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REWIRING FOOD VALUE CHAINS FOR PEOPLE, NATURE, AND PROSPERITY

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Food systems at a crossroads

The decade to 2030 is decisive for food systems. The Sustainable Development Goals (SDGs) provide a shared framework for tackling hunger (SDG 2), climate change (SDG 13), biodiversity loss (SDG 15), and inequality (SDG 10). Food systems sit at the intersection of these goals, yet progress remains uneven. Without structural reform, gains in one domain risk being offset by regression in another, for example, higher output achieved through land expansion; poverty reduction undermined by climate shocks; or export growth secured at the expense of ecosystems and long-term resilience.

Food systems are foundational to human well-being and economic development. They feed 8 billion people, employ more than a quarter of the global workforce, and anchor livelihoods across rural and urban economies.[1] At the same time, food and land-use systems generate roughly one-third of global greenhouse gas emissions and are the primary causes of deforestation, biodiversity loss, and freshwater depletion.[2] As climate volatility, soil degradation, and water stress intensify, the sector is increasingly exposed to the environmental risks it has helped create. Resilience is therefore not only an environmental objective but a macroeconomic and fiscal imperative. These interactions create reinforcing feedback loops between nature, the economy, and society. Degraded ecosystems reduce agricultural productivity, increase price volatility, and weaken rural livelihoods, while economic pressures can drive

1 FAO (2024).
2 FOLU (2019), 12.

further land conversion, resource depletion, and environmental decline. Food systems, therefore, sit at the center of a two-way relationship: Nature underpins economic and social well-being, while the choices made by producers, consumers, firms, and governments determine whether natural capital is maintained or eroded.

Despite widespread recognition of these pressures, progress toward sustainable and inclusive food systems remains patchy. Regenerative production models, forest protection initiatives, and smallholder inclusion strategies continue to struggle to scale. Structural barriers persist, including fragmented land and forest data; weak or misaligned policy incentives; opaque first-mile sourcing; and limited access to affordable transition finance. These constraints dampen investment, entrench short-termism, and shift risk onto the smallholders and forest communities least able to absorb it.

A lack of technical solutions is not the problem. Pathways to improve yields, restore soils, reduce deforestation, and strengthen livelihoods are well documented. The challenge lies in translating pilots into system-wide change. Incentives are embedded not at the level of individual farms, but in the commercial relationships that connect production, trade, finance, and consumption. Without reshaping those relationships, reforms remain incremental and vulnerable to reversal.

A value-chain perspective offers a practical entry point for systemic transformation. Value chains connect producers, traders, processors, retailers, and financiers; they are where procurement standards, trade finance, credit terms, and traceability systems converge.[3] When aligned with policy and financial reform, value-chain governance can internalize environmental and social costs that are currently externalized. When misaligned, it reinforces land expansion, short payback horizons, and ecological risk.

This chapter argues that rewiring food value chains—by aligning policy, finance, and technology—is a pragmatic route to delivering more resilient, equitable, and nature-positive food systems. The sections that follow examine how value chains function as levers for transformation, drawing on soy and cocoa to illustrate both potential and limits, before turning to finance, policy, and implications for the SDGs and the post-2030 agenda.

Treating value chains as the primary unit of transformation has important implications for governance. Rather than relying on fragmented interventions at the farm, firm, or consumer level, it requires institutions capable of aligning actors across production, trade, finance, and consumption. In practice, this means strengthening multi-stakeholder platforms that bring together governments, producers, traders, financiers, and civil society to develop shared transition plans; aligning public incentives and private procurement around common outcomes; and improving transparency over financial and commodity flows.

Value chains as levers for transformation

A value-chain approach examines the sequence of activities and relationships that connect production, processing, trade, and consumption for a given commodity. It asks where value is created, where risks and externalities arise, and how incentives are transmitted between actors. In food systems, this perspective is powerful because decisions affecting land use, farming practices, labor conditions, and environmental outcomes are rarely made in iso-

3 Gereffi, Humphrey, and Sturgeon (2005).

lation at the farm level. They are shaped by procurement contracts, quality standards, financing terms, and market access conditions embedded in commercial relationships.

The intellectual foundations for this approach lie in research on global value chains (GVCs), which shows that governance structures within commodity chains shape how standards, upgrading, and risk allocation occur.[4] Sustainability requirements increasingly function as governance mechanisms, redistributing compliance costs upstream while enabling lead firms to manage reputational and regulatory exposure. Transformation, therefore, depends not only on technological feasibility but on how coordination and commercial power are structured.

A value-chain perspective complements, but does not replace, landscape and jurisdictional approaches. Landscape strategies align conservation and production within defined geographies and are essential for addressing spatial externalities such as deforestation, leakage, and watershed degradation.[5] Jurisdictional initiatives link procurement and finance to performance across states or provinces, reducing transaction costs and leveling standards among producers. Yet these place-based approaches often struggle to mobilize sustained private capital when producers remain embedded in global markets shaped by external demand. Value chains connect those place-based outcomes to market incentives and financial flows across borders.

The ability of value chains to shape incentives is significant but uneven. In many commodity systems, prevailing commercial structures reward land expansion over productivity, short payback horizons over long-term resilience, and informality over compliance. Credit design, trade finance arrangements, and procurement practices often prioritize volume and cost minimization, reinforcing short-term production decisions rather than investment in soil health, traceability, or risk management. Public policy can compound these distortions when subsidies and regulatory frameworks favor input intensity or land conversion.

Even where leading firms adopt ambitious sourcing standards, transformation remains partial if a critical mass of buyers does not move in parallel. Certification experiences illustrate this constraint: Higher standards in one market segment rarely shift global production norms when alternative demand channels remain available. Lasting transition, therefore, depends less on market concentration alone and more on coordinated shifts across policy frameworks, financial systems, and technological infrastructure.[6]

These three domains—policy, finance, and technology—function as institutional complements. Policy establishes baseline rules through land governance, subsidy structures, and regulatory certainty. Finance determines whether sustainable practices are economically viable at scale, particularly for smallholders and small and medium-sized enterprises (SMEs) facing longer investment horizons. Technology reduces information asymmetries through traceability, geolocation, and digital monitoring, enabling risk differentiation and accountability. Progress in one area yields limited results unless reinforced by the others.

How these dynamics play out depends on value-chain structure. In export-oriented chains such as soy or palm oil, concentrated traders and buyers can rapidly transmit sourcing standards when aligned. In smallholder-dominated chains such as cocoa, traceability is more complex and value add is concentrated downstream, limiting producer leverage and making income and service provision central to sustainability. In domestically embedded chains such

4 Ibid.
5 Lambin et al. (2014).
6 IPCC (2023).

as beef or staple grains, political economy constraints are often stronger, as production is tied closely to national consumption, employment, and identity.

Value chains therefore do more than transmit goods—they structure markets. Lead firms, traders, financiers, and standards bodies shape procurement norms, allocate risk, and determine access to capital. When policy, finance, and technology align within these relationships, environmental and social costs can be internalized and capital redirected toward resilience. When misaligned, value chains reinforce degradation and inequality. The question is not whether value chains matter, but how they are governed and financed. Their transformative potential depends on whether incentives, risk allocation, and investment decisions are aligned around long-term resilience rather than short-term extraction.

Case study: Soy in the Brazil-China value chain

Soy illustrates both the potential and the limits of a value-chain approach to food system transformation. Several structural features shape incentives within this chain: producer and trader concentration; the export-oriented nature of trade; limited product differentiation; the relative feasibility of traceability; and the economics of transition, including capital intensity and payback periods. Brazil and the United States together account for roughly two-thirds of global production, while China imports around 60% of its soy from Brazil.[7] This combination of concentrated supply, consolidated intermediation, and stable export demand gives a relatively small number of actors outsized influence over land-use outcomes, trade finance, and production practices. Yet the short payback horizon of conventional expansion and the low differentiation of bulk soy reinforce incentives for land conversion unless financial and policy signals are deliberately realigned.

China's role is central. Analysis by the Food and Land Use Coalition, Re-WIRE, highlights that Chinese demand, driven by feed requirements and long-term food security concerns, creates stable, large-volume offtake relationships that shape trader behavior and investment decisions in Brazil.[8] Unlike the European Union, which has adopted mandatory due diligence requirements through the EU Deforestation Regulation (EUDR), China has historically relied more on supplier assurances, voluntary commitments, and bilateral engagement to promote sustainable sourcing.[9] These differing governance approaches influence how sustainability incentives are transmitted upstream through the soy value chain.

The concentration of actors within the soy value chain creates both opportunities and challenges for transformation. A relatively small number of traders, processors, financiers, and buyers influence sourcing practices across large geographies, giving them significant capacity to scale traceability systems, sustainability standards, and financing innovations. At the same time, market power and information asymmetries can obscure how risks, costs, and benefits are distributed across the chain. Traceability is, therefore, not only a technical challenge but also a political-economy challenge. Its effectiveness depends on who controls information, who bears compliance costs, and how incentives are transmitted between downstream market actors and upstream producers.[10]

7 FOLU, Systemiq, and WBCSD (2025), 7.
8 Ibid.
9 Ibid.
10 Santos, Zaytseva, and Serrano (2025).

Applying the Re-WIRE analytical framework to the Brazil-China corridor across five dimensions—systemic risks, production impacts, transition status, economic feasibility, and financial flows—identified a structural mismatch: While deforestation- and conversion-free (DCF) sourcing has reduced certain risks and improved traceability, the underlying incentives embedded in rural credit, trade finance, and procurement practices continue to favor expansion and short payback horizons over long-term resilience.[11]

Systemic risk is increasingly shared. Climate variability in Brazilian production regions directly affects Chinese feed markets, while evolving regulatory pressures, including European due diligence requirements, create spillover effects that influence how Chinese buyers assess supply chain resilience. Re-WIRE's analysis underscores that China's growing engagement in traceability dialogue and green finance reform represents a potential, though still emerging, leverage point.[12]

Over the past decade, the soy value chain has demonstrated that rapid progress is possible around a narrowly defined objective. Voluntary commitments by major traders, supported by satellite monitoring and farm-level traceability, have substantially reduced soy-driven deforestation in the Brazilian Amazon biome.[13] The Amazon Soy Moratorium is associated with a sharp decline in soy-linked deforestation in that region.[14] Yet Trase data indicates that soy-associated deforestation and conversion reached roughly 790,000 hectares in 2022, much of it concentrated in the Cerrado, where clearing remains legal or weakly enforced.[15] These gains demonstrate how downstream demand and credible monitoring can shift sourcing norms at scale but also show that voluntary compliance cannot offset broader land-use pressures where legal clearing and enforcement gaps remain.

The soy case also highlights why value-chain progress remains fragile when incentives are only partially aligned. DCF compliance addresses one acute risk—deforestation exposure—but does little to resolve broader structural pressures, including soil degradation, climate vulnerability, biodiversity loss, and livelihood inequality. Progress remains politically contested, as illustrated by mounting opposition to the Amazon Soy Moratorium amid shifting state-level tax incentives and legal challenges.[16] When sustainability requirements are perceived as externally imposed rather than aligned with domestic productivity and competitiveness goals, coalitions can weaken and hard-fought gains can stall.

A significant challenge lies in how finance flows through the value chain. Re-WIRE highlights that Brazil's rural credit system provides the majority of formal finance to soy producers, yet lending remains concentrated among larger farms and sustainability-linked credit lines account for only a small share of total flows.[17] Intra-value-chain finance, through forward contracts, input pre-financing, and barter arrangements often rivals formal credit in scale but is rarely tied to environmental or social performance. These instruments are structured to secure supply and manage short production cycles, with underwriting based on yield history rather than land-use outcomes. Without integrated traceability systems and financing aligned with transition payback periods, sustainability criteria remain largely outside the financial architecture of the chain.

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11 FOLU, Systemiq, and WBCSD (2025).
12 Ibid.
13 Heilmayr et al. (2020).
14 Ibid.
15 Pereira and Bernasconi (2025).
16 Wenzel (2026).
17 FOLU, Systemiq, and WBCSD (2025).

It also shows that Chinese financial institutions and trading firms increasingly participate in pre-financing and infrastructure investment linked to the soy corridor.[18] Yet sustainability-linked lending and environmental risk segmentation remain limited in cross-border trade finance. Integrating traceability and nature-risk metrics into China-facing credit lines represents a largely untapped leverage point.

The financing architecture produces a structural asymmetry: Producers most capable of complying with DCF requirements are often least in need of incentives to change, while mid-sized producers in high-risk regions face thin margins and limited access to capital. These actors represent a critical pivot point for transformation.

Finally, the economic logic of "produce-and-protect" remains under-integrated into mainstream finance. Brazil's competitiveness in soy, including its capacity for double-cropping, depends in part on stable rainfall patterns supported by intact forests. Recent research estimates that the rainfall-generation services of the Brazilian Legal Amazon amount to tens of billions of dollars annually, yet such ecosystem values rarely enter credit assessments or procurement pricing.[19] Making deforestation-free sourcing the market baseline is a necessary foundation, but not an endpoint.

Lasting progress within the soy value chain requires three reinforcing shifts:

- **First, embed sustainability conditionality into the financial plumbing of the value chain.** Trade finance, pre-financing arrangements, and working capital terms should incorporate traceability and risk segmentation so that access to liquidity reinforces environmental performance rather than operating independently of it.

- **Second, redirect both public and private finance upstream toward productivity-enhancing and regenerative systems on existing land.** Integrated crop-livestock-forest systems, pasture recovery, and soil restoration approaches can raise yields and diversify income but often require longer tenors, grace periods, and risk-sharing instruments aligned with transition payback periods.

- **Third, align value-chain incentives with place-based governance.** Demand-side commitments and trade finance can generate powerful signals, but outcomes depend on land-use governance, enforcement capacity, and producer legitimacy at state and municipal levels. Linking jurisdictional planning with value-chain procurement and finance can reduce leakage and stabilize gains over time.

Taken together, the soy case shows that value chains can rapidly redefine sourcing baselines when concentrated actors align. But lasting change depends on whether compliance is embedded in finance, reinforced by public policy, and linked to productivity and resilience. Where value-chain action substitutes for deeper institutional reform, progress remains partial and reversible. Where incentives across policy, finance, and technology are realigned, value chains can materially alter land-use trajectories.

18 Amendolagine, Presbitero, and Rabellotti (2024).

19 Baker et al. (2026), 1.

Case study: Cocoa in the West Africa-EU value chain

Cocoa offers a useful counterpoint to soy because it is also a highly concentrated and strategically important value chain, yet the main challenges, and therefore the levers of change, look very different. West and Central Africa produces roughly 70% of the world's cocoa, with Côte d'Ivoire and Ghana accounting for around two-thirds of global supply.[20] On the demand side, the EU remains the world's largest importer of cocoa beans, accounting for approximately 58% of global imports (around 1.8 million tons in 2023).[21] This concentration, where dominant origins supply a dominant consumer-processing region, creates a theoretical basis for rapid progress through downstream standards and due diligence. In practice, cocoa demonstrates why environmental compliance alone rarely delivers lasting outcomes when the production base is smallholder-dominated, and the political economy is defined by poverty, weak bargaining power, and social risk.

Over the past decade, sustainability efforts in cocoa have expanded through certification, company programs, and multi-stakeholder initiatives. One example is the Cocoa & Forests Initiative (CFI), launched in 2017, bringing together the governments of Côte d'Ivoire and Ghana, major cocoa and chocolate companies, and partners under a shared commitment to curb cocoa-driven deforestation and promote climate-resilient production.[22] These efforts increasingly rely on technology-enabled traceability, including farm mapping and geolocation, because credible proof of origin is central to both voluntary commitments and emerging regulation.

The EUDR reinforces this direction.[23] Although implementation timelines have shifted, the structural change remains that access to European markets increasingly depends on due diligence and evidence that commodities are not linked to deforestation and forest degradation. Cocoa is therefore moving toward a compliance-baseline logic like soy, but within a far more fragmented and socially complex production system.

Despite expanded sustainability architecture, cocoa continues to exhibit persistent poverty and labor risks that undermine long-term environmental outcomes. One synthesis report found that a majority (73-90%) of surveyed households in Côte d'Ivoire and Ghana fall short of living income thresholds.[24] Low and volatile incomes translate into underinvestment: Aging trees are not replanted, pest management is inadequate, and yield gaps persist; together, these conditions can increase pressure to expand cultivation into forest margins.

Child labor remains an acute risk, closely linked to chronic household poverty and weak rural service provision. An EU partnership summary estimates that as many as 1.56 million children work in cocoa production across Côte d'Ivoire and Ghana.[25] Evidence suggests that sustainable progress requires bundled interventions, for example, combining monitoring and remediation with education access, productivity support, and income stabilization, rath-

20 Wessel and Quist-Wessel (2015); USDA FAS (2025).

21 CBI (2023), 1.

22 See more on the Cocoa & Forests Initiative on their webpage at https://www.idhsustainabletrade.com/initiative/cocoa-and-forests/.

23 See more on the EU's deforestation regulation at https://environment.ec.europa.eu/topics/forests/deforestation/regulation-deforestation-free-products_en.

24 van Vliet et al. (2021), 1.

25 European Commission, Directorate-General for International Partnerships (2021), 6.

er than isolated compliance measures.[26] The critical barrier therefore differs from soy: whereas soy centers on land-use incentives and conditional finance, cocoa is constrained by structural poverty, low farm-gate incomes, and limited public services. Traceability-focused compliance will not address these ongoing social drivers.

Unlike soy, concentration in cocoa is asymmetric. Downstream segments—trading, processing, and chocolate manufacturing—are relatively concentrated, while upstream production in West Africa is overwhelmingly smallholder and highly fragmented, limiting collective producer leverage.[27] Farmers operate on small plots with insecure tenure, limited access to services, and high exposure to climate variability and disease. Regulated farm-gate pricing and forward-selling practices can insulate farmers from downside volatility but also limit their ability to capture upside during price spikes, leaving margins thin. When large cross-border price gaps emerge, informal trade expands, complicating traceability and governance.

The cocoa case illustrates why environmental compliance must be paired with income, productivity, and governance reforms. It also highlights why sequencing across policy, finance, and technology differs from soy.

- **First, make compliance workable by financing transition rather than merely auditing it.** Traceability and deforestation-free requirements impose new costs—mapping, documentation, farm upgrades—that must be offset through productivity support, replanting programs, input access, and credit facilities reaching farmers and cooperatives. Living-income-focused policies, such as the Living Income Differential introduced by Côte d'Ivoire and Ghana, reflect attempts to strengthen the income floor, though effectiveness depends on implementation and market transmission.[28]

- **Second, embed social risk management as a core operating requirement.** Given the scale of child labor risk, monitoring systems must link to remediation, education access, and livelihood support. Compliance cannot be document-based alone; it must be embedded in household economics.

- **Third, align producer-country governance with market incentives.** Pre-competitive coordination initiatives have shown potential to align forest protection and productivity goals but remain vulnerable when under-financed or politically contested. Due diligence in consuming markets ultimately depends on land governance, farmer registries, and enforcement capacity in producing regions.

- **Finally, treat technology as enabling infrastructure rather than a substitute for reform.** Farm geolocation and digital monitoring are indispensable in a due-diligence era, but without parallel finance and institutional support, they risk becoming compliance costs that concentrate market access among better-resourced actors.

Like soy, cocoa demonstrates that concentrated value chains can accelerate coordination downstream. But cocoa underscores a deeper lesson: Compliance layered on top of poverty and weak governance is unlikely to result in

26 NORC at the University of Chicago (2020).
27 Li et al. (2025).
28 Boysen et al. (2023).

lasting change. In the West Africa-EU corridor, environmental requirements are necessary foundations.[29] Without parallel reforms that raise incomes, close yield gaps, strengthen cooperative governance, and integrate social risk remediation into supply-chain operations, progress will remain partial and vulnerable to leakage and backlash.

Financing the transformation

Rewiring food value chains ultimately rises or falls on finance: who pays, when they pay, and what gets priced in. If value chains are governance architectures that shape markets, finance is the mechanism through which those architectures translate ambition into behavior. Credit allocation, trade finance, procurement-linked liquidity, and risk pricing determine whether deforestation-free, regenerative, and socially responsible practices remain peripheral or become economically rational.

Achieving this transformation requires two complementary changes in how finance is deployed. First, redirect existing financial flows that reward land expansion and resource depletion. Second, mobilize capital structures capable of underwriting transitions with longer payback horizons and higher upfront costs.

The transition challenge is fundamentally economic. Many practices that improve resilience and environmental outcomes, including agroforestry, regenerative agriculture, pasture restoration, and deforestation-free production, require upfront investment while generating benefits over longer time horizons. Farmers and value-chain actors often face higher initial costs, uncertain returns, and limited access to affordable finance. In many cases, market premiums remain too small, inconsistent, or short-lived to offset these costs. As a result, practices that generate long-term benefits for society can remain financially unattractive for individual producers and firms. Closing this gap is therefore one of the central challenges of food-system transformation.

Globally, agricultural support remains heavily misaligned with sustainability objectives. The Food and Agriculture Organization of the United Nations (FAO) estimates that support to agricultural producers is currently around $540 billion per year, much of it delivered through measures that distort markets, are unevenly distributed, and damage both the environment and human health. If current trends continue, this support could rise to almost $1.8 trillion by 2030.[30] Redirecting even a fraction of this support toward sustainable production and protection would significantly narrow the transition financing gap today. Yet the practical challenge is less about inventing new pools of money than redesigning the plumbing, i.e., turning routine financial decisions into vehicles for transformation.

The scale required is substantial. Recent syntheses estimate that agrifood systems require over $1 trillion per year in investment over the coming decade to align with climate and nature objectives, while current flows toward sustainable food systems remain far below that level.[31] Funding needs are concentrated in emerging markets, particularly in preventing land-use change and scaling regenerative production. Pilots will not move the needle unless designed as underwriting templates embedded in mainstream finance.

29 Krausing and Said Birch (2023).
30 FAO, UNDP, and UNEP (2021).
31 Climate Policy Initiative (2024), 5.

The soy and cocoa cases illustrate why finance is critical. In soy, concentrated traders shifted sourcing norms, yet credit design and trade finance largely operate independently of environmental risk segmentation. In cocoa, compliance requirements expand, but smallholder producers lack capital to invest in replanting, agroforestry, and productivity improvements. In both systems, the barrier is the capital structure.

At the producer level, scaling regenerative and forest-positive production requires instruments that close the gap between perceived and actual risk-return profiles. The issue is not only access to working capital and long-term credit, but how eligibility criteria, collateral requirements, and tenor assumptions systematically favor short-cycle models. Regenerative transitions often generate positive net returns over time, but with delayed cash flows and higher initial uncertainty that conventional underwriting frameworks discount.

Brazil provides a useful illustration of both opportunity and constraint. Plano Safra channels concessional agricultural finance at scale, and instruments such as RENOVAGRO offer preferential rates for low-carbon agriculture, including integrated crop-livestock-forest systems and pasture recovery.[32] This demonstrates that subsidy reform can retarget concessionality toward practices that generate public-good returns. Yet unless credit design matches transition economics, through longer amortization periods, grace periods, and risk buffers, even well-intentioned programs remain underutilized.

One of the largest near-term opportunities lies in intra-value-chain finance: the everyday mechanisms connecting farmers, intermediaries, processors, and buyers. Forward contracts, input pre-financing, supply-chain finance, and working capital facilities can rival formal agricultural credit in scale, yet typically remain blind to environmental and social performance. When traceability systems credibly segment low- from high-risk supply, financiers can price risk, structure covenants, and offer differentiated terms. Finance then becomes the delivery channel for sustainability rather than an afterthought.

Emerging models demonstrate this logic. Sustainability-linked loans tie borrowing costs to environmental and social performance metrics, creating incentives for upstream improvements. Supply-chain finance programs increasingly offer preferential payment terms to compliant suppliers. Their significance lies less in novelty than in embedding sustainability within existing commercial infrastructure.

Across commodities, the biggest barrier is not the availability of capital but the willingness to finance transition risk. A broader set of financial instruments will also be needed to support transition at scale. Sustainability-linked loans can reward progress against environmental and social outcomes through preferential borrowing terms, while blended-finance structures can help absorb early-stage transition risk. Insurance has an equally important role. As climate volatility increases, risk-transfer mechanisms can help producers, lenders, and governments manage the growing costs of droughts, floods, and other shocks. At a systemic level, climate and nature risks are increasingly relevant to banking supervision, sovereign creditworthiness, and fiscal stability. Integrating these risks into lending practices, financial regulation, and sovereign risk assessments can help shift capital toward more resilient produc-

32 KCI (2025).

tion systems while reducing exposure to future shocks. Scalable models, therefore, depend on structured risk-sharing. A financing stack clarifies the allocation of risk:

- **Commercial capital**[33] holds diversified exposure linked to predictable cash flows, such as procurement-backed lending or portfolio-based credit.

- **Catalytic capital**, either public or philanthropic, absorbs early-adoption risk, first-loss tranches, and verification infrastructure costs.

- **Value-chain actors** provide credit enhancement through long-term offtake agreements, working-capital facilities, price floors, interest buydowns, or barter arrangements, reflecting the resilience benefits they capture downstream.

This allocation reflects comparative advantage in risk-bearing and recognizes that private capital will not finance systemic land-use transitions at scale without aligned risk mitigation.

Outcome-based revenue streams such as carbon credits, biodiversity payments, or watershed services can strengthen the investment case for agroforestry, restoration, and produce-and-protect systems. However, these markets remain small relative to agricultural finance and are often inaccessible to smallholders due to high development and verification costs. They should function as accelerators and risk buffers rather than the primary engines of profitability. Significant scale depends on productivity gains, stable market access, and reduced exposure to climate and price shocks.

The deeper transformation is institutional. Nature and resilience must become legible within core decision systems, including credit committees, procurement policies, fiscal planning, and portfolio allocation models. Climate volatility is already increasing agricultural losses and affecting sovereign risk profiles.[34] Transition finance is therefore not only an environmental imperative but a financial stability concern.

Two system-level enablers are particularly important:

- **Standardized disclosure and reporting.** Emerging climate- and nature-related disclosure frameworks reduce information asymmetry and make environmental risk visible within financial decisionmaking. Their significance lies in whether they reshape underwriting criteria, loan covenants, and portfolio construction.

- **Forward-looking risk modeling.** Traditional reliance on historical yield data is increasingly misaligned with accelerating climate variability. Integrating scenario analysis, geospatial risk data, and nature-risk metrics into credit assessments is essential if transition investments are not to appear artificially risky relative to conventional practices built on outdated climate assumptions.

Technology underpins these shifts. Geospatial traceability, digital farmer registries, remote sensing, credit-scoring tools, and interoperable data platforms reduce transaction costs and enable risk differentiation. When embedded

33 Commercial capital refers to private, return-seeking finance deployed on market terms. It comes from commercial banks, institutional investors (pension funds, insurers), asset managers, private equity, infrastructure funds, hedge funds, corporates' balance sheets, and non-bank lenders. It is typically provided through loans, bonds, equity, project finance, receivables/trade finance, and leasing, structured to meet market risk/return hurdles.

34 Kling et al. (2025).

in commercial workflows, they reinforce incentives through lower interest rates, earlier payment, and preferential access, rather than merely documenting compliance.

Financing transformation is about restructuring mainstream capital flows within value chains so that environmental stewardship, social inclusion, and long-term productivity become embedded in ordinary financial decisions. Where finance remains detached from environmental and social objectives, value-chain gains remain fragile. Where capital is deliberately rewired, through risk-sharing, conditional liquidity, and incentive-aligned credit design, value chains can redirect land-use trajectories at scale.

Policy as the ultimate accelerator

Value chains transmit incentives through procurement, finance, and trade relationships, but public policy determines whether those incentives reinforce or undermine resilience. If finance transmits incentives, policy defines the rules of the game: property rights, subsidy structures, disclosure requirements, trade access, fiscal priorities, and enforcement capacity. Without policy alignment, even sophisticated value-chain initiatives remain partial and vulnerable to reversal.

Research across political economy and environmental governance shows that lasting land-use transitions require coordinated public authority. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) Global Assessment (2019) identifies subsidy reform and institutional alignment as primary levers for reversing biodiversity loss.[35] Similarly, the Intergovernmental Panel on Climate Change (IPCC) concludes in its Sixth Assessment Report (2022) that mitigation in agriculture and land use depends on enabling conditions—policy coherence, regulatory certainty, and public investment.[36]

Policy matters at three interconnected levels: multilateral and financial governance, trade and regulatory regimes, and national fiscal and land-use frameworks.

MULTILATERAL AND FINANCIAL GOVERNANCE

At the global level, financial and accounting standards increasingly incorporate natural capital into risk assessment and macroeconomic planning. The integration of climate risk into financial supervision, advanced by the Network for Greening the Financial System (NGFS), demonstrates how systemic risk can reshape regulatory expectations.[37] Disclosure frameworks, including the Taskforce on Nature-related Financial Disclosures (TNFD) and the International Sustainability Standards Board (ISSB), aim to make ecosystem dependencies visible within corporate and financial reporting.[38]

35 See the IPBES Global Assessment (2019) at https://files.ipbes.net/ipbes-web-prod-public-files/inline/files/ipbes_global_assessment_report_summary_for_policymakers.pdf.

36 See the IPCC's sixth assessment report at https://www.ipcc.ch/assessment-report/ar6/.

37 See the Network for Greening the Financial System webpage at https://www.ngfs.net/en.

38 See the Taskforce on Nature-related Financial Disclosures webpage at https://tnfd.global/; See the International Sustainability Standards Board webpage at https://www.ifrs.org/groups/international-sustainability-standards-board/.

Their significance lies not in disclosure alone, but in capital allocation. If regulators require financial institutions to model how nature-related shocks—such as deforestation bans, ecosystem collapse, and water scarcity—can affect loan books and portfolios, banks have incentives to price environmental risk, restrict capital to high-risk sectors, and offer more favorable terms to traceable and resilient producers.

Multilateral development banks (MDBs) and international financial institutions also play a catalytic role. Recent reforms emphasize integrating climate and nature into development finance.[39] When aligned with value-chain strategies, MDB instruments can de-risk jurisdictional sourcing, support rural credit reform, and embed sustainability conditionality within trade finance.

Yet governance remains fragmented. Agricultural trade, climate finance, biodiversity commitments, and food security are negotiated in separate forums. For value chains, this fragmentation produces mixed signals, sustainability-linked disclosure in some markets alongside subsidy and trade regimes that continue to reward expansion. Bridging these silos is essential if financial governance is to reinforce rather than dilute transformation.

TRADE POLICY AND REGULATORY REGIMES

Trade policy increasingly functions as environmental governance. The EUDR represents a structural shift: Market access for commodities such as cocoa, soy, palm oil, and beef now depends on due diligence and proof of deforestation-free origin.[40] This alters the risk calculus of exporters and traders globally.

Research on hybrid governance shows that regulatory backstopping strengthens voluntary commitments.[41] When due diligence is mandatory, sustainability shifts from reputational preference to legal obligation. At the same time, trade-linked environmental measures must navigate concerns over sovereignty, equity, and World Trade Organization (WTO) compatibility. Historical disputes underscore the importance of transparency, non-discrimination, and proportionality.[42]

Trade policy can also facilitate transition through preferential tariffs, mutual recognition of traceability systems, and green public procurement. Conversely, export bans and ad hoc restrictions, often deployed during food price spikes, can destabilize value chains and deter long-term investment.

The soy and cocoa cases illustrate this dynamic. In soy, concentrated export corridors amplify regulatory signals. In cocoa, due diligence without parallel producer-country investment risks exclusion and leakage. Trade policy can accelerate change, but only when paired with upstream governance and finance.

NATIONAL FISCAL AND LAND-USE POLICY

Ultimately, value-chain transformation hinges on national policy frameworks. Fiscal systems, rural credit design, land tenure security, and enforcement capacity determine whether sustainability commitments are feasible at scale.

39 MDB Nature Working Group (2025).
40 European Commission (2026).
41 Lambin et al. (2014).
42 WTO and UNEP (2009).

Agricultural subsidy reform is central. The Organisation for Economic Co-operation and Development (OECD) finds that a substantial share of global agricultural support remains environmentally harmful or weakly targeted.[43] Redirecting subsidies toward ecosystem restoration, soil health, and climate resilience would alter production incentives more effectively than isolated pilots.

Land tenure security is equally critical. Secure property rights correlate with higher investment in soil conservation and long-term productivity.[44] In cocoa systems, weak tenure discourages replanting and agroforestry; in frontier soy regions, unclear enforcement undermines compliance and increases regulatory risk.

National value-chain strategies represent an emerging frontier. Governments can map strategic commodities across production, processing, trade, and employment nodes, aligning fiscal tools and credit facilities with resilience goals. Brazil's Produce, Conserve, Include (PCI) strategy in Mato Grosso demonstrates how state-level coordination can align conservation targets with productivity growth.[45] Similar efforts in African countries seek to combine agricultural transformation with forest protection and climate resilience.[46]

Embedding natural capital into macrofiscal frameworks strengthens these strategies. The System of Environmental-Economic Accounting (SEEA) provides standardized methods to integrate ecosystem services into national accounts.[47] Countries incorporating natural capital into fiscal planning are better positioned to assess trade-offs and attract climate-aligned finance. Recent Systemiq work with Uganda's Ministry of Finance illustrates this shift. The initiative integrates climate and nature resilience into macrofiscal planning—including debt sustainability, growth projections, medium-term expenditure frameworks, and sovereign risk assessments—reflecting growing recognition that climate and natural capital degradation can materially affect fiscal stability and sovereign borrowing costs.[48]

POLICY AS ENABLER OF VALUE-CHAIN LEVERAGE

Value chains shape incentives only within policy environments that define contract enforceability, disclosure obligations, fiscal signals, and land governance. When public authority aligns these parameters with environmental and social objectives, value chains amplify transformation; when misaligned, they entrench depletion.

Policy functions as an accelerator in two ways. It reduces transition risk by providing regulatory certainty and coherent signals, and it reshapes relative returns—through subsidy reform, taxation, or enforcement—so that regenerative models become competitive without permanent concessional support.

Three priorities stand out through 2030:

1. Repurpose harmful subsidies toward resilience and regenerative productivity.
2. Mandate credible disclosure and due diligence to internalize environmental risk.
3. Align rural credit and fiscal planning with value-chain transition pathways.

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43 OECD (2023).
44 Besley (1995); Lawry et al. (2017).
45 See the Produce, Conserve, Include strategy webpage at https://pcimt.org/en/.
46 UN Food Systems Coordination Hub (2026).
47 See the System of Environmental-Economic Accounting webpage at https://seea.un.org/.
48 Systemiq (2025).

Policy does not substitute for value-chain action; it stabilizes and scales it. When public authority clarifies rules, enforces standards, and retargets fiscal incentives, value chains become conduits for transformation rather than vectors of risk.

From 2030 to 2050: Delivering on the SDGs and beyond

The preceding analysis underscores that resilience in food systems will depend on aligning value-chain incentives with public policy and financial architecture. As the international community approaches the 2030 deadline for the Sustainable Development Goals (SDGs), the question is no longer whether change is necessary, but how transition pathways can be institutionalized and scaled. The next phase must move from incremental compliance to structural alignment.

Climate change is not simply an additional risk factor within existing food systems. Between now and 2050, it is likely to reshape the geography of production, trade, and investment. Some regions may experience declining suitability for key crops, rising adaptation costs, and more frequent production shocks, while others may become relatively more competitive. These shifts will affect global trade flows, infrastructure needs, and sourcing strategies, creating new pressures for governments, firms, and financial institutions to manage transition and adaptation simultaneously. Climate volatility should be understood as an increasingly powerful driver of value-chain transformation.

In the near term, the priority must be stabilization. Governments can embed natural capital and climate risks into fiscal planning, reform harmful subsidies, and establish legal frameworks for traceability and due diligence. Businesses can make deforestation-free production the market baseline, integrate traceability into procurement and trade finance, and redirect rural credit toward regenerative systems. Financial institutions can scale blended finance and strengthen forward-looking risk modeling to price climate and nature exposure more accurately. These actions align with IPCC findings that near-term mitigation and adaptation in land use are both feasible and cost-effective when enabling governance conditions are present.[49]

However, full delivery on existing SDG targets will not, on its own, guarantee resilient food systems beyond 2030. The SDGs articulate outcomes but do not specify transition pathways within value chains. They identify targets—zero hunger, climate action, life on land—but leave open the institutional sequencing through which production, trade, finance, and governance must evolve. Absent clearer transition pathways, progress risks remaining fragmented and overly dependent on voluntary action.

Looking beyond 2030 toward 2050, three structural shifts will be essential.

1. Natural capital and climate risks must be embedded in economic systems

Treating nature as an externality has produced systemic economic risk. Ecosystem degradation undermines long-term agricultural productivity, increases climate volatility, and heightens financial instability. The critical challenge for the post-2030 agenda is not merely better measurement, but institutional integration: ensuring that environ-

49 IPCC (2023).

mental risk and ecosystem dependency are embedded within fiscal rules, credit allocation, and macroeconomic planning.

The next phase of reform may move beyond voluntary disclosure frameworks toward incorporating nature-related risk into prudential supervision, sovereign risk assessments, and capital allocation models. Evidence from financial regulation suggests that once risks are formalized within supervisory expectations, portfolio behavior shifts accordingly. If climate and ecosystem degradation are consistently reflected in underwriting standards and capital adequacy assessments, value chains that degrade natural capital will become structurally more expensive to finance than those that restore it.

In this context, value chains become transmission mechanisms through which macroeconomic risk recognition reshapes production decisions. When environmental exposure alters the cost of capital or market access conditions, sourcing strategies and investment patterns adjust across the chain. Institutionalizing nature risk directly influences which production models scale.

2. Develop shared value-chain transition pathways

The energy sector has science-based decarbonization pathways that define milestones, technology deployment rates, and capital requirements. Food systems lack comparable, commodity-specific transition pathways. The comparison with energy systems is instructive for another reason. Many low-carbon energy technologies increasingly offer commercial advantages through lower operating costs, improved performance, or favorable market conditions. Food-system transitions are often different. Practices that improve soil health, restore ecosystems, reduce deforestation, or strengthen resilience frequently involve upfront costs, delayed returns, and benefits that accrue across society rather than directly to individual firms or producers. As a result, market forces alone are unlikely to deliver transition at the pace or scale required. Policy reform, institutional coordination, and targeted financial support are therefore essential conditions for food-system transformation.

Developing value-chain transition pathways would involve mapping, for major commodities:

- Baseline land-use and emissions trajectories.
- Productivity and yield-gap closure opportunities, including their economics.
- Required finance flows and de-risking instruments.
- Sequenced policy reforms.
- Social safeguards to protect livelihoods and food security.

Such pathways would clarify the distribution of costs and benefits across actors, reducing political resistance and investment uncertainty. They would also align private sector action with national development strategies, mitigating the risk that sustainability commitments are perceived as externally imposed constraints.

The soy and cocoa cases illustrate why explicit pathways matter. In soy, deforestation-free sourcing is a first milestone, but resilience requires subsequent steps in regenerative productivity and credit reform. In cocoa, due diligence is a starting point, but lasting outcomes require income stabilization, replanting cycles, and service delivery integration. Without sequenced pathways, compliance risks stagnating or generating unintended exclusion.

3. Political economy must anchor transition design

Transitions that ignore domestic political realities rarely last. Experience across countries suggests that environmental reforms are more likely to succeed when they align and reinforce economic and social incentives, rather than being pursued as standalone environmental objectives.[50] Policies perceived as threatening rural livelihoods or national sovereignty face resistance, even when technically sound.

Aligning resilience, productivity, and income objectives with environmental goals increases the chance of lasting change. For example:

- Regenerative agriculture, framed as productivity enhancement and climate resilience, gains broader support than conservation, framed solely as restriction.
- Land restoration linked to water security and rural employment resonates more strongly than biodiversity metrics alone.
- Trade compliance integrated into export competitiveness narratives can build domestic coalitions.

From 2030 to 2050, governance capacity will matter as much as technological innovation. Climate volatility, geopolitical instability, and demographic change will amplify pressure on food systems. Value chains that are rewired to reward stewardship, share risk, and internalize environmental costs can function as engines of inclusive growth. Those that remain structured around extraction and short-term arbitrage will amplify instability.

GOVERNING THE TRANSITION

The challenge beyond 2030 is less about identifying solutions than about governing systemic change. Three institutional priorities stand out:

1. **Coherence across policy domains.** Agricultural, trade, climate, and fiscal policies must reinforce rather than contradict one another.

2. **Institutionalized risk pricing.** Climate and nature risks must be embedded in credit, insurance, and sovereign risk assessment.

3. **Equity safeguards.** Transition pathways must protect vulnerable producers and consumers, ensuring that costs are not shifted onto those least able to bear them.

Food systems are dynamic economic systems embedded in ecological limits. The SDGs established the direction of travel. The period from 2030 to 2050 must institutionalize the mechanisms—financial, regulatory, and market-based—through which value chains align with planetary boundaries and social inclusion.

The central argument of this chapter is that value chains are among the few institutional structures capable of linking upstream land-use decisions with downstream market incentives on a global scale. If governed deliberately,

50 Global Commission on the Economy and Climate (2018).

they can become vehicles for long-term resilience. If left to operate under misaligned incentives, they will continue to transmit ecological and social risk across borders.

The foundations for that choice must be laid this decade.

A healthier food system for people and planet

Food systems are foundational to human welfare and economic stability, yet they are under mounting strain. They sustain livelihoods and nourish billions, but they are also deeply entangled with environmental degradation and rising climate risk. As ecological pressures intensify, systems that depend on stable soils, water cycles, and climate patterns are becoming more exposed to disruption. The challenge now is to redesign the economic logic that governs production, trade, and finance so that resilience, rather than depletion, becomes the norm.

This chapter has argued that value chains are central to that redesign. Far from passive conduits of trade, they are institutional architectures that shape incentives, allocate risk, and structure access to capital and markets. Because they link upstream land-use decisions to downstream consumption and finance, value chains operate at the scale required to influence global trajectories. When policy, finance, and technology align within them, environmental costs can be internalized and investment redirected toward stewardship. When misaligned, they transmit ecological and social risk across borders.

The cases of soy and cocoa illustrate both the potential and the limits of this leverage. Concentrated actors can rapidly shift sourcing norms, but compliance alone does not ensure lasting change. Without aligned finance, credible land governance, and income viability at the farm level, progress remains vulnerable to reversal. Lasting transformation depends on embedding resilience within the financial and policy architecture of value chains, not layering sustainability onto unchanged incentives.

The decade to 2030 will determine whether food systems can be stabilized. Beyond 2030, the challenge is institutionalization: embedding natural capital and climate risk into fiscal policy, financial supervision, trade regimes, and value-chain transition pathways that are explicit, sequenced, and politically grounded.

Delivering this transition will require different forms of engagement from different actors. Governments must align agricultural, trade, fiscal, and environmental policies around shared transition objectives and provide the regulatory certainty needed to support long-term investment. Firms must move beyond compliance-based approaches toward active stewardship of the value chains on which they depend, including financing transition, supporting traceability, and strengthening producer resilience. Financial institutions must integrate climate and nature risks into lending and investment decisions while expanding access to instruments that support longer-term transition pathways. Civil society, producer organizations, and development institutions have a critical role in ensuring accountability, building local capacity, and safeguarding equitable outcomes.

Rewiring food value chains is not a peripheral sustainability agenda. It is a strategy for safeguarding long-term productivity, macroeconomic stability, and inclusive growth in a climate-constrained world. The institutions that shape trade and finance can either reinforce extraction or anchor regeneration. The choice, and the architecture that follows, will shape the resilience and prosperity of the global economy in the decades ahead.

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