MAY 2024

Blueprint for Good Food Finance Data Systems Integration

TO MAKE THE FOOD FINANCE TRANSFORMATION HAPPEN QUICKLY AND EFFICIENTLY—TO SUPPORT SUSTAINED BENEFITS TO PLANETARY AND HUMAN HEALTH, WHILE MAKING QUALITY FOOD AFFORDABLE FOR ALL AND EXPANDING OPPORTUNITY ACROSS VALUE CHAINS—WE NEED RELIABLE MULTIDIMENSIONAL PERFORMANCE DATA.

Good Food
Finance Network

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About the Good Food Finance Network

This 'Blueprint for Good Food Finance Data Systems Integration' is the culmination of Year 1 of the Integrated Data Systems Initiative and aims to guide development of exploratory integrations of data systems, technologies, platforms, and metrics.

The Integrated Data Systems Initiative is a workstream of the Good Food Finance Network, aimed at developing technical strategies for connecting the hardware, software, and data outputs used by distinct platforms and sectors. The IDSI was led by EAT Foundation in 2023 and is now led by Citizens' Climate International, through its Resilience Intelligence programme.

The Good Food Finance Network was created by the EAT Foundation, the FAIRR Initiative, Food Systems for the Future, the UN Environment Programme, and the World Business Council for Sustainable Development—alongside the UN Food Systems Summit in September 2021—to support critical innovations across the landscape of food-related finance.

The Access to Nutrition Initiative and Citizens' Climate International have since joined the group of core coordinating partners. The wider list of supporting partners includes: the UN Conference on Trade and Development (UNCTAD), the World Bank Group, The Global Environment Facility (GEF), The Green Climate Fund (GCF), the UN Development Programme (UNDP), the UN Food and Agriculture Organization (FAO), the Just Rural Transition Initiative (JRT), and the Transforming Urban-Rural Food Systems Consortium (TURFS).

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Key Messages

- Never before in human history has it been more important that we understand the extent of our impacts on the Earth system and its ecological life-supports.
- We need to develop data systems that are complex enough to not misrepresent the complexities of the living world, while producing integrated metrics that are easy to understand and act on, even for non-experts.
- The prevalence of affordable nutrition and good health shapes the overall quality of life and economic vibrancy of whole societies.
- Multidimensional metrics, based on integrated data systems, that provide summit to seabed health and resilience insights, can support new SME business models that diversify and revitalize local and rural economies.

Blueprint for Good Food Finance Data Systems Integration

Insights from Year 1 of the Integrated Data Systems Initiative, to inform exploratory integrations in Year 2

PURPOSE

This Blueprint for Good Food Finance Data Systems Integration is intended as a reference for all stakeholders who want to better understand the new metrics best suited for mobilization and tracking of investments in health-building and sustainable food systems. We hope this paper serves as something of a magnet to allow data experts, capable institutions, and interested end users to open or contribute to exploratory multisystem integrations involving technology, software, business models, metrics and enabling policies.

SITUATION REVIEW

In 2023, we confirmed through major science reports and world-first climate anomalies that nature loss, climate breakdown, and flawed market dynamics are all putting the sustainability of food systems at risk. Global food security continues to be under stress from multiple interacting and compounding factors, and background climate conditions are creating unprecedented sustained stresses that may lead to repeated failure of major food-growing regions to produce sufficient food to meet global demand.

The IPCC 6th Assessment Report finds we will likely breach the threshold of persistent global heating above 1.5ºC around or before 2040, and that "warming in many regions has already exceeded 1.5°C above pre-industrial levels".[1] Beyond 1.5ºC of global average temperature rise, it is now projected some critical stabilizing structures in the climate system may be lost irretrievably.[2]

The 2023 State of the Climate Report[3] found:

> *"By the end of this century, an estimated 3 to 6 billion individuals — approximately one-third to one-half of the global population — might find themselves confined beyond the livable region, encountering severe heat, limited food availability, and elevated mortality rates because of the effects of climate change (Lenton et al. 2023)."*

For four consecutive days[4] in July, we lived through the hottest day on record. On Monday, July 3, the global average temperature reached 16.2ºC (61.16ºF). That was the highest global average temperature ever recorded. The next day, July 4, reached 17.18ºC (62.92ºF), fully 0.98ºC hotter than any day ever recorded, just 24 hours after the record was set. Wednesday again reached that hottest ever temperature, and Thursday set another new record, at 17.23ºC (63.01ºF).

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[1] IPCC review of findings, "FAQ Chapter 1": https://www.ipcc.ch/sr15/faq/faq-chapter-1/#:~:text=Human%2Dinduced%20warming%20reached%20approximately,emissions%20reaching%20zero%20by%202055

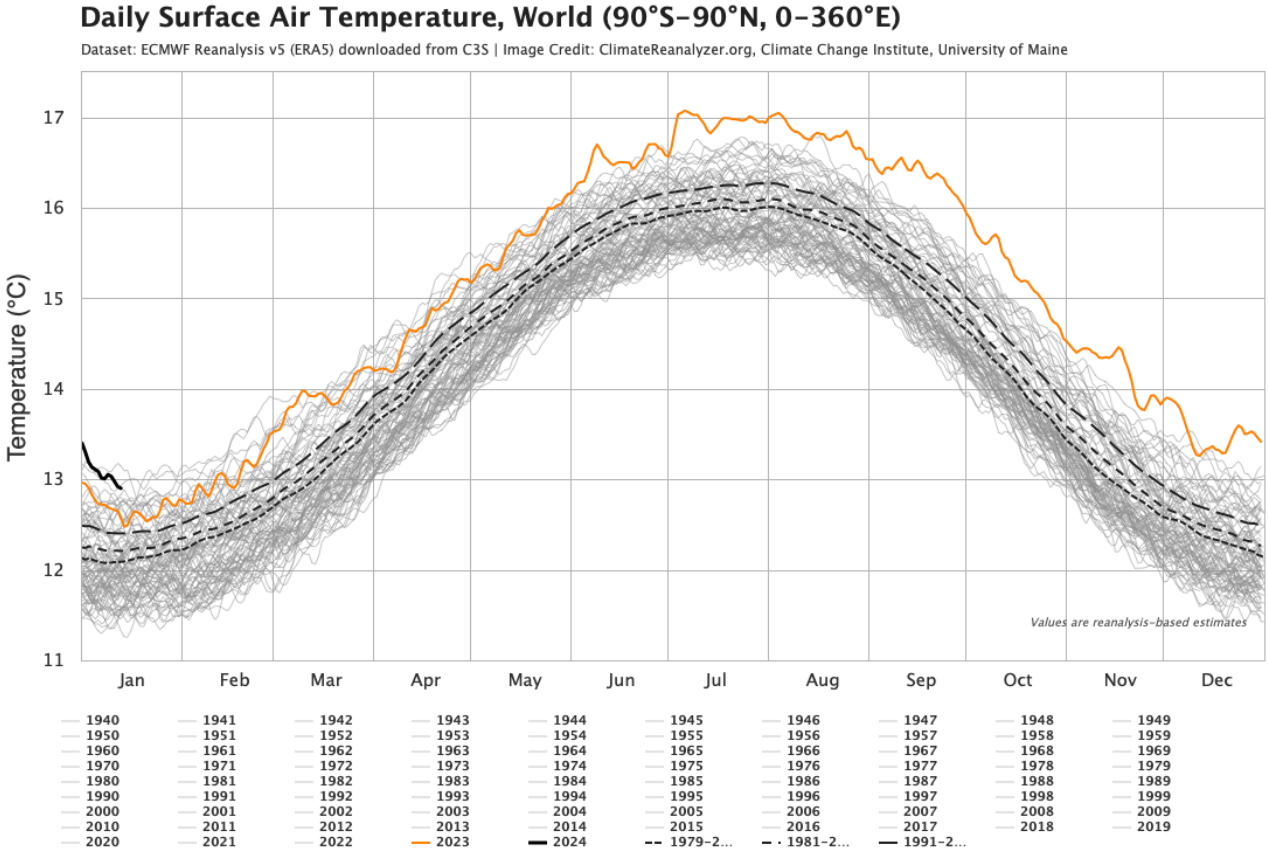
[2] Citizens' Climate International zooms in on these findings in a policy brief on Net Zero by 2040, which are also explored in the Food System Cost-Benefit section, below: https://cciblue.com/2023/03/24/netzero-by-2040-is-common-sense/

[3] The 2023 State of the Climate Report: https://academic.oup.com/bioscience/article/73/12/841/7319571?login=false

[4] ABC News, citing data from the U.S. Centers for Environmental Prediction: https://abcnews.go.com/US/4th-july-breaks-record-highest-temperature-measured/story?id=100702850

Analysis of ice core samples, cross-referenced with the geological record, indicates that Earth has not seen such heat in at least 125,000 years.[5] In other words, no human civilization has ever endured such global climate conditions. According to the European Union's Copernicus Climate Change Service:[6]

- Each month from June to December in 2023 was warmer than the corresponding month in any previous year
- July and August 2023 were the warmest two months on record. Boreal summer (June-August) was also the warmest season on record
- September 2023 was the month with a temperature deviation above the 1991–2020 average larger than any month in the ERA5 dataset
- Global average sea surface temperatures (SSTs) remained persistently and unusually high, reaching record levels for the time of year from April through December



Extreme degree of excess heat in global average temperatures throughout the second half of 2023 is clearly noticeable in charts plotting historic temperature curves. Daily Surface Air Temperature readings for the global average, from January

[5] URL: https://www.usatoday.com/story/news/weather/2023/07/05/was-july-4-earths-hottest-day-heres-what-scientists-say/70383436007/

[6] Copernicus: 2023 is the hottest year on record, with global temperatures close to the 1.5°C limit. URL: https://climate.copernicus.eu/copernicus-2023-hottest-year-record

1940 to January 2024, from the Climate Reanalyzer service.[7] Published under a Creative Commons Attribution 4.0 International license.[8]

The planet is changing in ways that are visible from space, with the naked eye. Across the northern hemisphere, snowpack is registering at historic lows,[9] putting water supplies at risk for billions of people and millions of farms in the year, or years, ahead. Research also shows many communities could go over a "snow-loss cliff" if current trends continue.[10] The ecological and hydrological effects on food-growing regions only add to other converging pressures that are making it harder to achieve reliable, affordable food security and nutrition security for the entire human family.

2024 has seen reduced ship traffic through the Panama Canal, due to low water levels as a result of climate change-induced prolonged drought. Many container ships are diverting across the world to the Suez Canal, where traffic is also reduced and prices soaring due to conflict in the region, including missile and drone strikes on ships moving through the Gulf of Aden and the Red Sea. Climate impacts are forcing trade to face non-climate risks, creating risk and cost on both sides of the realignment.

Food prices are expected to rise, with overall deliveries declining, with both of those factors leading to food security stresses around the world.

Disruptions of production and supply undermine the fiscal stability of nation states, both by reducing production and by increasing reliance on imports and making food products more expensive. Rising sovereign debt burdens in turn make it harder to finance solutions or achieve affordable everyday economic conditions for those most in need. This is happening at the very moment countries need fiscal space to respond to or prevent crisis and to reconfigure incentives and trade relations to support future nutrition security. And of course, food systems are a major driver of climate disruption, nature breakdown, biodiversity loss, and water resource stress.

Good Food Finance is not just a wish of advocates for better food systems.

Unless the world can shift food systems to standards and practices, and financing models, that are climate-resilient, nature-positive, and sustainable, we will not, as a global community, be able to get these converging threats under control. To make this food finance transformation happen as efficiently as possible, while providing real additional value to those often excluded from financial benefits, failing which, food systems will not be transformed successfully, we need data—not just information about food systems, but multidimensional data.

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[7] Data Source: Copernicus Climate Change Service (C3S) (2023): ERA5 hourly data on single levels from 1940 to present. Copernicus Climate Change Service (C3S) Climate Data Store (CDS). Hersbach, H., Bell, B., Berrisford, P., Biavati, G., Horányi, A., Muñoz Sabater, J., Nicolas, J., Peubey, C., Radu, R., Rozum, I., Schepers, D., Simmons, A., Soci, C., Dee, D., Thépaut, J-N. (2018): ERA5 hourly data on single levels from 1940 to present. Copernicus Climate Change Service (C3S) Climate Data Store (CDS). 10.24381/cds.adbb2d47 (Accessed daily 2023).

[8] Creative Commons Attribution 4.0 International license: http://creativecommons.org/licenses/by/4.0/

[9] Research published in the journal Nature: https://www.nature.com/articles/s41586-023-06794-y

[10] Report on "snow-loss cliff" risk, in The Verge: https://www.theverge.com/2024/1/10/24031852/snow-loss-climate-change-drought-research

We need integrated data systems that tell a clear, evidence-based story with resounding directional insights. In other words, we need data that are based in the real world, that reflect impacts on nature, climate, biodiversity, and human health and wellbeing, as well as investment risk and return insights, and we need the data systems delivering these multidimensional insights to also make it easier to keep good food (healthy, sustainably produced) affordable.

Some say this is asking too much of the food economy, that market dynamics won't allow so many goods to be created by the same investments. Others say this will mean making the food economy work as it should, for the first time.

DATA FOR MOBILIZING, MAINSTREAMING & TRACKING PERFORMANCE OF GOOD FOOD FINANCE

The Good Food Finance Network partners announced in 2022[11] an effort to create a first-of-its-kind co-investment platform for food systems transformation. Throughout 2023, that project evolved into the Good Food Finance Facility.[12]

The Facility will expand the reach of public, private, multilateral, and philanthropic finance by providing:

- **Facilitated Co-Investments** – to crowd in capital from public, private, multilateral, and philanthropic sources, and to provide investors with a way to buy into blended finance opportunities to expand food-related sustainable investment holdings
- **Bridging Funds and Seed Capital** – to support delivery of financing and funding assistance to underserved segments of the value chain, including vulnerable communities, low-income regions, smallholders, and innovators
- **Instrumentation Services** – including re-budgeting focused on maximizing co-benefits from sustainable outcomes, readiness and capacity-building initiatives, and the design and coordination of cooperative food financing arrangements, including an Innovative Collaborative Funding Model.[13]
- **Mutual Accountability** – assurance between co-investment partners and stakeholders that the overall arrangements are designed to achieve good outcomes and performing as intended, comprised of two main tracks:
  - Good Food Investing Framework – co-designed with the UN Development Programme, based on the SDG Impact Standards and including reference to other widely used and adopted sustainable investment standards

[11] June 2022 GFFN press release, "Good Food Finance Network proposes co-investment platform to tackle global food security challenges": https://goodfood.finance/2022/06/01/good-food-finance-network-proposes-co-investment-platform-to-tackle-global-food-security-challenges/

[12] Follow Good Food Finance Facility developments at https://goodfood.finance/workstreams/cip

[13] The ICFM is a ground-breaking funding model designed to spread costs and engage stakeholders across the entire food system. Its multi-faceted approach aims to create fiscal space, while catalyzing wider pools of investment in better food systems and related co-benefits.

- Integrated Data Systems Initiative (IDSI) – a five-year innovation sprint recognized by the AIM for Climate Summit in May 2023, starting with this Blueprint, supporting performance tracking for Good Food Finance Facility-linked investments, and building toward commercial data services

As part of the work of establishing the Good Food Finance Facility, the Integrated Data Systems Initiative will first develop exploratory integrations of financial and non-financial data platforms, then refine them into new technologies and services to deliver multidimensional food system finance performance metrics. This Data Systems Integration Blueprint reviews key constituencies, practical challenges, technical and operational priorities, and the future timeline for deployment of integrated data systems supporting the Mutual Accountability needs of the Good Food Finance Facility.

We also want this work to produce valuable data systems integrations that support multidimensional decision insights in areas unrelated to food systems and spanning the broad variety of end-user needs in the everyday economy.

THE BEST POSSIBLE STATE OF THE ART

The best possible state of the art, with regard to food-related data systems that deliver better financial return would likely include, among other elements:

1. Earth system science insights
2. Mainstream financial data
3. Individualized investment risk and return, linked to all of the other factors
4. Support for resilience of watersheds, ecosystems, productive landscapes, foundational landscapes, and more affordable nutrition security for all
5. Insights that support better public policy and optimized alignment of incentives with returns across the board
6. Consistent reinvestment into self-reinforcing co-benefits that make the entire system more resilient and sustainable

Most food finance discussions include one or more of these stated goals, but not all. All of these goals are relevant to whether food systems function optimally, but most food system business models are not designed to produce these resilience-building outcomes—each of which would move the whole system toward better practices and performance, creating foundational value for all actors and stakeholders. Many public policy discussions actively distinguish between food security goals and other Sustainable Development Goals that are perceived to potentially be at odds with industrial food production. Public institutions are too often saddled with risk they did not create and so hand money over to commercial entities whose business model works against success in the other areas. Multidimensional food finance data should help to remove these conflicts and make it easier to invest for sustained, shared benefit.

The best possible state of the art is possible. Early exploratory integrations of relevant data systems, data-producing platforms and technologies, and datasets, should focus on new, additional insights that emerge from constructive overlap and point to as many of these optimizing SOTA standards as possible.

FOOD SYSTEM COST-BENEFIT ANALYSIS

The costs of unsustainable food systems are staggering, generating at least $12 trillion in negative impacts compared to an estimated $10 trillion in measurable benefits annually. The 2019 Growing Better Report[14] from the Food and Land Use Coalition, tracked $12 trillion in traceable costs generated by our current industrial food systems model, including ill health and nature loss, and related reduced resilience.

The Growing Better report finds:

> *The need for urgent change is not obvious. On the surface, food and land use systems have been doing well in recent decades. Despite a growing global population, more and more people enjoy affordable, safe and plentiful food. But dig deeper, and the end-to-end system losses are well over 50 percent as a result of poorly allocated land and water resources, slow diffusion of best farming practice beyond large farms, under-investment in rural infrastructure and human capital, and food loss and waste amounting to one-third of primary production. Food and land use systems also generate "hidden" environmental, health and poverty costs estimated at almost $12 trillion a year, a number larger than the value of the system's world output measured at market prices.*

By contrast, shifting to better land use practices and an overall sustainable food system—achieved through ten critical transitions—would generate measurable economic gains:

> *The economic and social benefits offered by this programme would yield exceptional returns on investment. Total economic gains to society could reach an estimated $5.7 trillion a year by 2030 and $10.5 trillion a year by 2050 versus the Current Trends scenario.9 The transitions also open up business opportunities – from tackling food loss to creating the new value chains needed for regenerative agriculture and the shift to healthy diets – worth an estimated $4.5 trillion a year by 2030.10 Some entrepreneurs and progressive corporates are already leading the charge to capitalise on these opportunities, but a strategic reframing that today's hidden costs are tomorrow's new markets still needs to go mainstream.*

Unchecked climate change is now projected to cost $178 trillion—including direct, indirect, and opportunity costs—just between now and the year 2070. In June 2022, the Deloitte Center for Sustainable Progress[15] published a landmark Global Turning Point Report[16], which found that

[14] The Growing Better Report is online at https://www.foodandlandusecoalition.org/global-report/

[15] Deloitte Center for Sustainable Progress: https://www.deloitte.com/global/en/issues/climate/sustainability-and-climate.html/#vertical_flipping_tiles_frag_flipping_tiles_header2

[16] The Global Turning Point Report: https://www2.deloitte.com/xe/en/pages/about-deloitte/press-releases/deloitte-research-reveals-inaction-on-climate-change-could-cost-the-world-economy-usd-178-trillion-by-2070.html

unchecked climate change would lead to a total measurable cost to the global economy, over five decades, of $178 trillion. The findings are summed up as follows:

> *According to the modeling, unchecked climate change could cost the global economy US$178 trillion in net present value terms from 2021-2070. The human costs would be far greater: a lack of food and water, loss of jobs, worsening health and well-being, and reduced standard of living.*
>
> *If, on the other hand, the world acts now to rapidly achieve net-zero emissions by midcentury, the transformation of the economy could set the world up for stronger economic growth by 2070, according to Deloitte's analysis. Such a transformation could increase the size of the world economy by US$43 trillion in net present value terms from 2021-2070.*

Though shocking, the $178 trillion figure is almost certainly a conservative underestimate. The Food System Economics Commission[17] finds that cumulative hidden costs of unsustainable food systems now add up to more than $123.8 trillion, just since the Paris Agreement was signed roughly 8 years ago, in April 2016.[18]

The latest IPCC report calls for rapid decarbonization, meaning transforming food systems and shifting capital flows is now an urgent priority. The 6th Assessment Report[19] of the Intergovernmental Panel on Climate Change provides clear evidence that to avoid spiraling climate emergency, high-emitting countries should accelerate decarbonization efforts, aiming for net zero closer to 2040 than 2050.

Specifically, the report finds that the 1.5°C threshold is likely to be crossed before 2040.[20] Chapter 4 of the AR6[21] states:

> *In the near term (2021–2040), a 1.5°C increase in the 20-year average of GSAT, relative to the average over the period 1850–1900, is very likely to occur in scenario SSP5-8.5, likely to occur in scenarios SSP2-4.5 and SSP3-7.0, and more likely than not to occur in scenarios SSP1-1.9 and SSP1-2.6.*

Chapter 4 also finds that overshooting 1.5°C will make it harder to achieve climate-resilient development, even if the overshoot is partially reversed through carbon drawdown. Chapter 4.6.2 reads, in part:

> *Overshoot has been found to lead to irreversible changes in thermosteric sea level (Tokarska and Zickfeld, 2015; Palter et al., 2018; Tachiiri et al., 2019), AMOC (Palter et al., 2018), ice sheets,*

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[17] The Food System Economics Commission published its Global Policy Report in January 2024. URL: https://foodsystemeconomics.org/

[18] The FSEC Hidden Costs of Food counter is detailed at: https://foodsystemeconomics.org/hidden-food-costs/

[19] IPCC 6th Assessment Report: https://www.citizensclimateintl.news/p/ipcc-report-this-is-our-last-chance

[20] IPCC 6th Assessment Report overview: https://www.ipcc.ch/report/sixth-assessment-report-cycle/

[21] IPCC 6th Assessment Report Chapter 4: https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Chapter04.pdf

> *and permafrost carbon (Sections 4.7.2 and 5.4.9) and to long-lasting effects on ocean heat (Tsutsui et al., 2006)*

This means critical regulating structures within the climate system may be lost, increasing the prevalence and cost of devastating impacts, and making it harder to restore a livable climate, even if we learn to reabsorb all industrial, agricultural, and transport emissions. In other words, it is no longer credibly 'science-based' for the largest emitters to aim for net zero by 2050.

True cost accounting is starting to show with greater detail that we are losing value through our unsustainable, unhealthy food system status quo. Hidden costs are consuming as much as 27% of GDP across low-income countries, hindering future food system sustainability and wider national economic development efforts.

The 2023 State of Food and Agriculture report[22], from the United Nations Food and Agriculture Organization (FAO), finds:

> *Hidden costs appear to be a greater burden in low-income countries, where they are estimated to amount, on average, to 27 percent of gross domestic product (GDP), compared with 11 percent in middle-income countries and 8 percent in high-income countries.*

The Food Finance Architecture[23] report, prepared by the Finance Action Track for the 2021 United Nations Food Systems Summit, outlined the need for $350 billion per year, by 2030. This will require unprecedented collaboration among financial institutions, investors, businesses, governments and civil society.

The good news is that this massive investment need is also a clear investment opportunity: without this scale of realigned food system investment, the projected losses listed above will accumulate, and compound, rapidly. To preserve and expand value across whole economies, and across sectors, these investments need to take place. That means there will be unprecedented market-shaping pressure to identify and capitalize the relevant business opportunities. The business case at the macro level is clear; determining which specific choices make the most sense and provide the greatest opportunity for return on investment over the short, medium, and long terms, will require multidimensional metrics, valuing non-financial benefits. The business case for integrated data systems starts there.

THE VALUE OF NUTRITION

Due to the sheer scale of the global food system challenge, past crises have led to a generalized goal of ending hunger by producing more food, so food is cheaper and easier to access, for more people in more places. Food aid also works this way: budget constraints impose the rule that public funding dedicated to food assistance, whether for domestic needs or to aid people in foreign countries, be directed in such a way as to maximize the amount of food acquired per unit of currency. There is

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[22] 2023 State of Food and Agriculture: https://www.fao.org/3/cc7724en/online/cc7724en.html

[23] 2021 report on the Food Finance Architecture: https://www.worldbank.org/en/topic/agriculture/publication/food-finance-architecture-financing-a-healthy-equitable-and-sustainable-food-system

strong evidence that this approach does not optimize the delivery of nutritious food to more people, more affordably.

There are reasons this consideration has been secondary:

- When a population is facing famine, it is more pressing to get enough food to that population to prevent people from dying of starvation.
- Market economies tend to treat what is more desirable as worthy of a higher price, even the desirability in question is the ability to have a healthy life.
- Food products are not necessarily designed to to deliver maximum health benefit; they are often designed to deliver desirable experiences of food at prices that allow food providers to maximize profits and expand market reach.
- Laws and regulations shaping the food industry do not assume that ultra-processed food items could generate debilitating and life-threatening diseases, which can cost millions of lives and trillions of dollars.

Nutrition is a salient economic outcome, the contours of which are built into market-shaping economic forces. The prevalence of affordable nutrition and good health shapes the overall quality of life and economic vibrancy of whole societies. When the United States saw world-leading catastrophic outcomes from the COVID-19 pandemic, a 2018 study gained visibility, which had shown that only 12% of US adults qualify as "metabolically healthy". Diet-related non-communicable diseases were found to be leading "comorbidities" in cases of death caused by extreme cases of COVID-19.

If nutrition is graded not only as whether or not food contains ingredients, but whether that food is free from contaminants that undermine health outcomes, many environmental causes of ill-health become part of the Nutrition Value equation. Of the top 10 causes of death[24] listed by the US Centers for Disease Control and Prevention (CDC) for the year 2021, only one of them, accidents[25], cannot be made worse by lack of a nutrition, and there is growing evidence that in many cases, apparent accidental deaths might not have been deaths, had diet-related health been a consistent norm for the victim or for others involved in causing the death.

Data related to health and nutrition are also challenging due to privacy considerations. Individuals should not be singled out or adversely impacted by wider sharing of health-related data. But at population level, better outcomes, including longer lives and also better economic conditions, can be achieved by leveraging diet-related health information to create a competition incentive for businesses that aim to offer the best value in food products: better nutrition, lower prices, broader market share. The only way to tick each of those boxes is to make more nutritious food available to a wider population at lower prices.

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[24] The US Centers for Disease Control and Prevention (CDC) lists as the ten leading causes of death in the US in 2021: 1. Heart disease: 695,547; 2. Cancer: 605,213; 3. COVID-19: 416,893; 4. Accidents (unintentional injuries): 224,935; 5. Stroke (cerebrovascular diseases): 162,890; 6. Chronic lower respiratory diseases: 142,342; 7. Alzheimer's disease: 119,399; 8. Diabetes: 103,294; 9. Chronic liver disease and cirrhosis : 56,585; 10. Nephritis, nephrotic syndrome, and nephrosis: 54,358. URL: https://www.cdc.gov/nchs/fastats/leading-causes-of-death.htm

[25] Accidents includes automobile crashes, pedestrian deaths, gun violence, and drug overdoses.

The big question ultimately becomes: What does the overriding metric look like?

And from there, we have to ask:

- What can consumers do with that metric?
- Can they make choices between food options that are similar but different enough to make a difference in their health?
- Can they nudge markets to better food at lower prices by selecting the most affordable option that also has high nutritional value?
- Can retailers?
- Are there reliable ways to show correlation between higher nutritional value of specific foods and their being produced through agroecological, regenerative, and climate-aligned modes of production?
- Can national budgets be planned around the aim of reducing nutrition-loss and related economic losses due to ill health, to create fiscal space for better investments?
- Can jurisdictions use this kind of multidimensional insight to set policy and direct incentives?

The Access to Nutrition Initiative[26] reports that "The costs to human life due to unhealthy diets is $11 trillion", which is greater than the total amount spent on food, globally, per year. Helping people live healthier, longer, more vibrant lives has measurable benefits across the whole of society. Metrics that track market trends don't tend to capture this value. Combining data systems to generate new, additional insight regarding both financial and non-financial value creation can allow markets to see, chase, strengthen, and benefit from this widespread based of additional value.

Maybe most important in the area of nutrition is the core finding of the EAT-*Lancet* Commission, which outlined a Planetary Health Diet. The Commission found that food systems in their current form are breaching 5 of 9 planetary boundaries, and that significant changes are needed to slow and reverse the unsustainable destruction of the foundations of planetary health. The core finding was that it is, in fact, possible to feed 10 billion people sustainably, in a way that supports both planetary health and human health and wellbeing.[27]

[26] The Access to Nutrition Initiative is a GFFN Core Partner and works to transform markets to better align with delivery of healthy, nutritious food. URL: https://accesstonutrition.org/news/why-access-to-nutrition-initiatives-new-strategy-aims-to-transform-markets-for-healthier-food/

[27] For the full EAT-*Lancet* Commission report and extensive related materials: https://eatforum.org/eat-lancet-commission/

PLANETARY-SCALE STRESSES ON NATURE AND HUMAN SECURITY

Since we initiated the work of developing a *blueprint for data systems integration* to support healthy, sustainable food systems finance, we have seen a rapid escalation in intersecting pressures on the Earth system, and increasingly destabilizing impacts on ecosystems, food systems, and society.

The 15th Conference of Parties to the Convention on Biological Diversity agreed a new Global Biodiversity Framework, in December 2022.[28] This unprecedented breakthrough is good news, but it comes against a backdrop of catastrophic and accelerating nature loss and emerging planetary-scale mass extinction.

The 6th Assessment Report of the Intergovernmental Panel on Climate Change finds that the window for successful climate-resilient development is rapidly closing, and that even today's highest ambition plans would still see us breach 1.5C of global heating, possibly by 2040. Beyond 1.5C, the AR6 finds we could lose critical regulating structures within the climate system, making it far more difficult to recover a human-friendly stable climate.

2023 has seen record heat, with shocking anomalous events, including:

- an all-time global temperature record on July 3, with July 4 reaching 0.98°C warmer than that all-time record—a global temperature increase of 1°C above all previous records, in just 24 hours;
- the simultaneous occurrence of 5 static heat domes forming a planet-wide band of extraordinarily dangerous heat, sustained with abnormally rigid atmospheric structures;
- record low summer sea ice in the Arctic Ocean summer and record low winter ice cover around Antarctica;
- persistent repeated multi-disaster days, with 2 or more regions experiencing severe climate change impacts simultaneously.

An update to the Planetary Boundaries framework, based on new, more detailed observations, finds we are now actively breaching six of nine planetary boundaries.[29]

- "For >3 billion years, interactions between the geosphere (energy flow and nonliving materials in Earth and atmosphere) and biosphere (all living organisms/ecosystems) have controlled global environmental conditions."
- "Today, human activities with planetary-scale effects act as additional forcing on Earth system. Thus, the anthroposphere has become an additional functional component of Earth system[30] [31], capable of altering Earth system state."

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[28] The Global Biodiversity Framework: https://www.cbd.int/gbf

[29] 2023 Planetary Boundaries update: https://www.science.org/doi/10.1126/sciadv.adh2458

[30] Reference 3 to the Planetary Boundaries update: https://www.science.org/doi/10.1126/sciadv.adh2458#core-R3

[31] Reference 8 to the Planetary Boundaries update: https://www.science.org/doi/10.1126/sciadv.adh2458#core-R8

- "This planetary boundaries framework update finds that six of the nine boundaries are transgressed, suggesting that Earth is now well outside of the safe operating space for humanity."

The new State of the Climate report, published in late October 2023, finds that:

- 20 of 35 Earth system vital signs "are now showing record extremes";
- "By the end of this century, an estimated 3 to 6 billion individuals—approximately one-third to one-half of the global population—might find themselves confined beyond the livable region, encountering severe heat, limited food availability, and elevated mortality rates because of the effects of climate change (Lenton et al. 2023)."[32]
- "there may be serious and underestimated future risks of synchronized harvest failures caused by increased waviness of the jet stream";
- "adaptation-focused efforts are needed to improve crop resilience and resistance to heat, drought, and other climate stressors";[33]
- "The effects of global warming are progressively more severe, and possibilities such as a worldwide societal breakdown are feasible and dangerously underexplored."

The report calls for an IPCC special report "that focuses on the perilous climate feedback loops, tipping points, and—just as a precaution—the possible but less likely scenario of runaway or apocalyptic climate change." The report also finds that focusing only on climate change mitigation will be insufficient to prevent societal breakdown due to unsustainable stress on the Earth system, noting:

> *"Massive suffering due to climate change is already here, and we have now exceeded many safe and just Earth system boundaries, imperiling stability and life-support systems (Rockstrom et al. 2023). As we will soon bear witness to failing to meet the Paris agreement's aspirational 1.5C goal, the significance of immediately curbing fossil fuel use and preventing every further 0.1C increase in future global heating cannot be overstated. Rather than focusing only on carbon reduction and climate change, addressing the underlying issue of ecological overshoot will give us our best shot at surviving these challenges in the long run."*

The major news of this moment is that we are, as a global community, as a species, facing an existential crisis. That means two things, fundamentally:

1. We are facing threats that could wipe out civilization as we know it, and even our species itself, along with millions of others;

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[32] Significantly more information is needed, through cross-referencing of datasets, economic trends, and geopolitical impacts of mass migration, to quantify the value-building or value-destroying qualities of specific food systems practices and related investments, incentives, and policies.

[33] One insight that has arisen repeatedly in discussions about data required for successful climate adaptation in land use, food production, and wider environmental stewardship, is that the scale of climate disruption is such that the required level of crop-resilience benefits won't be achievable with modified or specially designed seeds. An ecosystem-scale approach to adaptation is needed, so all of the natural co-benefits of biodiversity and ecological health and resilience can be brought to bear. This will require additional layers of data system integration to provide distilled, actionable insights to non-expert food system actors across the value chain.

2. Extreme conditions are compounding so rapidly, we may soon have few to no options available to prevent the worst.

Never before in human history has it been more important that we understand the extent of our impacts on the Earth system and its ecological life-supports. The very prospect of stable, sufficient, and secure food systems is now in doubt.

SUMMIT TO SEABED STRATEGIC INSIGHTS

In the policy and finance realms, discussions of climate, biodiversity, nature, watersheds, sustainability, and health, tend to be separated into institutional rubrics: one agency deals with pollution; another deals with energy; another deals with agriculture; environmental protection related to energy and agriculture may or may not be linked to the pollution control agency, but will likely be separate from energy and agriculture. Other industries answer to other agencies, and trade is often treated as an area of concern that need not directly act on anything except expanding the market reach of exported goods and services.

This fragmentation of insight and responsibility leads to the erroneous strategic decision to treat these highly consequential overlapping areas of concern as niches where only highly trained specialists need focus their attention. This leaves government, markets, and the wider mainstream economy, less able to intelligently act on intersecting sustainability imperatives. It can also leave overall planning for major objectives limited to those actions that take place after most of the damage has been done.[34]

The Blue Economy, for instance, is often treated as anything that takes place in the ocean. “Blue carbon” investments that support enhancing carbon sinks in land-based marine ecosystems may also qualify. There are numerous efforts to engineer better boats, nets, sonar, and other technologies, that might make ocean-related activities cleaner and more sustainable. But that leaves out the vast array of economic activities that occur on land and which undermine or condition ocean health and resilience. Actors and decision-makers across watersheds, some as far as the very center of large continents, thousands of miles from any ocean, are positioned to make decisions of great consequence that could shift market standards and decide the fate of ocean ecosystems.

Food systems across the world currently pollute waterways and through them the ocean. Changing how food is produced, to eliminate this pollution, can make ocean-safe land-based practices into investable business models. Connecting those ocean-safe practices to watershed management, pollution control, municipal budgets, and watershed-scale policy, public spending, and investment incentives, can build small-scale novel business models into economies of scale that attract new investment to hundreds or even thousands of small, rural communities.

[34] It is becoming more workable to project with reliable detail the difference in value-building capacity between costly investments made too late and preventive measures that reduce or eliminate catastrophic costs over time. As this kind of insight becomes more readily available to mainstream actors, it will be imperative for investors, financial actors, and the public sector, to assess, comprehend, and leverage this information for more optimal investment outcomes.

The data needed to support this kind of investment needs to trace impacts from Summit to Seabed, showing how and where outcomes overlap with other priorities, and highlighting financial cascade effects. Cleaner air and water, greener spaces, and more productive lands, can make a region more attractive to new residents and new investors; practices upstream that make it easier to achieve those outcomes can make other aspects of one large investment portfolio more stable, sustainable, and lucrative.

Summit to Seabed strategic insights are needed; integrated data systems are needed to make them visible and viable; intersecting areas of impact include[35]:

- Benefits to clean air and water;
- Healthy, resilient biodiversity and ecosystems, throughout the watershed;
- Healthy, resilient biodiversity and ecosystems in the marine environment;
- Reduced costs for managing pollution and producing clean water downstream;
- Reduced costs for managing impacts of extreme weather events;[36]
- Benefits to protection of pollinator populations, including ecosystems that support them;
- Related benefits to sustainable productive capacity of agricultural lands;
- Microclimate improvements both on agricultural lands and in urban areas;
- Improved trust and inevitability for businesses at all scales;
- Unlocking of new sustainable investment for local SMEs providing non-financial benefits.

LINKING ANIMAL WELFARE TO VALUE CREATION

Animal welfare is a critical area of food system sustainability that affects how land is used, whether ecosystems are valued or devalued, how value is prioritized in the consumer marketplace, what kind of information is traceable and made available on labels to inform purchase decisions, and whether consumers enjoy the maximum health benefit from the food they consume. Animal welfare —and the general valuing of animals' health and living conditions—can also affect human health by making viral spillover to the human population more or less likely. The better animals are treated, the less likely they become vectors for spillover of novel pathogens.

One critique by both public authorities and food industry actors of the pandemic prevention insight is that there is not enough practical everyday use of relevant information to show a direct correlation. That is precisely why advocates for both public health and animal welfare say better data system integration is needed, to ensure we have the necessary insight to make informed

[35] This list is not exhaustive, but is meant to exemplify the diverse range of interests that can attract new investment, provide financial and non-financial benefits, and leverage the enhanced decision insights of good food finance-related integrated data systems focused on watersheds and the Summit to Seabed approach.

[36] There is strong evidence that communities facing extreme events benefit from “green infrastructure”, including wetlands, mangroves, and other unique frontline ecological agents, but also extending to the compounding effects of rich, biodiverse subsurface ecosystems protecting against secondary extreme events such as landslides or soil loss following extreme flooding, wind, drought, or fire events.

decisions that reduce risk and harm and provide conditions for a healthier, more sustainable, and more prosperous future.

Animal welfare is a major point of interest for consumers, and can help to shape food systems to be more sustainable, more investable, and more conducive to good health outcomes for people. We will detail in future briefs building on this report some of the specific ways data related to animal welfare can improve the health and resilience of natural systems, deliver improved health benefits to people, and improve the overall inevitability of sustainable food systems.

PRACTICAL AND STRATEGIC OBJECTIVES

Mainstreaming

To mainstream food systems transformation as a value-creation strategy in finance and investment, financial decision-makers will need access to **reliable multidimensional data**, integrating across diverse areas of interest. These multidimensional data flows will need to contain detailed time-sensitive and cross-referenced information about provenance, relevance, and directional decision support, while allowing financial decision-makers **to see the future value embedded in the choices they are making today.**

Business model innovation

To achieve this level of routine decision insight, detailed strategies for data systems integration and related business model innovation, across sectors, will be needed. This DSI Blueprint outlines some of the key challenges and solution areas for achieving that integration. This Blueprint also serves as a window into the first exploratory integrations, to be conducted in 2024 and 2025.

Design and development of new, refined data-related business models will be part of this exploratory phase. Initial experiments, analyses, and output concepts will include emerging and over-the-horizon business models for **financial intermediary services, Earth system science insight translation services, and relevant technologies** large and small that will play a role in connecting Earth system science insights to financial data flows.

Health, nutrition, privacy, and security

We are also conscious that data systems integration strategies supporting the mobilization of good food finance—both through the Good Food Finance Facility and more broadly across public, private, multilateral, and philanthropic sources of funding—will need to reliably produce information about the **health and nutritional value** of items moving through the food system value chain. Where health data is concerned, **privacy and security concerns** are paramount, so the IDSI will look at existing metadata usage profiles, and the role of static general application information emerging from conventional academic studies of public health conditions and influences.

In other words, data privacy and security measures should put individuals first, prioritizing human rights over trade secrets or perceived commercial opportunity. This standard—putting privacy and

security before profit—is necessary to safeguard the structural and functional integrity of integrated data systems and multidimensional metrics, and to secure the widest possible market for good food finance-related decision-support data.

Non-voluntary data

For the purposes of **climate-related MRV** (monitoring, reporting and verification), it is widely understood we need to move beyond voluntary reporting as the primary data-gathering method, and support robust, detailed, intelligently cross-referenced, fair, and evolving **non-voluntary remote observation** of impacts related to value chain activities. We use the term 'non-voluntary', because this should not be against the wishes of assessed entities, but corresponding to an operational interest in demonstrating higher levels of performance, quality, and sustainable outcomes.

A key measure of success of the IDSI endeavor will be the creation of integrated data systems that reliably produce **multidimensional metrics**, drawing in part on non-voluntary observational and cross-referenced information, to qualify performance of value chain actors large and small, giving those that activate sustainable, healthy, and resilience-building strategies sooner a clear indication of value added.

Integrating financial and non-financial value

These multidimensional performance insights should demonstrate both financial value added (including expanding market opportunity, and credit access linked to resilience contributions that benefit the wider economy) and non-financial value added (co-benefits across climate, biodiversity, nature and ecosystems, watersheds, health, nutrition, affordability, and more broadly, the SDGs). A critical core aim of the IDSI is to deliver end-user directional insights that fit into existing financial market activity, by **allowing non-expert decision-makers to see this enhanced investable value**, where status quo systems would not.

CRITICAL EMERGING QUESTIONS

Given the complexity, and the far-reaching consequences, of information that will inform food-related finance decision-making, this Blueprint cannot simply lay out one clear path to the optimal design of integrated data systems. No matter how much progress is made toward best-case state of the art multidimensional data, the work of ongoing optimization must continue. At all times, there will be critical questions about performance, both for human and planetary health and wellbeing, and for financial risk and return.

We examine here some critical questions that have remained open throughout our process of inquiry and insight-sharing:

- Can **the *nature data* challenge** be best addressed by considering each of the possible technologies, platforms, stakeholder groups, and food finance architecture elements, in

practical and interactive detail? Will any examination of those interactions include enough interactions over enough time to yield a single best integration strategy?

- Given the complexity of the integrated data systems challenge, should practitioners apply **multiple overlapping means of quality assurance testing** to each integration?[37]
- Can the best case for **nature-positive investment** be the many connections healthy, sustainable food systems hold across all areas of human activity?
- Can the **risk and resilience** spectrum of considerations[38] provide a unifying frame for data relating to finance, food, nature, and human health?
- Are there specific **tools and strategies** that are currently succeeding while tying together many of the above priorities?

There has been general consensus among participants in Good Food Finance Data Systems Dialogues that this DSI Blueprint should provide some contextual detail pointing to the optimal ways to proceed with data systems integrations, while continuing to ask, answer, and reformulate these critical questions, and others like them. It has also been a consistently shared insight that a helpful guidepost would be active consideration for the known or potential beneficiaries, including long-term benefits to future generations.

TRANSLATING VITAL SIGNS

The work of translating scientific observations of vital signs of the Earth system into context-specific decision insights that can be understood and acted upon by end-users across food system value chains will require an unprecedented level of alignment, interconnection, and evolutionary shared learning between and among distinct data generation and management platforms. More succinctly: information systems that have nothing in common will need to connect, understand each other, get smarter, and make all of us smarter, too.

The Integrated Data Systems Initiative embraces the complexity of this challenge; it was initiated precisely for this purpose. This means we recognize that to achieve reliable everyday mainstreaming of good food finance, we will need to connect science insights about Earth system vital signs to both financial and non-financial data used by decision-makers at all levels.

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[37] When using 'integration' in this way, we are referencing three specific levels of data systems interaction: 1) the addition of a new dataset or data system to an already existing one; 2) the resulting interactions between the new dataset or data system and the others previously integrated, with each of those resulting interactions qualifying as a new 'integration'; and 3) the overall result of a given combination of datasets, data systems, and past integrations into one new whole.

[38] The resilience spectrum of considerations includes human health, as well as the quality of other systems that support and sustain human health, the detail and quality of our scientific understanding of interacting forces that lead to better health and resilience or to vulnerability, harm, and cost, the quality of emerging multidimensional risk and resilience metrics, used by financial and insurance practitioners, government decision-makers, and local end users, as well as planetary scale science on climate, nature, biodiversity, and other underpinnings of overall resilience. This spectrum extends to questions that shape the fiscal health and stability of nation states.

- **Financial decision-makers** want better, more detailed, intelligent and evolving information regarding risk and return; their having access to such information will make it easier to get capital deployed to support better, more sustainable practices.
- **Food producers** need to know which practices will produce the best results across a range of irreducible interests: production, health of soils, nature and ecosystems, restoration and resilience, and market viability over multiple timescales.
- **Earth system science platforms** produce critical decision-relevant data, but do not have an easy way of translating all of the information they produce into the optimal data resource for the wide diversity of decision-makers who will play a role in shaping the overall quality and sustainability of our food systems.
- **Marginal and frontline communities** can benefit from constructive overlap and targeted translation of connections between data flows used by financial, food production, and Earth science managers and decision-makers. By connecting these distinct areas of insight generation to produce new additional insights, it becomes possible to extend impact-focused financial resources to communities that have so far had little to no access to banking, capital investment or financing.
- **Intermediary SMEs:** Small and medium-sized enterprises across the food system value chain can benefit from multidimensional food system sustainability insights, to support the delivery of new services, which may include critical aggregation and disaggregation of Earth system insights and financing.
- **Public officials** need to have multidimensional decision-support insights, to accelerate discovery of optimal alignments between revenues, budget provisions, incentives, and outcomes across nature, health, macro- and microeconomics, financial opportunity, and fiscal health and stability.
- **Distributors and retailers** can better identify emerging opportunities in healthy, sustainable food products, by utilizing data regarding trends and outcomes linked to specific financial and non-financial data.
- **Consumers** are ultimately the largest group of food systems actors, whose collective activity can shift overall market dynamics. We list consumers last here, not because they are least important, but because they do not, on their own, have leverage to generate demand for better, healthier food that is sustainably produced and affordable. To achieve that, consumers need to be able to make choices rooted in common sense, better value, and consistent evidence, so they can readily and reliably make choices that align with planetary health.

To create consistent, economy-wide "demand pull", each of these groups of decision-makers need to be informed by data systems that talk to each other, assess meaningful overlaps, and produce multidimensional insights into provenance, process, and performance. As a result, the Integrated Data Systems Initiative should prioritize active translation of observations and evidence regarding Earth system vital signs into ratings, labeling, and financial priority data, to drive better decision-making across the whole value chain.

This goal of successfully translating Earth system vital signs insights into food value chain decision insights will be a core organizing priority for the IDSI endeavor.

BENEFICIARIES OF GOOD FOOD FINANCE DATA

The beneficiaries of good food finance data include people, communities, institutions, and enterprises across the world, and operating at all scales. Of course, the constituencies listed under Translating Vital Signs, above, are beneficiaries, as decision-makers in the food system value chain, but we wish to focus here not on data usage but on the outcomes related to generalized usage of good food finance data across all of society.

The following list of projected beneficiaries is meant as a starting point for mapping out new additional value creation linked to integrated good food finance data systems—including for health, wellbeing, and generalized sustainable prosperity:

- **Municipalities** – Cities have a measurable interest in creating conditions that allow residents to live healthier lives and reduce the cost of both slow-moving and shock events in personal health, local economies, and wider macroeconomic experience.
- **SMEs** – So do small and medium-sized enterprises (SMEs), national governments, and the wealthiest corporations and financial institutions.
- **Sustainability data intermediaries** – The food systems transformation will invite and reward innovative intermediary business models that deliver data to support smarter decision-making about overall value creation and resilience building.
- **Farmers** – Such intermediaries can help to reward small producers for delivering climate services, ecosystem services, improved conditions for biodiversity and watersheds, and public health benefits. This can help to resolve the mismatch of scale between subsistence communities that operate in single digit amounts of major currencies and international financial institutions that manage capital flows in the billions and tens of billions.
- **People and communities** – Human health is conditioned by our food systems, and by the background of destructive or constructive practices that comprise the policy and investment environment; integrated and cross-referenced food systems data flows can generate benefits for job-creation and economic development or diversification. For food systems to be healthy for people, and to generate a lower incidence of diet-related non-communicable diseases, we need to surround consumers with better choices, and allow them to distinguish between the available options.
- **Nature** – We cannot manage what we do not measure, and decision-makers cannot act on measurable goals if the measurements don't align with their objectives. Climate, water, ecosystems, biodiversity, and the wider health and resilience of nature—including in terms of circular economy aspirations and related business models—require information gathering, processing, and support. The diversity of potential benefits, and avenues of delivery of those benefits range from health of nature to human health, to the investment opportunity available to institutions large and small.

As we noted in the section on Planetary-scale stresses on nature and human security, the latest science regarding the state of the Earth system points to worsening threats to the stability of the climate, to nature (including biodiversity, ecosystems, watersheds, and the impacts on all kingdoms of life), to fresh water supplies, and to geophysical security for people, cities, and regions. As complex assessments of **nonlinear compounding interactions** reveal more about forcing factors for vulnerability, risk, and resilience, it is becoming clear that we will not be able to develop the optimal financial and insurance tools, until we learn to combine information flows that each reveal part of the wider picture.

The Anthropocene is a time not only of human impacts on nature, and resulting degradation of conditions for human thriving; it is also a time of inescapable complexity, when our actions, and our institutions, play a role in shaping medium- and long-term outcomes we may not yet have imagined. This operational complexity of the current moment is a clear enough signal that it should be treated as a governing principle for design of integrated data systems to support sustainable, resilience-building decision-making.

What this means for end users and beneficiaries of improved outcomes, in operational terms, is:

We need to develop data systems that are complex enough to not misrepresent the complexities of the living world, while producing integrated metrics that are easy to understand and act on, even for non-experts.

PRIORITY AREAS OF PRACTICAL NEED

To link real-world practical capabilities with strategic imperatives for full-spectrum food systems transformation, the first exploratory Good Food Finance Integrated Data Systems should provide some or all of the following:

- **Data capture** linked to production, supply management, and end user experience (sales to consumers, including detailed information about the contents and origins of food items);
- **Data management systems**, including closed proprietary systems and open systems with limited or unlimited public access;
- Existing and emerging **business models** that produce, utilize, or leverage data systems, whether narrowly or across a range of indicators;
- Data systems and services that provide **financial decision-support**;
- **Technologies** (including Earth-orbiting satellites) that monitor environmental indicators and track environmental change;
- **Information and reporting processes** moving through public agencies tasked with supporting environmental stewardship, agricultural optimization and production, ecosystem health, public health, and food safety and nutrition;
- **Fiscal data management**, including technologies that produce, store, and share data, as well as policy-level capability to shape fiscal outcomes in line with well-tested or emerging metrics and priorities.

In each of these areas, there are resourcing considerations and technical capacity constraints.

1. Does the institution, jurisdiction, sector, or relevant stakeholder environment, have the financial support, institutional mission and capability, technical capacity, or everyday business models necessary to generate, manage, access, and apply data in these ways?
2. Where that deficit exists—and there are good food finance deficits in every country, regardless of wealth or technical advancement—which strategies allow for filling the remaining need?
3. Are any of the relevant institutions predisposed to operate optimally—according to their own criteria—without meeting the needs of the most vulnerable, marginal, or excluded communities? Are those communities directly connected to the food system value chain?
4. What can be done to improve the practical understanding of integrated function and integrated risk and vulnerability?

Since the Good Food Finance Network began exploring Integrated Data Systems as a needed infrastructure improvement to food-related and financial decision-making, we have seen vulnerability, marginalization, inequality, and sustainability-linked risk turn into increasing pressures on sovereign debt.[39] We have also seen that situation exacerbated by the COVID-19 pandemic, so that in 2022, dozens of countries were facing deep debt distress at the same time—a potentially existential threat to the international financial system.[40]

This means vulnerability-sensitive debt relief, and related information systems and financial innovation, will be critical to optimizing the global financial future. All nations now need macrocritical (economy-shaping) insights[41] into financial opportunity, geophysical and market risk, and fiscal stability. Since the Sustainable Development Goals were adopted in September 2015, they have become an increasingly important map of macrocritical forces.

A critical area of practical need will be the design of new multidimensional metrics that link fiscal stability to Earth system vital signs, geophysical risk, and sustainability and economic inclusion.

Each of the projected priority areas listed above requires understanding and management of data from one or more related categories of performance tracking.

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[39] Detailed analysis from Boston University's Global Development Policy Center, "The World Is Going Bust: What Is the Sovereign Debt Crisis and Can We Solve It?" URL: https://www.bu.edu/articles/2023/what-is-the-sovereign-debt-crisis-and-can-we-solve-it/

[40] Analysis by UNCTAD Secretary-General Rebeca Grynspan, who is also a Co-Chair of the Good Food Finance Network, "The world lacks an effective global system to deal with debt". URL: https://unctad.org/news/blog-world-lacks-effective-global-system-deal-debt

[41] On macrocritical resilience and the forces that shape it: https://resilienceintel.org/macrocritical

DATA CATEGORIES

Overview of data categories

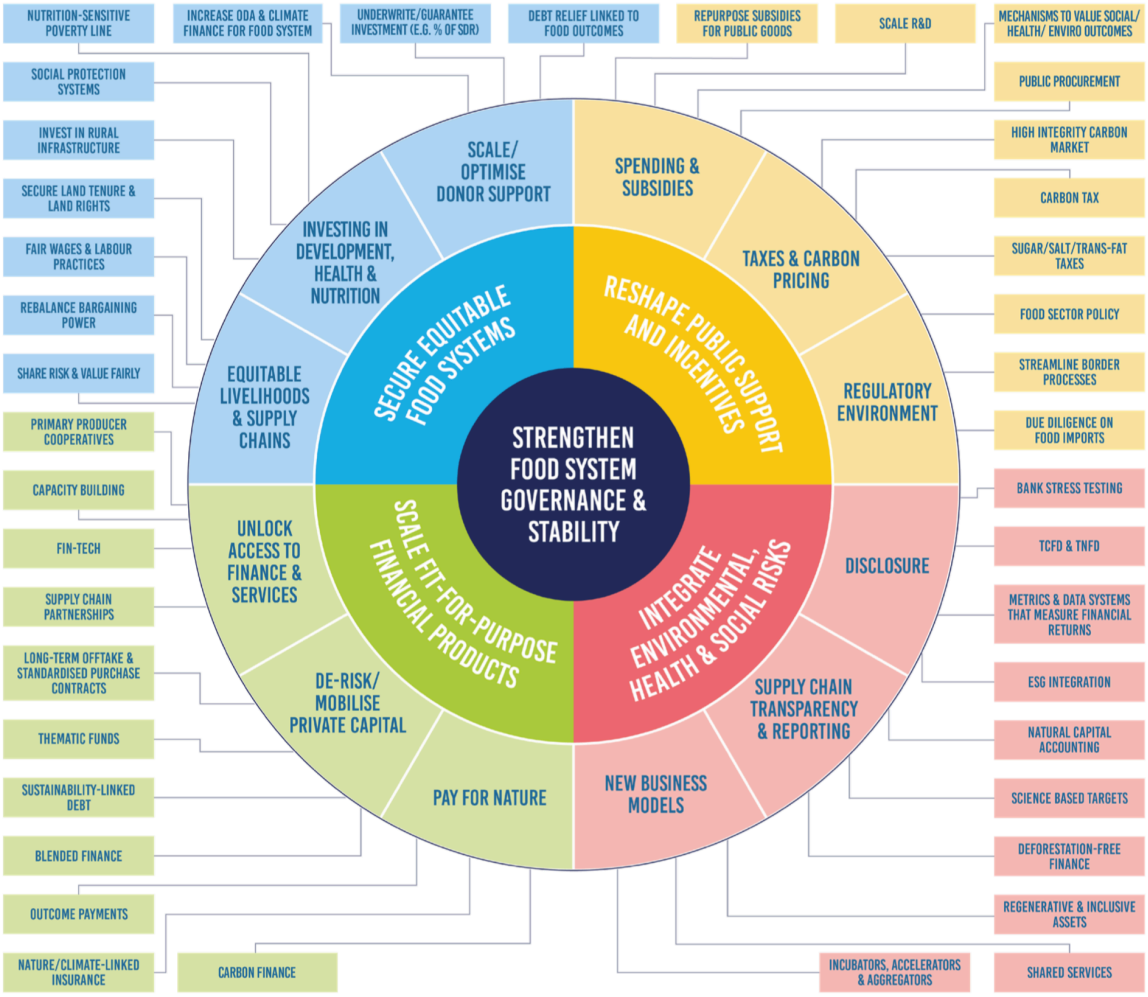
Relevant categories of data, including some that may be more subjective, include:

- Financial valuation data:
  - Which business models
  - Which innovations
  - Which capital structures
- Financial transaction data:
  - Which financial instruments – bonds, etc.
  - Special purpose vehicles showing new interest in emerging sustainability activities
- Data that support public-sector decision-making
- Science data relating to Earth systems, including:
  - Temperature
  - Water
  - Emissions
  - Ice cover
  - Forest cover
  - Biodiversity
- Food systems data, including:
  - Agricultural land
  - Total production
  - Export volume, origin, timescales
  - Supply chains
  - Animal welfare insights related to food production and retail food products
  - Processing vs. unprocessed retail food products, by volume
  - Cold chain and other storage and distribution data
  - Nutrition information at product level
  - Nutrition information at population level
  - Human health trends and specifics
- Macroeconomic trends
- Public sector tracking of local, regional, and national economic health and resilience

- Fiscal and budgetary data at all levels of public authority
- Indicators of local capability and resilience
- SDG-specific indicators[42]

Food Finance Architecture

In addition to this general overview of data categories, we specifically want to identify data platforms and strategies that connect to each of the segments of the Food Finance Architecture which was published on 23 September 2021 for the United Nations Food Systems Summit.



The Food Finance Architecture report included this detailed mapping of the landscape of food finance analysis, decision-making, and action. Around a core of five areas of transformation, the landscape includes dozens of discrete areas of work, some with highly specialized networks of professionals dedicated to performing at known high standards, and which will need to cooperate to innovate to achieve the best-case state of the art, in terms of analysis, decision-making, and action. While we will zoom in on some key areas of overarching need, this report recognizes that practitioners and stakeholders will need to see real-world benefits from data systems integration, under all of these headings.

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[42] An important note on the development of accountability standards for the Good Food Finance Facility: Good Food Finance Network partners will work with the UN Development Program to develop a Good Food Investing Framework, which will be structured around the SDG Impact Standards and other proven effective sustainable development and sustainable investing indicators.

Different sectoral actors and stakeholder groups may wish to focus on distinct action items across the overall Food Finance Architecture. While the DSI Blueprint is not intended to pre-determine this sectoral interest for any particular group, our discussions to date suggest it would be useful for the Integrated Data Systems Initiative to provide core foundational support for mainstream decision insights and relevant tools that can be of most use to specific actors and stakeholder groups.

To build on past work done by Good Food Finance Network partners, exploratory integrations undertaken by the Integrated Data Systems Initiative should recognize and address the 14 Actionable Areas of Innovation identified by the Innovation Experts Group that informed the launch of the Good Food Finance Network:

1. Science-based targets[43]
2. Metrics and data systems
3. Cooperative de-risking strategies[44]
4. Blended finance
5. Innovative financial services
6. Payments for nature
7. Sustainability-linked debt
8. Regulatory requirements[45]
9. Green budgeting—projections, policy, and incentives
10. Public procurement actions and administration
11. Repurposing subsidies for public good
12. Debt relief linked to food outcomes
13. Targeted tax adjustments
14. Land value reassessment

Budgeting, procurement, and subsidies (9-11 in the above list) can seem to comprise one overall area of action, but critical innovations are needed that are specific to each.

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[43] Early GFFN consultations that led to the creation of the Integrated Data Systems Initiative identified the need to link science-based targets to clearly defined metrics that can be widely deployed through mainstream activities, and to new and emerging business models that benefit from cooperative de-risking, green budgeting, and other innovative modes of financial intervention.

[44] Cooperative de-risking means, above all, including in de-risking benefits those actors along the value chain who might not otherwise have access to finance, and who therefore tend to carry an outsize risk burden. Such strategies can greatly enhance the overall pool of investable value, and grow real-world benefits not only for newly included parties but for more affluent investors that used to depend on externalized cost as a de facto de-risking strategy.

[45] Regulations can be leveraged to reward those entities that enter into sustainability-oriented, cooperative financial arrangements, building a wider base of overall value. For this to work, new data-driven insights are needed that support the enhanced valuation of better-practice business models.

- Budgets need to account for non-market benefits, and the difference between value claims that depend on generating massive hidden costs as compared to those that do not.
- Procurement can focus on the direct support for producers and service providers, by making strategic purchases to grow and steer markets.
- Subsidies likely lag behind both of these other areas of innovation, because they tend to support major structural elements of the status quo, so restructuring, realigning, and repurposing subsidies will require innovation in policy, institutions, data, metrics, and business practices; threading them together through integrated approaches can be critical to accelerating progress.

The goal of all practical information added to these thematic headings will be to provide the broadest and most diverse possible scope for assessing where high-value intersections and network effects can be achieved through DSI linked to good food finance outcomes that benefit people and nature. During the Exploratory Integrations phase of the IDSI endeavor (2024-2025), we aim to provide structure and detail for specific practical examples of how advanced DSI, in support of multidimensional metrics, can link finance and investment to the above areas of innovation.

Financial Risk & Return

We will also aim to assess financial risk and return profiles for distinct categories of financial delivery, investment prioritization, and asset management. These might include:

- Data relating to design and delivery of reduced risk and enhanced return through thematic (outcome-focused) funds;
- Data linking financial performance both internal to the investment and for others across the investment landscape to specific supported practices and their non-financial outcomes;
- Sustainability-linked debt, nature and climate-related insurance, and carbon risk reduction financing, as linked to commercial banking activities;
- Targeted application of Earth system science data and public health and true cost food system accounting to inform realignment of budgets, public spending, and incentives;
- Data tracing financial impacts on forest cover, ecosystem restoration, and the broad spectrum of sustainable land use practices, including regenerative farming and agroecology, exploring the possibility of revaluing assets for this specific kind of value added;
- Cross-referencing systems that support financial insights linked to ESG metrics, and reporting/reduction of nature-related and climate-related risk.

Understanding that new financial instruments and financing strategies can only emerge when there is reliable information available to make the investment case clear, the IDSI will aim to support such financial innovation efforts by assessing the availability, applicability, interoperability, and reliability of relevant non-financial information flows.

SERVICE CATEGORIES

Throughout the priority areas of practical need and the survey of data categories, there is an implied benefit in terms of the kind and quality of services that can be provided if more multidimensional data were more readily available.

The following is a provisional list of service categories, where the use of multidimensional data can provide both practical improvements and also improve the performance of routine activities for generating healthy, sustainable, and climate-smart food system outcomes:

- Financial decision support
- Policy tracking and support
- Climate performance tracking
- Sustainability and resilience data
- Insurance and liability
- Nature and ecosystems, including biodiversity and conservation
- Agriculture
  - Production
  - Policy and incentives
  - Land use practices
  - Land valuation
  - Soil carbon
  - Water management
  - Animal welfare
  - Linkages with commodities markets
  - Trends linked to trade
- Business management support, including SMEs
- Banking – finance, commercial, SME, food value chains
- Consumer decision support
- Health-building quality of food items and related production methods

For each of these service categories, the DSI Blueprint should include information about relevant tools and technologies, specific service providers or sectoral associations and networks, enabling and boundary policy provisions, and information about data producers, managers, service providers, and end users.

Discussions to date suggest this information about producers, managers, providers, and users should answer a series of common guiding questions—outlining where their interests intersect and diverge.

TECHNOLOGIES AND MODALITIES

Data related to food systems, finance, and to social and environmental outcomes moves through widely varied technologies, device networks, and structural modalities. Some of these are specific to the devices that gather or store data; some are specific to business models at work in a particular segment of the overall value chain.

For this Draft Blueprint we focus on technologies and modalities that are most likely to produce, contain, or deliver data related to investment opportunity in food system transformation actions. The following is a non-exhaustive list:

- Voluntary digital reporting systems
- Digital reporting systems required by law or regulation
- Financial market tracking systems, including stock market indices and both open and proprietary analysis of markets, currencies, and financial instruments
- Satellites and satellite arrays
- Public repositories of Earth systems data
- Processed, refined, and cross-referenced science information systems, including:
  - key data points aligned with prevailing metrics
  - decarbonization, land and water use, food production methods
  - conservation of forests and marine ecosystems
- ESG tables, reports, and indices
- Public-sector tracking systems linking financial interventions to outcomes for people and nature, including climate indicators

We aim to provide actionable insight on which technologies and modalities connect to which areas of action, which enabling policies, and which investable climate-related or healthy, sustainable food system endeavors. The Technologies and Modalities section will be developed in collaboration with contributing collaborators across the relevant sectors, over the coming months.

We also note that modalities for data sharing are a critical potential barrier to both data integration and to end-user insight access. Public goods data standards could be useful for fostering the necessary ecosystem of multidimensional data systems integration. Open data standards—or specialized data-sharing arrangements designed to allow proprietary information to mix both with openly access data sets and with other proprietary data sets—may be needed to achieve the right balance between commercial and public data.

We invite any who wish to bring new insight to this section of the DSI Blueprint to share their tools, platforms, business model insights, and other resources, or to reach out to arrange small-group discussions, as appropriate.

ARTIFICIAL INTELLIGENCE PRINCIPLES AND RECONNAISSANCE

Artificial intelligence and machine learning are rapidly evolving, with potentially world-changing implications. Data systems at all levels will be affected by the AI revolution—with potential implications for the reliability and traceability of initial inputs, processing, and delivery of insights to end users. Provenance data, and information about integrated value chains, will be improved or corrupted, or inaccessible, based on whether AI systems are used responsibly.

For many reasons—not least the existential implications food systems have for human existence and the stability of nature and of nation states—the IDSI endeavor must grapple with the emerging capabilities of advanced AI. We aim to set clear parameters, rooted in core principles and considering outcomes for people and planet.

Recent news (in the 2nd half of 2023 and first half of 2024) regarding the promise of "generative AI systems", which use large language models (LLMs) to generate new content in response to prompts, search terms, or other inputs, suggest a primary focus of AI reconnaissance must be to watch for potential fabrication or distortion of evidence. Beyond the risk of fabrication or distortion is the risk of excess deference to systems that do not actually make informed judgments, but produce words that state that they have. Surrendering decisions to such systems in the early stages of development can, even without hallucinations, lead to unintended negative outcomes, which might escape detection or fail to be address in a timely manner.

There are also questions about whether non-AI systems can be made secure against intrusion or interference by AI systems which might be leveraged to cause disruption or distortion in data flows and outputs. Given these concerns, and the already active real-world use of AI to spread disinformation, we see a need to clearly outline the appropriate limited functional spaces where AI might play its optimal role in supporting integrated data systems.

We wish to note several important efforts to set parameters, principles, and controls for development and deployment of AI systems:

- **The Bletchley Declaration**[46], produced by the world's first AI Safety Summit, held north of London November 1-2, 2023, calls for AI systems “to be human-centric, trustworthy and responsible,” noting their potential to enhance “public services such as health and education, food security, in science, clean energy, biodiversity, and climate, to realise the enjoyment of human rights, and to strengthen efforts towards the achievement of the United Nations Sustainable Development Goals. The Bletchley Declaration also warns of “potential for serious, even catastrophic, harm, either deliberate or unintentional”, as well as “potential intentional misuse or unintended issues of control relating to alignment with human intent.”
- **The Zero Trust AI Governance Framework**[47] notes the need to enforce existing laws against discrimination and human rights abuses, to draw bright-line rules against potentially threatening or ill-conceived AI system design or business strategies. It calls for prohibition

[46] The Bletchley Declaration: https://www.gov.uk/government/publications/ai-safety-summit-2023-the-bletchley-declaration/the-bletchley-declaration-by-countries-attending-the-ai-safety-summit-1-2-november-2023

[47] The Zero-Trust AI Governance Framework: https://ainowinstitute.org/publication/zero-trust-ai-governance

on seizure or disclosure by third parties of private personal data. It clearly states the principle that "At each phase of the AI system lifecycle, the burden should be on companies to prove their systems are not harmful," and traces correlations with the process for approval of pharmaceuticals.

- **AI provenance tracking standards**—Noting the need for AI regulation that centers human rights, leaders for the organization Witness[48] have called on policy-makers to "ensure that technologies that track how media is made are interpretable across a range of technical expertise. Provenance data for both AI and user-generated content helps understand the integrity of the media and provides signals—i.e. additional information about a piece of content—but does not prove truth."
- **The Blueprint for an AI Bill of Rights**[49], put forward by the White House Office of Science and Technology Policy, highlights many of these concerns and specifically calls for protections against algorithmic discrimination[50], for data privacy protections[51] to be operationally built into the technological and business model design of AI systems, and for end users to have access to a human alternative[52], so automated systems don't effectively crowd out the real-world circumstances, challenges, and right to corrective solutions, of people needing support, noting that "Human consideration and fallback should be accessible, equitable, effective, maintained, accompanied by appropriate operator training, and should not impose an unreasonable burden on the public."

We take these emerging cooperative AI safety and stewardship measures and statements of principle to mean the IDSI endeavor should:

1. Prioritize personal data security, accuracy and accountability, non-distortionary practical applications, and the rights and wellbeing of people over the inclination to deploy data systems to raise funds for commercial endeavors;
2. Treat that principled approach as the best way to provide strong evidence for both financial and non-financial return from integrated data systems designed to support good food finance mobilization and accountability;
3. Aim to limit AI usage in early exploratory integration to non-generative processing functions, to improve speed and reliability, not to tell new non-evidentiary stories about the underlying information;

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[48] "What's needed in deepfakes detection?" by Sam Gregory, for Witness, reviews insights from WITNESS' global preparedness work and the Partnership on AI's SteerCo on Media Integrity work on the Deepfake Detection Challenge. URL: https://blog.witness.org/2020/04/whats-needed-deepfakes-detection/

[49] The White House Blueprint for an AI Bill of Rights: https://www.whitehouse.gov/ostp/ai-bill-of-rights/

[50] Protections against algorithmic discrimination: https://www.whitehouse.gov/ostp/ai-bill-of-rights/algorithmic-discrimination-protections-2/

[51] Data privacy protections: https://www.whitehouse.gov/ostp/ai-bill-of-rights/data-privacy-2/

[52] On end users having access to a human alternative to AI: https://www.whitehouse.gov/ostp/ai-bill-of-rights/human-alternatives-consideration-and-fallback/

4. Consider the human element, including the need for direct human-scale benefits to producers, consumers, communities, to human health and the health of nature, and to create systems that have room for intermediary services.

APPLIED DATA SYSTEMS INTEGRATIONS

We know that exploratory integrations, starting in 2024, will be the beginning of a far-reaching process of inquiry, and that multidimensional performance indicators will be useful not only to financial decision-makers across the food system value chain, but to other actors as well. End-user applications might include labeling standards based on robust provenance tracking and traceability infrastructure, drawing on many of the above-mentioned technologies and categories of data.

We should also expect to see smart-phone apps that draw on integrated data systems to provide decision insights to consumers, to help them better assess and understand purchasing decisions.

- Many consumer-side food systems decisions will be made by distributors and retailers, who fill shelves with nutritious, health-building, sustainably produced food. Such retailers provide an important information resource, and will leverage integrated data systems to scale up and build resilience across their supply chains.
- Smartphone apps providing multidimensional decision insights—drawing on Earth science, health and nutrition science, and data that tracks and visualizes value chains, so their qualities can be cross-referenced, graded, and labeled—can allow consumers to enhance the market opportunity for nutritious, health-building sustainably produced food products.
- The effect of consumer-driven market enhancement is that the reach of better production methods, and so of financing that supports those methods, can expand beyond the select group of mission-driven retailers focused on providing those choices for consumers, sometimes at a noticeable mark-up.
- Multidimensional decision-insights based on integrated data systems can, therefore, be a key lever for expanding the overall supply of nutritious, health-building sustainably produced food products, and for making those products more competitive in the mainstream food economy. This should have the effect of supporting lower prices, while also expanding incomes for producers.

CONCLUSION

When we examine the landscape of need, capability, frontier innovation, and emerging models for sustainable food systems enterprise, we find that actors at all scales, across the spectrum from the most well-funded to the most marginal constituencies, need robust, detailed, actionable insights about the degree of value-building or value-destroying impact of their choices. Integration of data systems is a critical step toward reliable, everyday, mainstream metrics for decision-making that builds resilience, improves health, and fosters prosperity open to all.

From the body of exploratory work outlined above, we find that food systems finance will need to interact with and deploy insights from a broad and diverse range of data sources, interested parties, public good priorities, and innovative enterprise solutions. The following key messages stand out:

- Never before in human history has it been more important that we understand the extent of our impacts on the Earth system and its ecological life-supports.
- We need to develop data systems that are complex enough to not misrepresent the complexities of the living world, while producing integrated metrics that are easy to understand and act on, even for non-experts.
- The prevalence of affordable nutrition and good health shapes the overall quality of life and economic vibrancy of whole societies.
- Multidimensional metrics, based on integrated data systems, that provide summit to seabed health and resilience insights, can support new SME business models that diversify and revitalize local and rural economies.

The underlying premise for this work is to give partners in the Good Food Finance Network—and other innovators, institutions, and stakeholders—a way to shape the emerging multidimensional data systems and metrics that will determine how, where, and why certain standards and practices emerge to drive food systems transformation.

In 2024 and 2025, as the Integrated Data Systems Initiative moves into exploratory integrations—involving technology, networks, platforms, and datasets across overlapping geographies and timescales—we aim to develop more focused versions of this work. Areas of focus will include:

- **nutrition and health outcomes**, including nutrition security and the sustainability of production practices leading to more nutritious foods, ethical treatment of animals, and the co-benefits to such practices that markets have tended to ignore;
- local context for **Planetary Health Diet insights** across food system value chains;
- **climate risk and resilience value added** by specific production practices or business model innovations across the value chain, including for the benefit of attracting new flows of investment into local and national economies;
- how specific samples of data systems integration can support **new business models** that diversify, revitalize, and create more long-term sustainable prosperity in local economies, including for just rural transition and improved rural livelihoods.

Contact

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