A food system framework breaks down entrenched sectoral categories and existing adaptation and mitigation silos, presenting novel ways of assessing and enabling integrated climate change solutions from production to consumption.

Cynthia Rosenzweig, Cheikh Mbow, Luis G. Barioni, Tim G. Benton, Mario Herrero, Murukesan Krishnapillai, Emma T. Liwenga, Prajal Pradhan, Marta G. Rivera-Ferre, Tek Sapkota, Francesco N. Tubiello, Yinlong Xu, Erik Mencos Contreras and Joana Portugal-Pereira

Rosenzweig et al. 2020 Nature Food



Policy measures for supporting adaptation and mitigation

Plenty of great lists but ZERO accountability!

Mbow et al. 2020 SRCCL

Table 5.6 | Potential policy 'families' for food-related adaptation and mitigation of climate change. The column 'scale' refers to scale of implementation: International (I), national (N), sub-national-regional (R), and local (L).

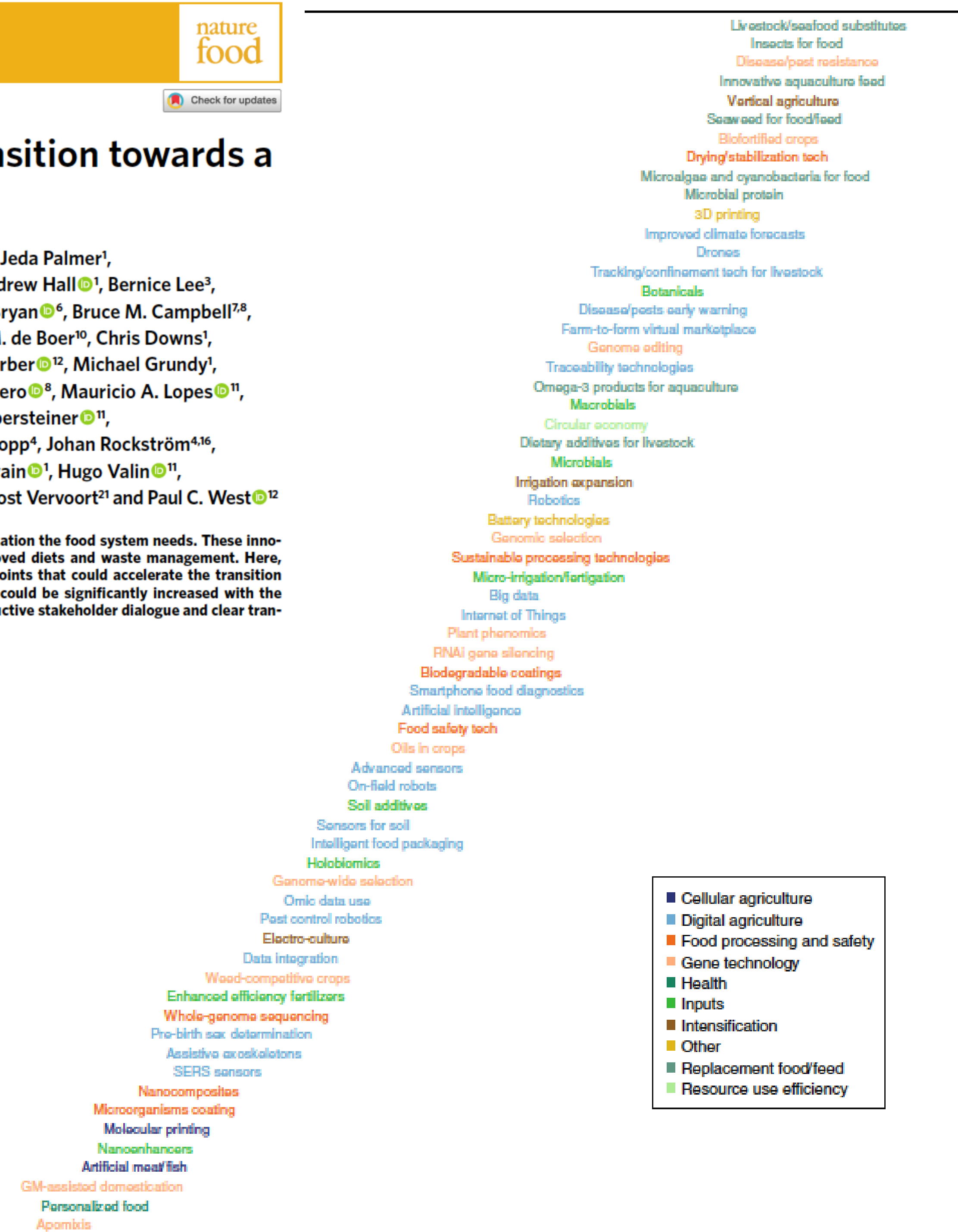
Family	Sub-family	Scale	Interventions	Examples
Supply-side efficiency	Increasing agri-cultural efficiency and yields	I, N	Agricultural R&D	Investment in research, innovation, knowledge exchange, e.g., on genetics, yield gaps, resilience
		I, N	Supporting precision agriculture	Agricultural engineering, robotics, big data, remote sensing, inputs
		I, N	Sustainable intensification projects	Soils, nutrients, capital, labour (Cross-Chapter Box 6)
		N, R	Improving farmer training and knowledge sharing	Extension services, online access, farmer field schools, farmer-to-farmer networks (CABI 2019)
	Land-use planning	N, R, L	Land-use planning for ecosystem services (remote sensing, ILK)	Zoning, protected area networks, multifunctional landscapes, 'land sparing' (Cross-Chapter Box 6; Benton et al. 2018; Jones et al. 2013)
		N, R, L	Conservation agriculture programmes	Soil and water erosion control, soil quality improvement (Conservation Evidence 2019)
		N	Payment for ecosystem services	Incentives for farmers/landowners to choose lower-profit but environmentally benign resource use, e.g., Los Negros Valley in Bolivia (Ezzine-de-Blas et al. 2016)
	Market approaches	I, N	Mandated carbon cost reporting in supply chains; public/private incentivised insurance products	Carbon and natural capital accounts (CDP 2019), crop insurance (Müller et al. 2017a)
	Trade	I	Liberalising trade flows; green trade	Reduction in GHG emissions from supply chains (Neumayer 2001)
Raising profita-bility and quality	Stimulating markets for premium goods	N, R	Sustainable farming standards, agroecology projects, local food movements	Regional policy development, public procurement of sustainable food (Mairie de Paris 2015)
Modifying demand	Reducing food waste	I, N, L	Regulations, taxes	'Pay-As-You-Throw (PAYT)' schemes; EU Landfill Directives; Japan Food Waste Recycling Law 2008; South Africa Draft Waste Classification and Management Regulations 2010 (Chalak et al. 2016)
		I, N, L	Awareness campaigns, education	FAO Global Initiative on Food Loss and Waste Reduction (FAO 2019b)
		I, N	Funding for reducing food waste	Research and investment for shelf life, processing, packaging, cold storage (MOFPI 2019)
		I, N, L	Circular economy using waste as inputs	Biofuels, distribution of excess food to charities (Baglioni et al. 2017)
	Reducing consumption of carbon-intensive food	I, N, L	Carbon pricing for selected food commodities	Food prices reflective of GHG gas emissions throughout production and supply chain (Springmann et al. 2017; Hasegawa et al. 2018)
		I, N, L	Changing food choice through education	Nutritional and portion-size labelling, 'nudge' strategies (positive reinforcement, indirect suggestion) (Arno and Thomas 2016)
		I, N, L	Changing food choices through money transfers	Unconditional cash transfers; e-vouchers exchanged for set quantity or value of specific, pre-selected goods (Fenn 2018)
		N, L	Changing food environments through planning	Farmers markets, community food production, addressing 'food deserts' (Ross et al. 2014)
	Combining carbon and health objectives	I, N, L	Changing subsidies, standards, regulations to healthier and more sustainably produced foods	USDA's 'Smart Snacks for School' regulation mandating nutritional guidelines (USDA 2016) Incentivising production via subsidies (direct to producer based on output or indirect via subsidising inputs)
		N	Preventative versus curative public healthcare incentives	Health insurance cost reductions for healthy and sustainable diets
		I, N, L	Food system labelling	Organic certification, nutrition labels, blockchain ledgers (Chadwick 2017)
		N, L	Education and awareness campaigns	School curricula; public awareness campaigns
		N, L	Investment in disruptive technologies (e.g., cultured meat)	Tax breaks for R&D, industrial strategies (European Union 2018)
		N, L	Public procurement	For health: Public Procurement of Food for Health (Caldeira et al. 2017) For environment: Paris Sustainable Food Plan 2015–2020 Public Procurement Code (Mairie de Paris 2015)

PERSPECTIVE
https://doi.org/10.1038/s43016-020-0074-1
nature food
Check for updates

Innovation can accelerate the transition towards a sustainable food system

Mario Herrero[1], Philip K. Thornton[2], Daniel Mason-D'Croz[1], Jeda Palmer[1], Tim G. Benton[3], Benjamin L. Bodirsky[4], Jessica R. Bogard[1], Andrew Hall[1], Bernice Lee[3], Karine Nyborg[5], Prajal Pradhan[4], Graham D. Bonnett[1], Brett A. Bryan[6], Bruce M. Campbell[7,8], Svend Christensen[7], Michael Clark[9], Mathew T. Cook[1], Imke J. M. de Boer[10], Chris Downs[1], Kanar Dizyee[1], Christian Folberth[11], Cecile M. Godde[1], James S. Gerber[12], Michael Grundy[1], Petr Havlik[11], Andrew Jarvis[8], Richard King[3], Ana Maria Loboguerrero[8], Mauricio A. Lopes[11], C. Lynne McIntyre[1], Rosamond Naylor[13], Javier Navarro[1], Michael Obersteiner[11], Alejandro Parodi[10], Mark B. Peoples[1], Ilje Pikaar[14,15], Alexander Popp[4], Johan Rockström[4,16], Michael J. Robertson[1], Pete Smith[17], Elke Stehfest[18], Steve M. Swain[1], Hugo Valin[11], Mark van Wijk[19], Hannah H. E. van Zanten[10], Sonja Vermeulen[3,20], Joost Vervoort[21] and Paul C. West[12]

Future technologies and systemic innovation are critical for the profound transformation the food system needs. These innovations range from food production, land use and emissions, all the way to improved diets and waste management. Here, we identify these technologies, assess their readiness and propose eight action points that could accelerate the transition towards a more sustainable food system. We argue that the speed of innovation could be significantly increased with the appropriate incentives, regulations and social licence. These, in turn, require constructive stakeholder dialogue and clear transition pathways.

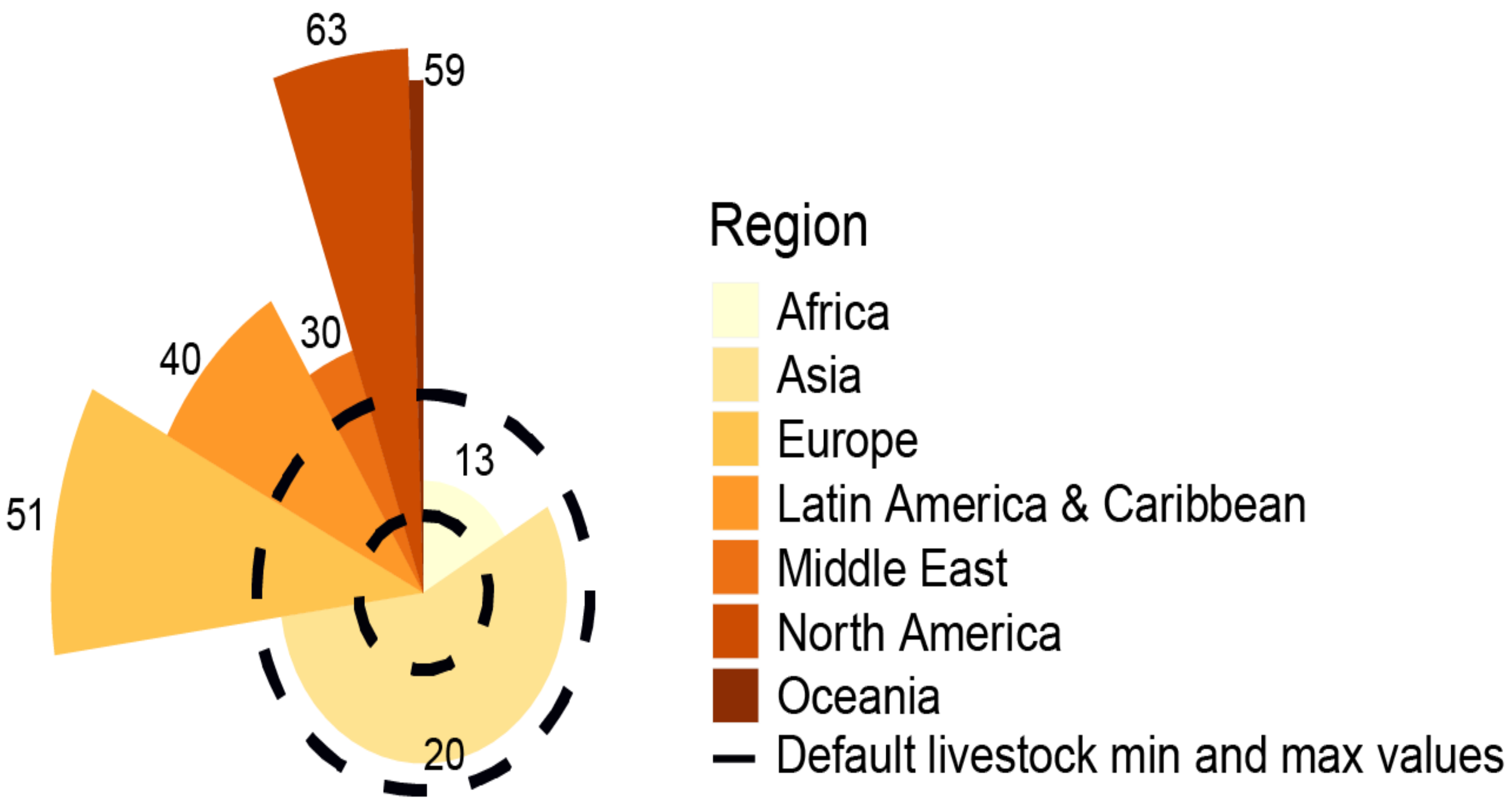


Herrero et al. 2020 Nat Food.

Accelerators of food systems innovation

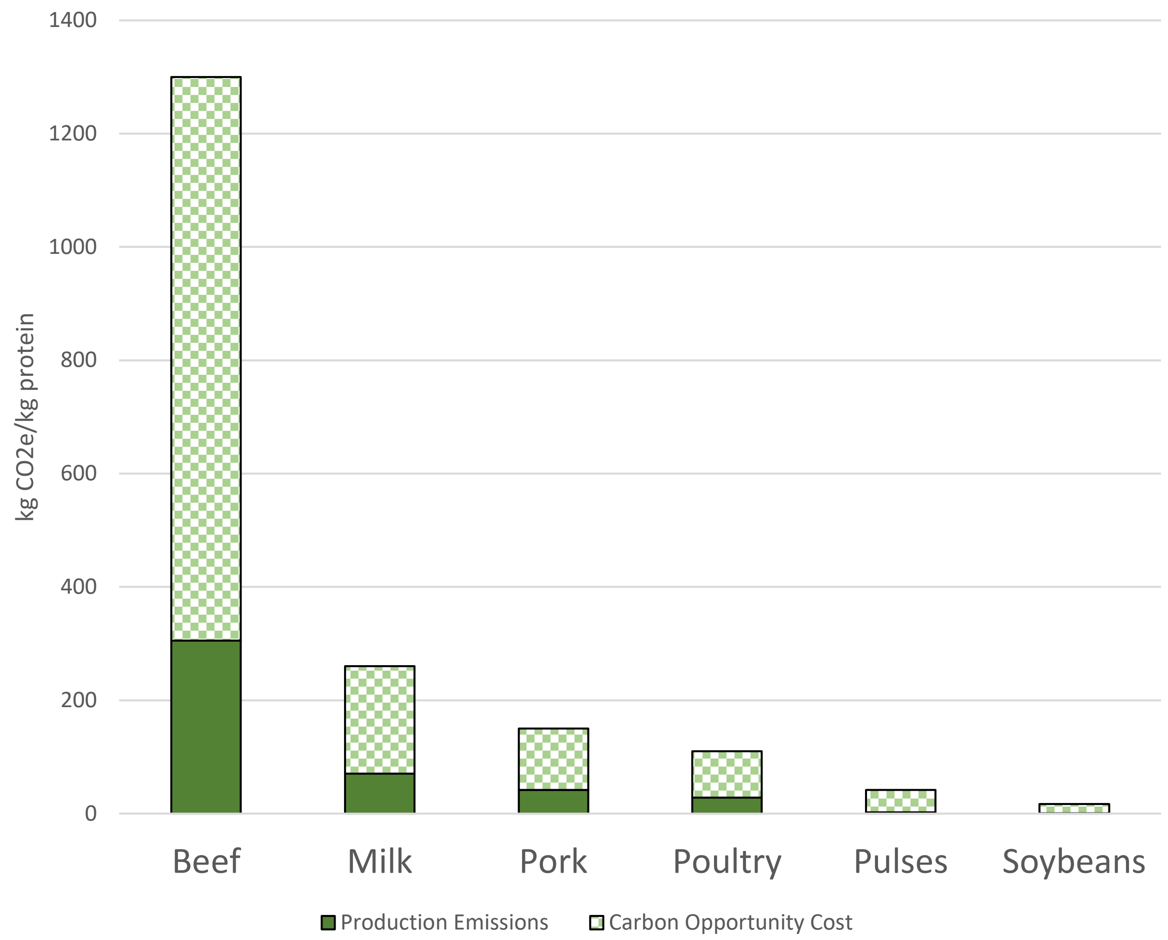
Herrero et al. Nature Food 2020

The Circular Economy
Decoupling livestock from land through a circular economy



Van Zanten, Herrero et al. 2018
Global Change Biology

Back to better land use planning
Account for the opportunity cost of land and carbon



Source: Searchinger et al., *Nature* (2018)

The true cost of food is $29 trillion dollars

UNITED NATIONS FOOD SYSTEMS SUMMIT 2021

United Nations Food Systems Summit 2021
Scientific Group
https://sc-fss2021.org/

A paper from the Scientific Group of the UN Food Systems Summit

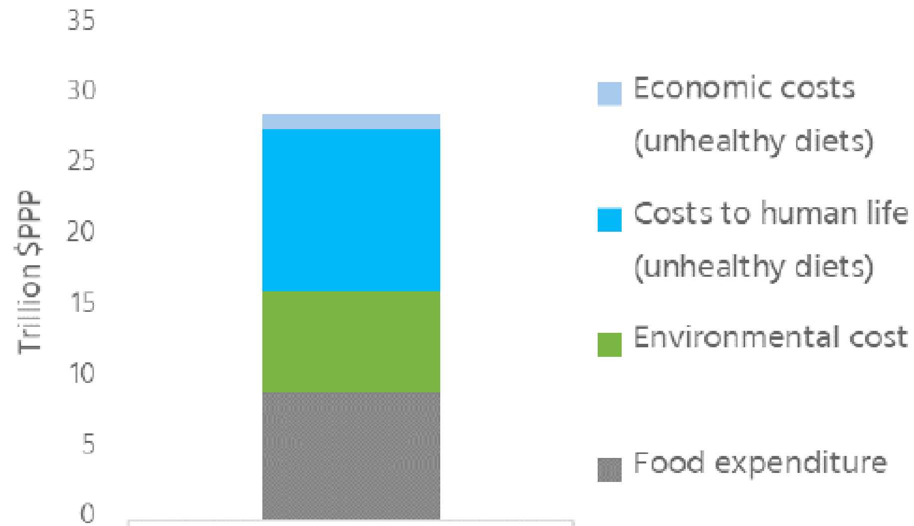
Draft

1 June 2021

The True Cost and True Price of Food

By

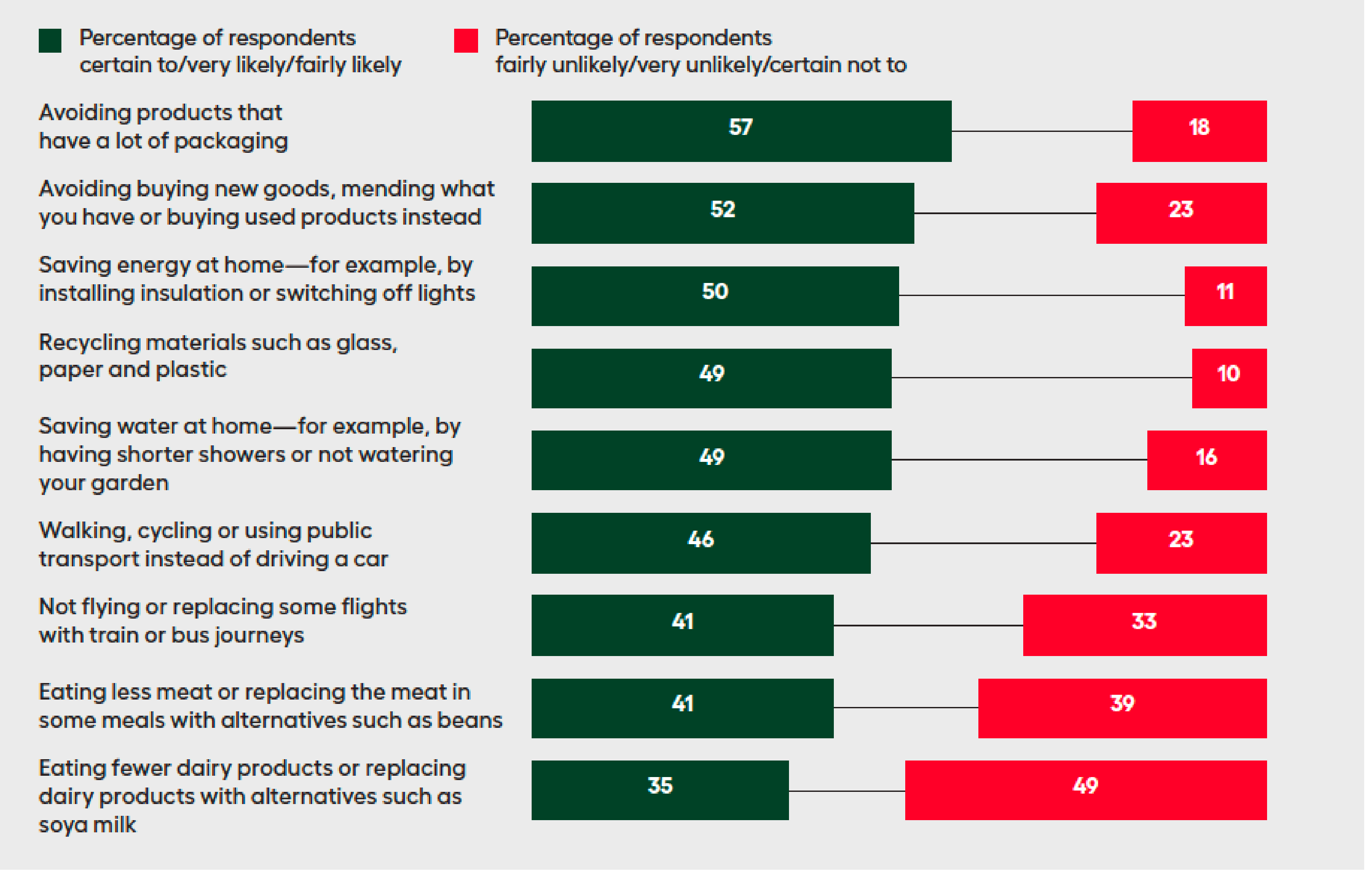
by Sheryl Hendriks, Adrian de Groot Ruiz, Mario Herrero Acosta, Hans Baumers, Pietro Galgani, Daniel Mason-D'Croz, Cecile Godde, Katharina Waha, Dimitra Kanidou, Joachim von Braun, Mauricio Benitez, Jennifer Blanke, Patrick Caron, Jessica Fanzo, Friederike Greb, Lawrence Haddad, Anna Herforth, Danie Jordaan, William Masters, Claudia Sadoff, Jean-François Soussana, Maria Cristina Tirado, Maximo Torero, Matthew Watkins



2/3 of the costs are currently not accounted for!!

Hendriks et al. 2021

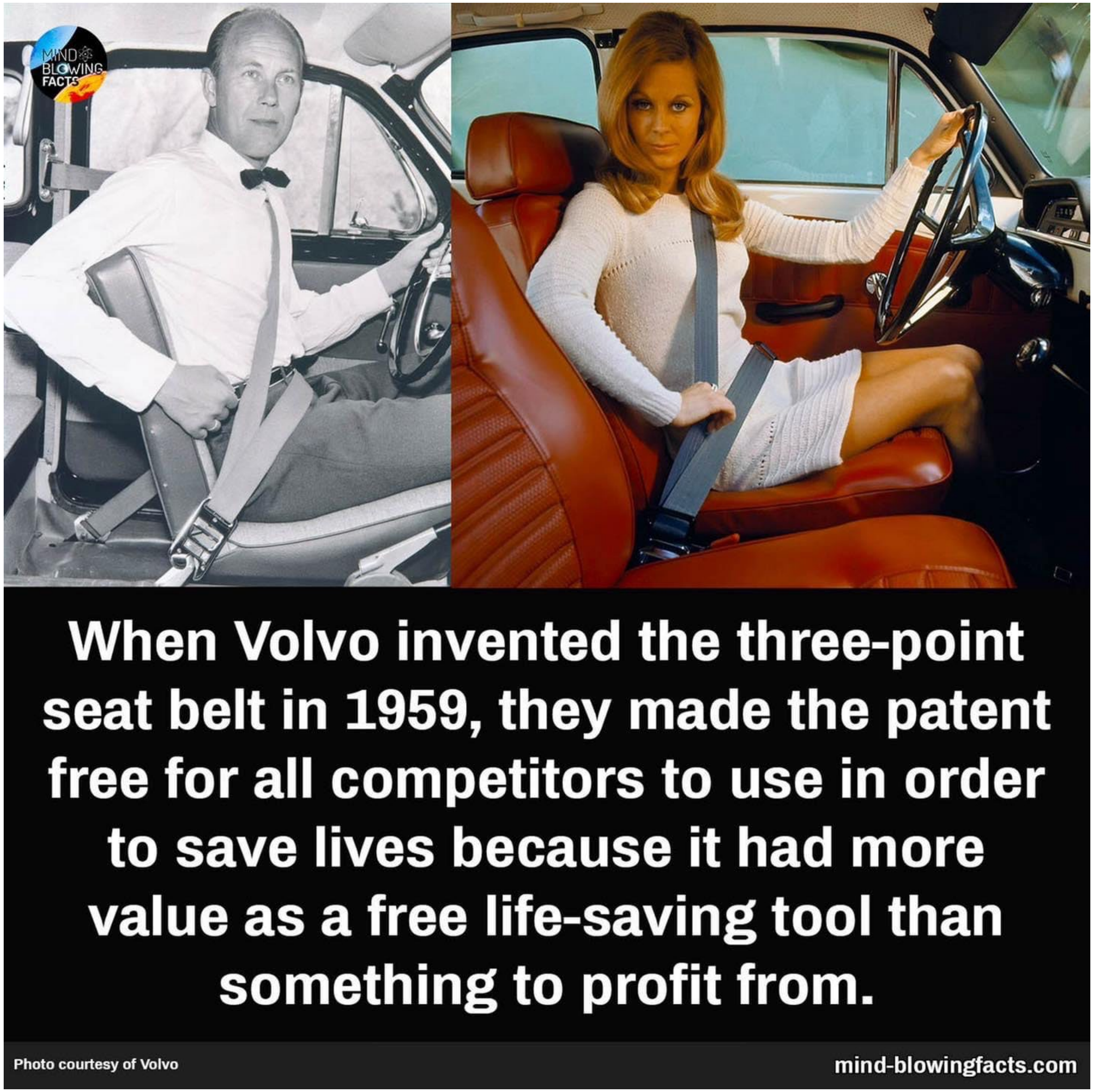
A behavioural change revolution occurring



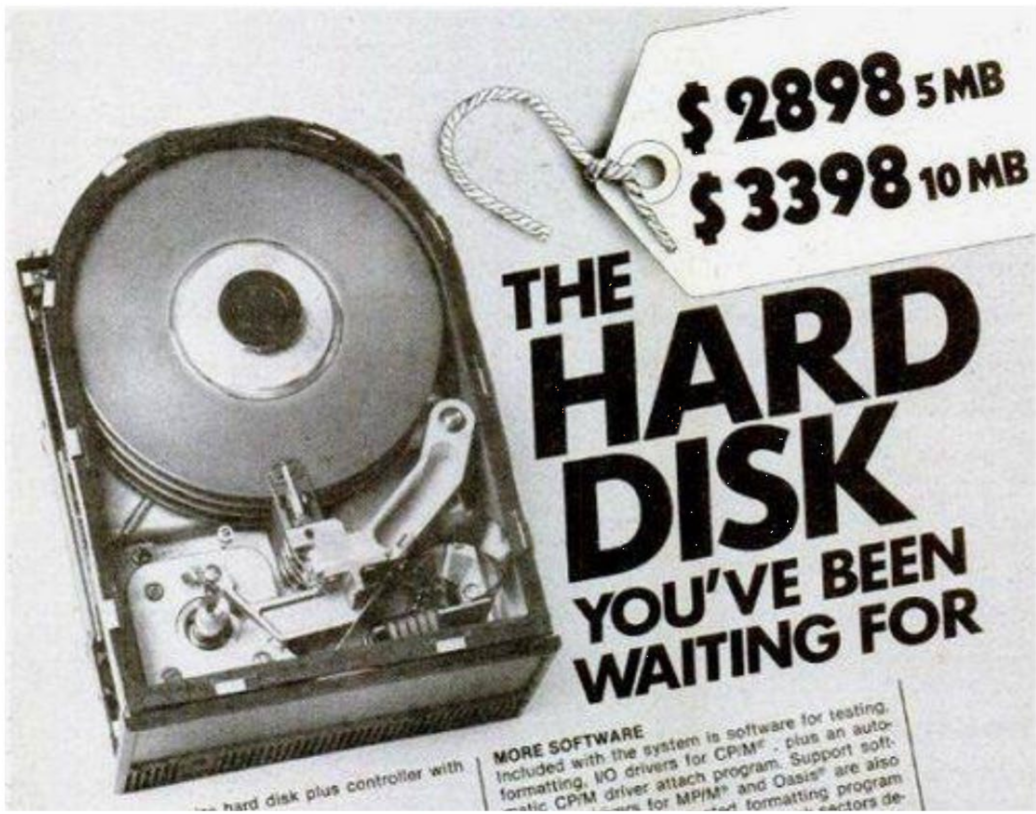
Note: Reflects online responses by 20,590 adults ages 16–74 to the question "Thinking about things you might do in order to limit your own contribution to climate change, how likely or unlikely would you be to make the following changes within the next year?"
Source: IPSOS Global Advisor 2020.

HDR2020

Responsible behaviour will help drive change



It will be expensive at the beginning, but the costs of inaction will be even higher!



Thank you

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