UNIVERSITY OF CAMBRIDGE | Institute for Sustainability Leadership

The orchestra plays: Co-ordinating action to scale nature positive business models in Europe

September 2026

A-Track

The University of Cambridge Institute for Sustainability Leadership (CISL)

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About A-Track

A-Track is a four-year, €11 million project that will accelerate action for nature by business, financial institutions and government.

A-Track brings together leading thought leaders and practitioners who have been driving change in the measurement and valuation of natural capital and biodiversity in business, finance and government.

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Acknowledgements

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Guy Duke, Eleanor Gourevitch, Tom McKenna, Rosimeiry Portela (Capitals Coalition) Nadine McCormick (WBCSD); Jonathan Porter, Matthew Brown (Oppla); Jacob Bedford (UNEP-WCMC); Alison French

Funding

This deliverable is part of a project (A-Track) that has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101082268, as well as from UK Research and Innovation (UKRI) and Switzerland's State Secretariat for Education, Research and Innovation (SERI).

Citing this report

James MacPherson (Third Epoch) and Harry Greenfield (CISL) (2026). *The orchestra plays: Co-ordinating action to scale nature positive business models in Europe*. Cambridge, UK: University of Cambridge Institute for Sustainability Leadership.

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Executive summary

Why does this matter?

Nature-related risks are becoming strategic economic risks: over half of the world's gross domestic product (GDP) – some US$44 trillion of economic value generation – is vulnerable to nature risks. Across Europe, businesses and policymakers face a growing recognition that many existing business models are poorly aligned with long-term competitiveness, resilience and growth. Degraded ecosystems, volatile input markets, fragile global supply chains and rising climate pressures are exposing the limits of incumbent models in sectors that depend heavily on land, water, biological resources and a stable natural environment. Environmental and geopolitical crises are now compounding to make it ever more urgent to address these issues.

At the same time, Europe has a major opportunity to build a nature positive bioeconomy: one in which biological resources, advanced technologies and circular value chains support economic prosperity and nature positive outcomes. Scaling nature positive business models goes beyond the environmental agenda, fundamentally underpinning successful competitiveness, resilience and industrial strategy. As visibility of nature related risks increases, through initiatives such as the Taskforce on Nature-related Financial Disclosures (TNFD), company boards will inevitably soon be faced with information that challenges the fundamental viability of their business models.

What did we do?

We examined four nature positive transitions across the agrifood and built environment value chains, chosen because they have major implications for nature and economic performance. These were: alternative proteins; bio-based agricultural inputs; bio-based construction materials; and green and green-grey built environment infrastructure. We focused on barriers, opportunities and scaling strategies for each transition.

What did we find?

Across these transitions, the analysis shows that technological feasibility is no longer the principal constraint in scaling. Advances across fields including biotechnology, advanced manufacturing, digital technology and artificial intelligence, natural capital measurement and circular economy are creating a plethora of commercially relevant options for investment. Many of the business model innovations needed to scale these capabilities are emerging too. But the central challenge to scaling is co-ordination.

Nature positive business models often depend on systemic interactions that are absent at scale and that no single actor can address alone: new infrastructure, standards, procurement models, financing mechanisms, measurement systems, regulatory frameworks, value chain partnerships and trusted forms of stakeholder engagement. Without these enabling conditions, promising innovations remain stuck at pilot stage, in niche markets or in fragmented supply chains.

Two strategic pathways for scaling emerge. **Substitution strategies** introduce lower impact products and services into existing value chains, offering lower-risk routes to adoption. **Co-ordination strategies** reorganise value chains, infrastructure, financing and institutions to enable more systemic change. While substitution strategies can accelerate near-term progress, the largest nature positive opportunities identified in this report depend on co-ordination and orchestration across multiple actors.

What does it mean?

This report's central finding is that co-ordination is now the binding constraint on scaling of nature positive technologies and associated business models. Effective co-ordination does not occur spontaneously; it requires deliberate efforts to orchestrate change across government, business, finance and civil society within particular places and value chains. Building this orchestration capacity – and helping it to proliferate – is the enabling layer on which the transitions described in this document depend. This is the practical means through which nature positive technologies, business models, roadmaps and transition pathways are actually delivered.

Because nature positive transitions address market failures and complex interactions between ecological systems, infrastructure and economic activity, they cannot be delivered through private enterprise alone.

- **Governments** play a critical role in shaping the enabling environment through regulation, standards, procurement policies and financial incentives.
- **Businesses** (particularly startups and early adopter corporates) develop and deploy the technologies and business models that translate these signals into operational solutions that can be financed.
- **Financial institutions** enable the flow of capital and availability of insurance to these solutions to fund and de-risk scaling.
- **Civil-society organisations** and research institutions act as intermediaries to build trust, co-ordinate action, and support diffusion of information and resources.

Progress will require deliberate, catalytic investment in co-ordination capacity. Dedicated, independent intermediaries – able to convene across sectors, resist capture and assemble systemic solutions – remain scarce. Building and proliferating this capacity across Europe is not a long-term fiscal burden; rather it is a time-limited pump-priming at the nodes of the economy where collaboration must take root, with outsized returns for both nature and society, and competitiveness, resilience and growth. Realising this will require a co-ordinated, Europe-wide effort to build, connect and replicate the needed capacity.

Introduction

Context

Europe's competitiveness, resilience and growth increasingly depend on the green economy, which continues to outperform the wider economy in value added, employment and investment returns. Within this context, the bioeconomy is a major strategic opportunity: by using biological resources and advanced technologies in efficient value networks, it can reduce dependency on fossil-based and imported materials, cut environmental pressures, and strengthen rural and coastal economies (Box 1). It is increasingly a strategic issue among the G20, but a thriving bioeconomy – or a 'nature positive bioeconomy' – depends on resilient nature and an orderly transition away from incumbent industries.

At the same time, Europe's natural systems – and those in its global supply chains – are under acute strain. More than half of global land has experienced critical losses in ecological integrity, and Europe's own terrestrial and marine ecosystems face similar degradation. These pressures create escalating physical risks: around two-thirds of EU gross value added is considered highly or moderately dependent on nature. The threat to society is profound: degradation of nature is increasingly recognised as a threat to national security. Businesses – and the actions that they take on behalf of society to deliver value – are the primary drivers of these trends.

Analysis and reporting driven by initiatives such as the Taskforce on Nature-related Financial Disclosures (TNFD), EU Corporate Sustainability Reporting Directive (CSRD) and integration of nature into transition planning (Box 2) is beginning to illuminate corporate nature impacts, dependencies, risks and opportunities. Momentum is building: 90 per cent of companies no longer in scope for CSRD following recent changes in the rules (Omnibus 1) intend to continue reporting in line with the disclosure framework. As these assessments scale, many corporate boards will confront a central challenge: existing business models are often incompatible with long-term ecological stability.

However, substantial barriers to a nature positive transition persist. Current market, governance, financial and technological conditions are often misaligned with nature positive outcomes. National Biodiversity Strategies and Action Plans, which act as nature roadmaps for countries, rarely connect clearly to economic, bioeconomy or industrial strategy or policy. On top of this, decision-makers across the public, private and third sectors frequently lack visibility of viable nature positive business model options or the pathways required to scale them.

Box 1: The EU bioeconomy's potential

Europe's bioeconomy encompasses all activities that create value from biological resources – including agriculture, forestry, fisheries, aquaculture, bioprocessing, biomanufacturing, and biotechnology applications in sectors like food, health, energy, ecosystems and industry. These resources include genetic materials, biomass, by-products, residues and biogenic carbon.

The EU has strong foundations for a thriving bioeconomy thanks to world-class research, advanced technologies, a large consumer market and substantial biomass production. In 2023, the EU bioeconomy was worth up to €2.7 trillion, employed 17.1 million people and generated €863 billion in added value. R&D investment reached €23.2 billion, and bioeconomy-related patents represented 5 per cent of all EU patents. Over the last decade, the sector has grown faster than the wider economy, with each bioeconomy job creating nearly three additional indirect jobs.

The EU Bioeconomy Strategy presents a way forward for the bioeconomy by:

- scaling innovation and investments
- building new lead markets for bio-based materials and technologies
- ensuring sustainable biomass supply across value chains
- harnessing global opportunities.

By substituting resource-intensive, finite, often imported inputs to production (e.g., mined minerals) for renewable and waste biological materials (e.g., agricultural waste), bioeconomy strategies can align competitiveness, resilience and growth with nature positive outcomes – this is the 'nature positive bioeconomy'. But doing so effectively requires supportive policy to maintain the ecological integrity of the developing market. This includes developing credible standards (e.g., for sustainable forest management and waste valorisation) and supportive regulations (e.g., for Green Claims). Failure to do so exposes the bioeconomy to nature risk and the erosion of the natural capital upon which it is based.

Box 2: Mainstreaming of nature assessment and markets

The Taskforce on Nature-related Financial Disclosures (TNFD) recommendations and guidance enable business and finance to integrate nature into their decision-making processes and meet the growing interest and information needs of regulators, investors and other capital providers. Adoption is scaling fast. Over 733 organisations worldwide have committed to nature-related reporting, including asset managers overseeing US$22.4 trillion in assets under management and publicly listed companies with a total market capitalisation of US$9.416 trillion. Leading companies are now implementing TNFD guidance on nature in transition plans. This will encourage boards to assess the fundamental alignment between nature and the organisation's business model, strategy and resource allocations.

The EU Corporate Sustainability Reporting Directive (CSRD) builds on this by creating a level playing field on nature assessment and disclosure, and orientates the continent's businesses towards green innovation. While there have been concerns regarding the weakening of this legislation, the simplified European Sustainability Reporting Standards (ESRS) (Disclosure Requirement E4-1) do ask affected companies to think about business models, directing undertakings to include a clear explanation of how their strategy and business model "will evolve to contribute to the global goal of halting and reversing global biodiversity loss set out in the GBF…". More to this, research suggests that 90 per cent of companies no longer in scope for CSRD following Omnibus 1 intend to continue reporting in line with the disclosure framework. These changes are driving increased awareness of how nature affects businesses.

Simultaneously, regulated nature markets are emerging across Europe. In the UK, *Biodiversity Net Gain (BNG)* became mandatory for major developments from February 2024 under the Environment Act 2021, requiring developers to demonstrate a minimum 10 per cent net gain in biodiversity value. The EU Nature Credits Roadmap, published in July 2025, will help build a market across 27 Member States from 2028. The stage is set for rapid and large-scale change in how businesses interact with nature to create value in Europe. Successful implementation – underpinned by a clear, consistent and stable regulatory environment – will determine how well European economies capture the opportunities for new nature positive business models being presented.

What is (and is not) a nature positive business model

A nature positive business model is defined here as a financially viable business entity whose value proposition and rationale are centred around nature positive principles (see the first paper in this series for a fuller discussion). These models capture, create and deliver value in harmony with natural, economic and social capital within given landscapes, seascapes, ecologies or ecosystems[1]. The Science Based Targets Network's (SBTN) Action Framework ('AR3T'), which helps companies to structure plans to safeguard nature, provides a useful framing for operationalising nature positive principles. It encourages companies to:

- Avoid and Reduce pressures leading to nature loss
- Regenerate and Restore working and natural lands so that nature can recover
- Transform systems to address the drivers of nature loss.

This framework highlights the importance of avoiding and reducing impacts as a first priority, but it also encourages companies to take proactive steps to regenerate and restore nature. Both are essential to halting and reversing nature loss[2].

We distinguish between shifts in business *practices* and business *model*s. A business model is the underpinning architecture of how a business operates and achieves its objectives. It is centred around its core value proposition, as well as how it captures, creates and delivers this value. Changes to business practices (e.g., procurement processes, isolated business units) place their focus on incremental or piecemeal improvements to existing business models (though these could in time add up to achieve a full change in business model).

Two previous A-Track reports have explored business models that align with nature positive outcomes. *Better business: Re-thinking business models for nature positive outcomes* introduces business model 'archetypes' (Table 1) that are aligned with the nature positive goal, and *Aligning business models with a nature positive economy: From theory to practice*[3] looks at how the archetypes are emerging in corporate practice. We build on those in this report and identify where these archetypes map onto scaling strategies for nature positive transitions.

Table 1: Overview and key features of business model archetypes

Archetype	Primary business model canvas focus [1]	Alignment with AR3T framework[2]	Core value proposition
A1. Products and services to minimise nature impact	Value Creation / Capture	Avoid/minimise	Reduced impact through material and process efficiency (including circularity)
A2. Service models to minimise nature impact	Value Delivery	Avoid/minimise	Access over ownership; maximised asset utility
A3. Regenerative products and services	Value Creation / Capture	Restore/regenerate	Verifiable, net-positive ecological impact
A4. Regenerative value enablers	Value Delivery	Restore/regenerate and Transform	Scaled access to, and verification of, regenerative outcomes
A5. Value chain reconfiguration	Value Creation (Partnerships)	All	Collective efficiency and resilience through collaboration
A6. Supplementary service provision	Enablement (across all elements)	Transform	Tools and knowledge for nature positive transformation
A7. Purposeful stewardship	Value Creation / Delivery	Transform	Building social and cultural capital for nature

This document

This document aims to help decision-makers in the public and private sectors to align value creation for businesses and society with beneficial outcomes for nature. To support this, we provide insights into nature positive business models in the context of selected socio-technological transitions within Europe's bioeconomy. This should help:

- policymakers to identify strategic priorities – including for policy alignment – to support the scaling of nature positive innovations and business models
- corporate boards (and their advisers), investors and innovation managers to explore potential options for business model innovation and understand barriers and enablers of scaling
- stakeholders from across business, finance, government and the third sector to identify opportunities to work together to scale nature positive innovations.

Our analysis is grounded in nature impact and commercial relevance. We prioritised the two value chains with the greatest relevance for nature impact – agrifood and the built environment – identified through the World Economic Forum's (WEF) *New Nature Economy Report II*[4]. Business models and associated barriers and enablers to scaling were then identified through review of online materials (including company websites and grey literature), academic literature (sourced via Undermind), and interviews and group dialogues with experts across the public, private and third sectors. WEF's list of investible nature positive financing opportunities was used as a starting point for this analysis[5].

The results were distilled to identify four socio-technical transitions that demonstrate nature positive-aligned business model options, barriers to adoption and scaling strategies:

- Intensive livestock production > Alternative proteins in agrifood value chains
- Bulk synthetic fertilisers > Bio-based nutrition inputs in agriculture
- Impact-intensive construction materials > Bio-based construction materials
- Grey infrastructure > Green-grey built environment infrastructure.

This analysis is not intended to be comprehensive. But the transitions have been selected to highlight innovations and business models with outsized economic and societal value. In identifying the transitions, we also paid particular attention to those that primarily avoid/reduce nature impacts but also include those that regenerate/restore nature. These are complementary impact pathways that align with the mitigation hierarchy and complement the priorities outlined in the Science Based Targets Network Action Framework (AR3T), Global Biodiversity Framework and TNFD. The exercise can be repeated by others who want to replicate for other contexts.

Nature positive business model innovations in agrifood

Agricultural systems are among the most significant direct drivers of biodiversity loss, land degradation and pollution globally[6]. Almost half (44 per cent) of the world's habitable land is used for agriculture. Livestock production occupies two-thirds of that land and cropland a third[7]. The prevalence of intensive production methods and the sheer volume of land use requirements (which are set to increase with global population growth and improvements in living standards) leave little space for nature. This frames one of the greatest challenges facing humanity – how to feed a world of nine billion people, sustainably.

The 'green revolution' of the 20th century saw a transformation of the global food system through new production methods (including synthetic inputs including chemical fertilisers and pesticides/herbicides) and supportive policy that dramatically improved productivity. But this success came with environmental costs[8]. Chemical fertilisers for example create significant environmental pressures across their life cycle, including biodiversity destruction in raw material extraction, atmospheric pollution during production, and excess nutrients that drive eutrophication in water systems and degrade soils when used. Nitrogen pollution alone costs the EU between €70 billion and €320 billion per year[9].

As a result of this intensification, Earth's natural systems – climate, land, water, air and nutrients – and the 'natural capital' underpinning global food production have been degraded. The effects associated with this loss of resilience are starting to reverberate through global economic systems as supply shocks[10], price volatility and regional food crises, with clear implications for geopolitical stability and national security[11]. The current global geopolitical context amplifies this: European agriculture remains structurally dependent on imported agricultural commodities and inputs that are exposed to increasing instability in global agrifood supply chains, exemplified by the wars in Ukraine and Iran[12].

While the global food system is diverse and complex, we explore two innovation themes that offer substantial potential to transform how the agrifood sector interacts with nature:

1. **Alternative proteins in agrifood value chains:** A shift in the balance of primary production globally away from impact-intensive traditional livestock production – enabled by developments in the bioeconomy and advanced manufacturing technologies – towards resource-efficient controlled biological processes with dramatically lower environmental impacts and increased resilience to supply shocks.

Table 2: Alternative proteins in agrifood value chains

Nature benefits	Economic benefits
Avoid land conversion, degradation and habitat loss by shifting protein production away from livestock and feed crops towards resource-efficient, controlled biological processes.	Manage exposure to imported commodities and (volatile) global markets.
Avoid freshwater, marine and soil pollution associated with inputs and agricultural runoff from livestock and feed production.	Manage demand (competition) for productive land to produce food/feed and other critical uses.
Avoid atmospheric pollution including methane emissions and fertiliser-related emissions from livestock supply chains.	Manage dependency on (scarce) freshwater and other resources.
	Manage exposure to pests and diseases affecting conventional livestock systems.

2. **Bio-based precision nutrition inputs in agriculture:** A shift in dominant agricultural production methods away from high-volume synthetic nutrients and other inputs – underpinned by advances in biotechnology, digital agronomy and the proliferation of sustainable and regenerative agriculture – towards lower-volume, higher-value precision inputs that actively promote positive ecological outcomes such as regeneration of soil structure and function.

Table 3: Bio-based precision nutrition inputs in agriculture

Nature benefits	Economic benefits
Reduce biodiversity loss associated with extraction of mined fertiliser resources.	Manage exposure to imported commodities and (volatile) global markets.
Reduce air pollution (including greenhouse gases) associated with energy-intensive production of fertilisers and excessive application.	Manage dependence on soils with declining fertility by regenerating natural biological processes.
Reduce nutrient pollution of soils and water through lower synthetic fertiliser application volumes.	Manage exposure to water stress and climate variability through improved soil structure and water retention.
Regenerate soil ecosystems by rebuilding soil organic matter, microbial diversity and nutrient cycling.	

Alternative proteins in agrifood value chains

Technological advances across the alternative protein landscape can re-shape the agrifood system by shifting value creation away from land-intensive livestock systems and towards engineered biological production processes. These include a range of technologies and approaches such as reformulating food (using plant-based alternatives to livestock products), biomass and advanced/precision fermentation, insect protein and cultured meat. Taste, texture, nutrition and cost per unit of protein are improving rapidly[13]. Microbes, cells and insects can be cultivated in controlled production systems to generate proteins alongside fats, enzymes and functional ingredients (such as emulsifiers and thickening agents) with dramatically lower environmental impacts than conventional animal agriculture.

Advanced fermentation systems in particular, which build on traditional fermentation (e.g., cheese) and established biomass fermentation (e.g., Quorn)[14], have the potential to revolutionise the food system and accelerate the shift. The range of applications is enormous, offering potential to reduce human dependency on environmentally problematic ingredients including and beyond livestock products. Progress is most advanced for production of high-value ingredients including proteins, fats, enzymes and functional additives, often producing molecules identical to conventional counterparts with far greater control and consistency, and using only simple feedstocks that can be derived from organic waste.

The total size of the alternative protein market globally is expected to reach US$320 billion by 2030, up from US$130 billion at present[15]. Separate analysis indicates that Germany's domestic market alone could be worth between €8 billion and €23 billion by 2045, up from around €2 billion in 2023[16]. This growth trajectory will be further catalysed by wider applications of foundational technologies including AI and precision fermentation.

Scaling bottlenecks

Key barriers to scaling include[17]:

Technology and infrastructure: Novel production techniques such as precision fermentation and insect farming require specialised infrastructure, including bioreactors, specialised downstream processing facilities, reliable and environmentally sustainable feedstock supply and access to low carbon energy. Dedicated capacity remains limited and bioprocess scale-up is technically challenging. Feedstock logistics – particularly for waste-based inputs – are underdeveloped.

Capital intensity: Biomanufacturing facilities are capital-intensive and characterised by high technology, market and regulatory risk. This creates two persistent 'valleys of death': first between demonstration and first commercial plants, and then when firms seek to scale production volumes. Current financing remains heavily skewed towards early-stage research and development (R&D) and venture capital, with limited availability of patient, low-cost capital suitable for investment in large-scale infrastructure.

Regulatory fragmentation: The EU has articulated strong bioeconomy ambitions and its largest economies including France, Germany, Italy and Spain have national-level strategies. But implementation is hindered by fragmented governance and incompatible regulatory templates (e.g. Novel Foods regulations) for food safety, waste, chemicals, energy and agriculture across Europe[18]. This raises compliance costs, regulatory risk and the cost of capital.

Consumer acceptance: End user demand remains complex and fragile. Novel proteins can raise concerns around 'unnaturalness', ultra-processing, and impacts on farmers and rural livelihoods, but this is highly dependent on personal and social context[19]. Sales in the meat-free retail category for example in the UK and US markets have been declining, driven by cost-of-living concerns[20]. These issues are compounded by limited institutionalised channels for involving farmers, citizens and civil society in shaping acceptable transition pathways, increasing the risk of backlash and political resistance.

Demand uncertainty: Demand for alternative proteins remains uneven and volatile. The most acute issue is lack of structured market pull in intermediate markets – including animal feed, food manufacturing and public procurement – where large-scale adoption could occur more rapidly because those sales channels would mitigate consumer acceptance challenges.

Scaling priorities

Based on the barriers identified above, the following priorities would help existing innovations in alternative proteins develop their presence in the market. The scaling strategies set out below, and for the subsequent value chains discussed, each address one or more of the barriers to scaling. In many cases, multiple strategies will be needed simultaneously, or in sequence, in order to provide the foundation for wider scaling.

Support bioprocess scale-up and spread technology costs and risks through new manufacturing models

- **Open-access biorefineries (Archetype 2, Archetype 5 – see Table 1)** provide shared, multi-user processing facilities where multiple feedstock owners or product developers 'rent' biorefining capacity rather than building their own plants during R&D. Feedstocks and product slates can be adapted as markets evolve. This spreads CAPEX and compliance costs over many users, maximises utilisation, reduces bioprocess (scale-up) risk, and lowers entry barriers for startups. Example: Biorenewables Development Centre.

- **Industrial clusters (A5)** co-locate facilities such as biorefineries, food processors, waste handlers and energy infrastructure to enable industrial symbiosis. Shared utilities, heat and water systems, and logistics, and direct exchange of intermediate waste streams (e.g., CO_2, digestate, process water) can then improve economics and reduce feedstock and energy-supply risk. Example: see Pilots4U database.

- **Full stack bio-manufacturing solutions (A2, A4, A5)** have potential to facilitate rapid development of advanced production techniques. By aggregating biomanufacturing capabilities into large networks of facilities that produce a range of advanced biomaterials – for example alternative protein alongside bioplastics and speciality chemicals – these business models can accelerate cross-domain learning and innovation, while capturing economies of scale, scope, and knowledge spillovers across biomaterial applications. Example: Planetary Group.

Substitute alternative proteins into existing products to mitigate market and regulatory risks

- **Food reformulation services (A2, A6)** can help to adapt existing products and supply chains to provide rapid routes to scaling, particularly for business-to-business (B2B) uses (e.g., pea protein as a substitute for dairy protein in yogurt)[21]. Advances in biotechnology and AI will catalyse this process, helping make food products that are cheaper, healthier and more appealing. Reformulations often face fewer technology, regulatory and market (consumer adoption) risks than do more novel approaches. This provides low-risk routes to entry for incumbent agrifood firms. Example: Nomad Foods Future Foods Lab.

- **Animal feed production and supply models that substitute alternative proteins (A1, A2)** into existing products and value chains circumvent many issues associated with consumer acceptance and help mitigate some of the regulatory issues discussed above[22]. Co-ordinated demand signals from feed buyers for products containing alternative protein (e.g., from insect protein) could stimulate production at industrial scales. Example: FEED-X Challenge.

Improve the impact and economic performance of alternative protein value chains through circular processes and infrastructure

- **Use/supply of waste- and residue-based inputs (A1, A2)** in place of virgin, food-grade feedstocks can reduce costs and environmental impacts. This is technologically feasible at present, but new business models are needed to overcome market barriers, notably new logistics services (A2) that manage the flow of materials across bioeconomy value chains and regional orchestration bodies (A5) that co-ordinate the value chain configuration across municipalities, processors and manufacturers. Example: BioVale.

Overcome gaps in the investment pipeline through procurement and financial innovations

- **Public–private procurement platforms (A5, A6)** that orchestrate cross-sector contractual innovations such as advance market commitments and price guarantees have proven highly effective in sectors such as pharmaceuticals and energy. While there have been limited applications in the agrifood sector, initiatives focused on crop resilience and carbon removals have emerged. More broadly, public procurement of alternative proteins for institutional food environments (e.g., in schools) can provide effective routes to cultural normalisation and scale. Examples: BioPreferred; Denmark's municipal food strategies.

- **Blended finance platforms (A5, A6)** provide risk-sharing capital structures that make large-scale alternative protein investments bankable by combining public and/or philanthropic funding with commercial capital. Good Food Institute analysis shows that blended finance platforms for alternative proteins typically unlock private capital at a scale two to four times the public sector contribution[23]. Example: Circular Bio-based Europe Joint Undertaking (CBE JU) and the PLENITUDE Project.

Deploy collaboration mechanisms to reduce regulatory and cultural frictions

- **Farmer networks (A7)** can support buy-in with farmers, which is critical to successful adoption of supportive policy and regulation. This can be complemented by regional alternative protein strategies that create higher-value local markets for crops such as peas and soy[24] and policy interventions including transition financing and offtake contracts. To mitigate regulatory friction and improve public acceptance, these should be integrated within the regulatory development process. Example: Food Valley NL.

- **Regulatory sandboxes and structured dialogue mechanisms** (not strictly a business model, but partially analogous to A5) are emerging as a key tool for reducing regulatory friction for emerging food technologies. Early dialogue between innovators and regulators can significantly lower compliance risk and time-to-market. However, mechanisms that facilitate better co-ordination across departments within government and at different spatial scales are still needed. Example: EU proposed Novel Food Sandbox.

Bio-based nutrition inputs in agriculture

Emerging agricultural input systems demonstrate that landscapes can be managed in ways that maintain crop productivity while reducing reliance on synthetic fertilisers. Critically, these systems offer potential to decouple agricultural productivity from volatile, energy-intensive and environmentally damaging global mineral and chemical fertiliser supply chains. Efficient systems that integrate biological resources and biomanufacturing can create localised/regionalised resource loops that replace ecologically damaging synthetic inputs with regenerative, equitable options that genuinely enhance farmland and improve nature across landscapes. Both organic fertilisers and biofertilisers are part of the solution[25].

- Organic fertilisers, such as compost, digestate (from anaerobic digestion) or emerging options like biochar and sludge from nutrient recovery systems, provide nutrients and organic matter that build soil structure, increase water retention and support long-term soil fertility. They are essential for recycling nutrients within food systems and restoring soil carbon.

- Biofertilisers, by contrast, contain living micro-organisms that enhance plant nutrient uptake and stimulate soil biological activity (e.g., via seed coatings or fertigation systems). Rather than supplying large quantities of nutrients directly, they improve the efficiency with which crops access nutrients already present in soils or applied through fertilisers. This can reduce fertiliser requirements, increase nutrient-use efficiency and improve crop resilience.

Organic fertilisers and biofertilisers are being complemented by parallel developments including in biotechnologies such as biopesticides and (to a lesser extent to date) biostimulants, ecological approaches to farming including regenerative agriculture that encourage integration with natural processes, and wider technological capabilities in AI and agritech. Together these trends can support a shift away from heavy reliance on synthetic fertilisers towards more circular and biologically driven nutrient systems.

Scaling bottlenecks

Key barriers to scaling include[26]:

Technical and agronomic uncertainty: Outcomes vary across soils, climates, crops and native microbiomes, making results less predictable than synthetic inputs. Many biological products require precise timing and preventive application rather than the curative use patterns farmers are accustomed to. Variability in nutrient content (especially for waste-derived fertilisers), shelf-life limitations, formulation challenges and incompatibility with existing equipment and processes further undermine scaling.

Regulatory and metrology misalignment: Biological inputs often fall between regulatory categories for fertilisers and plant protection products, facing fragmented definitions and disproportionate data requirements. Waste-derived fertilisers are caught between waste and product legislation, with inconsistent standards shaping market access. Lack of standards undermines quality control and reinforces perceptions of unreliability.

Economic risk and behavioural inertia: Upfront investment, learning costs, potential yield variability and market risks fall primarily on farmers operating with thin margins. Sustainable fertiliser systems often require system redesign rather than simple input substitution, including new soil management practices and crop rotations. Existing agronomy advisory systems are often optimised for high-volume synthetic inputs, limiting support for more complex biological and organic approaches.

Infrastructure and institutional gaps: Lack of traceability, certification and consistent methodologies for soil health, biodiversity and water quality make it difficult to quantify and monetise environmental outcomes. This prevents integration of soil restoration benefits into supply contracts, financial instruments or public incentives. Short-term procurement practices fragment responsibility and prevent co-ordinated transition across value chains.

Technology lock-in: Oligopoly in global fertiliser supply has created power imbalances that impede farmers from changing practices. This is compounded by technology systems designed to maintain structural dependence: hybrid seeds are bred to require synthetic chemical inputs, while long-term use degrades soil health and creates a cycle in which ever-greater inputs are needed to maintain yields. Corporate lobbying for fertiliser subsidies keeps biological alternatives at a financial disadvantage.

Scaling strategies

Reduce life-cycle impacts and improve value chain economics through circular bio-materials models

- **Circular bio-based fertiliser production models (A1, A5)** help improve the economics of bio-based fertiliser value chains by providing cheap, low-impact feedstocks and monetising waste for suppliers including farmers, food processors, water utilities and municipalities. Compositing and anaerobic digestion already use this approach at scale, but applications such as bio-fertilisers and wastewater treatment sludge (e.g., for struvite fertiliser) are still developing. Example: RUSTICA.

- **Territorial waste-to-fertiliser models (A2, A5)** integrate bio-based fertiliser production into municipal waste-management systems, turning organic waste streams, such as green waste or beach-cast biomass, into fertilisers. Municipalities capture value through avoided disposal costs and product sales, and (co-invest) in infrastructure, which can help scale circular bio-based fertiliser models. Example: Solrød Municipality, Denmark.

Bundle sustainable fertilisers with other value propositions to reduce risk and cost

- **Reformulated fertiliser manufacturing models (A1)** that integrate organic fertilisers alongside synthetic ingredients can lower farmer adoption barriers while offering familiar fertiliser performance with improved supply chain impacts and benefits for soil health. They can be embedded in established value chains and delivery mechanisms to provide a rapid route to scaling. Example: Goulding Soil Nutrition.

- **Full-stack agronomy solutions (A2, A4)** combine proprietary biological products (e.g., microbial seed treatments, biostimulants and biopesticides) with digital technologies (e.g., sensors, drones, robotics, data analytics and AI) to guide farmers to adopt and deliver bio-based nutrient management systems that actively regenerate soils and increase farm profitability. This helps reduce costs for farmers, reducing adoption risk, and improves financial and nature outcomes. Example: Koppert.

- **Outcomes-as-a-service models (A2)** charge for results, such as maintaining yields and improving soil organic carbon content, rather than for fertiliser volumes. This reduces risk and upfront investment requirements for farmers. They are often combined with full-stack solutions and most models focus on soil carbon, which can be more readily monetised, but could be linked to nutrients. Example: Indigo Ag.

Provide working capital, revenues and risk mitigation for farmers through mechanisms that link financing and environmental outcomes

- **Ecosystem services trading mechanisms (A5, A6)** create markets for environmental outcomes such as nutrient reduction and improved water quality by allowing farmers to generate tradable, verifiable ecosystem services. Practices that reduce nitrogen and phosphorus losses such as shifting from synthetic to bio-based fertilisers can be incentivised (e.g., via environmental credits or payments for ecosystem services contracts and carbon/nature insetting) to help farmers meet transition costs. Effective supply chain monitoring, reporting and verification (MRV) systems are critical to this. Examples: EcoHarvest; Soil Capital.

- **Insetting platforms (A5, A6)** are similar to ecosystem services platforms but specifically focus on transactions within supply chains. Buyers fund nature positive practices in their supplier farms, which generates verified outcomes. Applications have tended to focus on carbon, but the model can encourage a shift towards nature positive nutrient management where there are synergies with climate impact (e.g., reduced synthetic fertiliser application, improved manure management). Example: Regenagri.

- **Blended finance platforms for farmers (A5, A6)** can provide grants, concessional loans or performance payments for adopting practices such as improved manure management, cover cropping and nutrient-efficient fertilisation, with repayments or incentives linked to environmental outcomes such as reduced nitrogen and phosphorus runoff. Examples: Chesapeake Bay Program; Regenerate European Sustainable Agriculture Fund.

- **Blended finance platforms for technologies (A5, A6)** can mobilise public guarantees and concessional capital alongside private investment to scale companies developing bio-based nutrient technologies. By reducing investment risk and providing patient capital, these mechanisms help accelerate the commercialisation of alternative systems and infrastructure. Example: European Circular Bioeconomy Fund.

Empower farmers and rural communities through co-operative, localised and value reward models

- **Co-operative and cluster-based investment (A5, A7)** help farmers and allied actors jointly own and finance key assets – machinery, processing, storage, branding, advisory – so that no single farm bears the full cost of regenerative transition. The business model helps share costs and risks and capabilities, distributing returns to members according to agreed rules. Example: Organic Valley.

- **Direct-to-consumer models for regenerative producers (A4, A5)** such as Community Supported Agriculture, where households pre-pay for a season's production and receive a share of the harvest, can mitigate farmer risk in adopting regenerative nutrient management practices. Community members effectively co-finance the farm's annual budget, creating upfront cash flow and shared yield risk rather than per-kg market prices. Example: Stroud Community Agriculture.

- **Value reward models (A1, A3)** where strong ecological credentials are rewarded by higher revenues. This can generate revenue to pay for transitions away from production systems dependent on synthetic inputs and towards more sustainable and regenerative practices. These models may allow for experimentation and developing new practices, though are unlikely to scale without wider market-wide shifts. Example: Silver Fern Farms.

Nature positive business models in built environment value chains

The built environment sits at the centre of Europe's competitiveness, resilience and growth agenda. It is a major driver of nature degradation and on the frontline of escalating physical environmental risk. Core materials such as cement and steel are highly energy intensive and linked to biodiversity loss, land degradation and water use pressures[27]. In the EU, construction generates over 35 per cent of total waste and consumes half of all extracted materials[28].

At the same time, the resilience of Europe's built environment is increasingly inseparable from the condition of natural systems. Nature impacts are increasingly recognised as financially material drivers of transition risk for real estate portfolios, infrastructure assets and construction supply chains[29]. Climate change and ecosystem degradation are imposing escalating financial and physical risks. Between 1980 and 2024, weather- and climate-related extremes such as flooding, storms and heatwaves accounted for an estimated €822 billion in economic losses. Annual average losses have risen sharply in recent years and are projected to continue escalating. Dense urban areas with limited green space, altered catchment hydrology and ageing grey infrastructure are particularly exposed. This exposure to physical risk is driving a reframing of nature from an external environmental issue to critical natural capital.

Two transition imperatives in this context are explored here:

1. **Bio-based construction raw material supply chains** that reduce exposure to materials with high impacts and dependencies on nature such as steel and cement. This transition is enabled by regenerative primary production, circular bioeconomy and advanced manufacturing technologies. The goal is to move towards resource-efficient value chains that avoid high-impact commodities and increase resilience to supply shocks.

Table 4: Bio-based construction raw material supply chain

Nature benefits	Economic benefits
Avoid habitat conversion and loss associated with extraction of raw materials for steel, cement and other construction materials.	Manage dependency on high-risk, finite and scarce mineral resources.
Reduce lifecycle emissions and pollution through lower energy processing and carbon storage in bio-based materials.	Manage dependency on fossil fuel-based industrial processes.
Regenerate working lands through regenerative biomass production (e.g., regenerative forestry) to support bio-based material supply chains.	Manage exposure to fragile global extraction supply chains vulnerable to ecological and geopolitical disruption.

2. **Green and green-grey built environment infrastructure** that uses natural assets in place of or to complement existing engineered systems. This is supported by advances in digital monitoring, reporting and verification (MRV) technologies and innovative financing models – to reduce lifecycle costs, protect built asset values, and bolster social and economic resilience through the active restoration and conservation of nature.

Table 5: Green and green-grey built enviornment infrastructure

Nature benefits	Economic benefits
Restore ecosystems such as wetlands, floodplains and urban green corridors.	Manage exposure of communities to flooding, drought, extreme heat and pollution (water, atmospheric).
Regenerate working lands to improve the extent and condition of nature.	Manage expenditure on water treatment and flood management infrastructure.
Reduce environmental pressures from construction of grey infrastructure (habitat loss, climate change, pollution).	Manage reliance on energy-intensive infrastructure e.g., engineered cooling systems.

Bio-based construction materials

Bio-based construction products, including timber and other renewable materials such as engineered timber, hemp, straw and mycelium, offer a credible pathway to reduce the environmental footprint of the built environment while strengthening supply resilience. Unlike materials such as steel and cement that depend on mined raw materials, carbon-intensive production processes and increasingly volatile global supply chains, many bio-based materials sequester carbon during growth, store it during use and typically require less energy to process.

These benefits are contingent. Increased demand for bio-based materials could drive land-use change, intensify pressure on ecosystems and compete with social needs such as food production. But when paired with regenerative, circular value chains and effective spatial planning, bio-based construction value chains can deliver alternative materials with comparable (or superior) structural and safety performance, and drastically improved sustainability impact and risk profiles.

Scaling bottlenecks

Key barriers to scaling[30]:

Incompatible regulations and standards: Most existing regulations and standards were developed for traditional materials like steel, concrete and fibreglass. Bio-based and circular products must therefore work much harder to prove they are ‘equivalent’, even when their performance is sufficient or superior. Uncertainty over liability, responsibilities and acceptable risk discourages adoption by designers and developers.

Economic disincentives: Bio-based and circular materials typically face higher and/or more uncertain upfront costs and perceived financial risk. This is a major challenge for the deeply conservative, risk-averse real estate industry. Lighthouse projects often do not trigger replication because investors, lenders and quantity surveyors prioritise short-term capital expenditure and benchmark against conventional, mass-produced products with lower production costs and risk/return profiles. Standard financial appraisal tools often do not recognise the value of non-financial impacts or long-term savings.

Fragmented decision-making: Decision-making in the real estate sector is known to be highly fragmented. This is structural – for example, current approaches to design and planning tend to structure projects around sequential stages (e.g., see RIBA in the UK), separating capital allocation at fund or investment committee level from design, costing and procurement decisions. This disincentivises bioeconomy developments, which often require co-ordination across the value chain.

Underdeveloped value chains: Primary producers for bio-based materials (e.g., farmers, foresters) are highly dispersed, feedstock quality is variable, and processing capacity is limited. Lack of reverse logistics infrastructure, intermediaries (suppliers/platforms), and availability at quality and scale keep costs high and reliability low for circular inputs. Emerging manufacturers struggle to scale up production capacity and invest in industrial-scale facilities, which in turn keeps unit costs high and availability uncertain.

Lack of data and metrics: Inconsistent life-cycle assessment (LCA) practices (particularly relating to biodiversity impacts), scarce impact and performance data and non-standardised value factors for bio-based products limit the development of rigorous business cases. Lack of standardised indicators and metrics for circular biomaterials and the limited use of material/building passports inhibit tracking of components and future reuse. This means that it is hard to compare and verify the impact of alternative material strategies.

Scaling strategies

Embed emerging bio-based construction materials in design products, services and solutions to normalise use and scale deployment

- **Modular product platforms (A2, A4)** (e.g., mass-timber systems) designed for disassembly minimise material use and allow easier recovery at end-of-life for refurbishment and redeployment in circular biomaterials value chains. Similarly, building design services (e.g., bio-based architecture and engineering) and product-as-a-service models (e.g., building design kits) could promote standardisation and normalisation of bio-based materials in construction. Example: Sustainer Homes.

- **Engineered timber products (A1, A3)** including cross-laminated timber, glulam and mass timber are beginning to mainstream, enabled by the industrialisation of production. Offsite prefabrication and automated manufacturing reduce waste, costs and timelines, and improve reliability, making timber competitive with conventional materials. Example: WIEHAG.

- **Bio-based insulation materials (A1, A3)** such as hemp, wood fibre, cellulose and straw-based materials help avoid impacts associated with traditional materials (such as fibreglass, derived from glass and petrochemicals). Use of agricultural residues in insulation materials production avoids impacts and trade-offs associated with virgin biomaterial production, and provides additional revenue streams for farmers and horticulturalists. Example: TNO BioBuilt.

- **Sustainable cement and concrete blends (A1)** substitute virgin inputs into concrete with waste materials. It can command a price premium at comparable cost and performance, and can largely be substituted into existing processes with little to no adaptation. Existing business models tend to rely on inorganic industrial waste, but emerging approaches using agricultural wastes and biological processes are likely to evolve alongside bioeconomy markets. Example: Low Carbon Materials OSTO.

Simplify the market for biomaterials in construction through procurement platforms and new supply models

- **Digital procurement platforms for bio-based materials (A6)** can aggregate supply and demand, provide quality assurance and co-ordinate logistics. This reduces search, negotiation and quality verification costs within fragmented supply chains. They could also be used to aggregate demand around specific contractual price, performance and consistency criteria. Example: European Bioeconomy Alliance.

- **Turnkey bio-based solutions platforms (A2, A4)** operate under vertically integrated, alliance or consortium models, earning fees for managing complexity and risk across the chain (e.g., integrating farmers, processors, manufacturers, logistics, designers, demolition contractors). This allows designers and developers to access the bio-based market with reduced technical friction. Example: We Build Eco.

- **Regional bio-based construction material clusters (A5)** can integrate biomass suppliers (e.g., agricultural wastes), processors (e.g., fibre treatment, panel pressing, prefabrication) and logistics into coherent production and supply systems. Co-located material supply and processing facilities provide efficiencies (e.g., in meeting standards) and network effects (e.g., technology learning) that support improvements in price, quality and performance. Example: RECONSTRUCT EU.

Improve bankability of bio-based construction material manufacturing models through innovation in procurement, investment and insurance

- **Performance-based contracting models for bio-based building components (A4)** (e.g., building envelopes, structures or fitout) could shift revenue from one-off product sales to recurring, outcome-linked payments. These models generate stable, predictable cashflows to improve bankability. Example: CityLoops.

- **Insurance products for biomaterials manufacturing firms (A6)** can enable biomaterial projects to access mainstream construction and real estate finance rather than specialist capital pools. As performance datasets improve and loss histories mature, insurers can price risk more accurately and offer risk-based pricing for construction projects that use biomaterials. Collaboration between insurers, developers and engineers can reduce perceived underwriting uncertainty. Example: Built by Nature's Mass Timber Insurance Playbook.

- **Public–private de-risking mechanisms (A5, A6)** including blended finance, public procurement, structured dialogue mechanisms and regulatory sandboxes can lower the cost of capital for capital-intensive biomaterials investments, help overcome hesitancy of conservative financial markets, stimulate investment and normalise the use of materials like mass timber. This addresses the primary barrier to their scaling – *bankability*. This does not represent a business model *per se*, but effective delivery could be supported by dedicated intermediaries. Example: Built by Nature.

Deploy community-based models to promote social acceptance and local buy-in alongside technical viability

- **Community-led and co-operative development models (A7)** can explicitly integrate bio-based materials into their charters, linking material choices to local jobs, skills and identity. This bolsters social acceptance of biomaterials initiatives, helps secure local buy-in, and enables hybrid social–commercial models where longer payback periods and innovative materials are more acceptable. They can also act as early-adopter niches that prove concepts (using e.g., demonstration projects, open houses, material libraries and living labs). Example: Building Balance, Netherlands.

Green and green-grey built environment infrastructure

There is a fundamental shift underway in how ecosystems are understood and valued within the built environment[31]. Rather than being treated as marginal amenities, natural ecosystems are increasingly recognised as infrastructure assets ('nature-based solutions') that deliver services including mitigation of flooding, extreme heat, and water pollution. While quantified benefits are not well resolved, the EU integrated system of ecosystem accounts has estimated that ten ecosystem services generate €234 billion in benefits annually in the European Union.

This infrastructure can be implemented at a range of scales:

- Landscape: improved management of wetlands, forests and agricultural land can help regulate ecosystem services for urban and rural communities.

- City: natural assets such as urban forests, green corridors and bio-swales can help regulate flooding and heat.

- Building: green roofs and façades, permeable surfaces and on-site planting reduce peak runoff, moderate local temperatures and improve building envelope performance.

The business case emerges when these ecological functions can be measured, verified and contracted. When positioned as infrastructure, nature can become a strategic issue for C Suites considering capital allocation and transition plans, rather than an environmental liability to be disclosed or a reflexive 'corporate social responsibility' (CSR) add-on. It can be framed in familiar terms for boards – risk reduction, asset protection and system resilience – and provide attractive investments for financial institutions seeking long-duration, uncorrelated cashflows comparable to traditional infrastructure assets.

Scaling bottlenecks

Key barriers to scaling[32]:

Misaligned incentives: Built environment value chains are highly fragmented, which is particularly acute in landscape approaches to nature-based solutions. There is a lack of market infrastructure connecting key stakeholders, for example between land managers (e.g., farmers), ecosystem service beneficiaries (e.g., business tenants in urban environments), those who would capture long-term asset value benefits (e.g., asset owners) and regulators (e.g. Ofwat in the UK). This limits the transactional flow of value.

Lack of durable offtake: Long-term contractual commitments by institutional buyers (businesses, cities, utilities) to pay for specific ecosystem services like flood risk mitigation or avoided water treatment costs are lacking. Projects tend to run on short-term, grant-based public funding. Where offtake contracts do appear (such as in Landscape Enterprise Networks in the UK) they are often prototypes that require complex orchestration.

Implementation risk: Many decision-makers continue to view nature-based assets as less predictable than conventional grey infrastructure solutions, particularly under extreme environmental conditions. Gaps in long-term monitoring data, financial track records and return profiles, and limited standardisation of design typologies, metrics and certification schemes exacerbate this. For investors, there is also uncertainty over alignment with fiduciary frameworks built for other (grey) assets.

Lack of delivery capacity: Intermediary organisations capable of orchestrating the complex process involved in design and implementation of landscape-level ecosystem services contracts have emerged but are scarce. The multi-stakeholder negotiation and MRV approaches required can be cumbersome and result in high planning and delivery costs, constraining implementation at scale.

Fairness concerns and lack of trust: Land use and land use change are contentious issues, and poorly implemented environmental market interventions can be politically fraught. Pilot studies have indicated that farmers and rural residents feel they bear land-use constraints so downstream towns and cities benefit, often without clear or durable compensation. Strong attachments to existing landscapes and land uses also mean visible changes can be resisted and trust in new approaches can be weak. At the same time, a contrasting narrative around the need for housing and infrastructure, and delays to developments caused by environmental regulations is also present, despite evidence to the contrary.

Scaling strategies

Adopt hybrid green-grey infrastructure to provide enhanced environmental benefits at reduced cost

- **Infrastructure design and engineering services combining natural and engineered solutions (A4/A6)**. Nature-based solutions will not replace hard-engineered solutions such as water pipes and treatment works or floodwalls and embankments. Optimised hybrid systems can deliver resilience and regulatory compliance at lower lifecycle cost (because of the relatively low cost of nature-based solutions) and mitigate concerns over efficacy and compatibility. Example: Room for the River, Netherlands.

- **Environmental land management business models (A4, A5)** – where natural ecosystems are developed and managed explicitly to provide defined services over time – are at the heart of this transition. They increasingly combine multiple sources of revenue, such as biodiversity units, nature-based carbon credits, ecosystem services contracts, regenerative agriculture and tourism to fund nature restoration. Example: Oxygen Conservation.

- **Integration of nature-based solutions into water and wastewater utilities (A5)** is a key enabler of scaling closely related to the above. By investing upstream in catchment restoration, utilities can reduce treatment costs, improve regulatory compliance and extend asset lifetimes – effectively treating natural capital as complementary infrastructure. Examples: Yorkshire Water's East Riding infrastructure. See also Catchment Management in the Catskills, New York.

Aggregate natural infrastructure projects at landscape scales to create attractive, investable assets

- **Natural capital asset managers (A6)** link nature restoration and conservation projects and capital providers. Their core function is to turn fragmented activities within natural habitats and landscapes into managed assets with predictable environmental outcomes and cashflows. This simplifies the market for institutional investors and ecosystem service buyers. Example: Rebalance Earth.

- **Integration of natural capital into institutional investment portfolios (A6)** can enable scaling. Pension funds for example can provide 'patient capital' that is well suited to the long life cycle of natural capital assets. This does not necessarily represent a business model shift *per se,* but even modest allocations (e.g., 2 per cent of assets under management (AUM) for large UK pension funds) within balanced portfolios could support the emergence of natural capital as a recognised asset class. Example: Foresight Natural Capital Ltd / East Riding and West Yorkshire pension funds.

- **Risk-management solutions (A6)** including guarantees, insurance and blended finance are also key enablers. Nature-focused insurance models for example convert uncertain ecological performance risks into defined, transferable liabilities that insurers can price and diversify. This reallocates risk away from project developers, improves the overall risk-return profile, and builds confidence across the value chain. Example: NATURANCE (EU Horizon).

Link natural infrastructure projects to priced risk, regulated demand and investor-grade MRV

- **Landscape initiatives (A6, A7)** can help broker agreements, provide transparency and build trust (including across sectors). Clear, transparent benefit-sharing and compensation frameworks – such as downstream beneficiaries paying upstream providers – promote successful implementation and uptake in communities that provide natural assets and ecosystem services. Example: Landscape Enterprise Networks.

- **Integration of nature into climate risk management services (A6)** presents a key route to scaling. Companies will pay for nature when it reduces priced risks such as flooding, water-quality failures and supply chain disruption, so physical climate management can drive nature restoration. Water risk is emerging as the primary economic driver of demand for natural capital solutions (while carbon offsets and biodiversity units tend to provide a potential upside). Example: Mitiga Solutions.

- **Technical products and services for measurement, reporting and verification (MRV) (A3, A6)** help to quantify and price ecosystem services. They can play a central role by making environmental performance visible, comparable and contractable. Natural capital MRV technology markets are diverse, including for example remote sensing and satellite monitoring platforms, in-situ sensor networks, environmental modelling software, registry systems for credits, and data and reporting platforms. Examples: Vizzuality; TreesAI.

- **Habitat banking models (A2, A4)** pay farmers for verified environmental outcomes on their land that are then sold to developers or companies that need to offset their unavoidable impacts on nature (often arising from a regulatory obligation e.g., Biodiversity Net Gain in the UK). Farmers can sell multiple benefits from the same land, 'stacking' or 'bundling' outcomes for different beneficiaries and markets. Example: Environment Bank.

Discussion

This paper has examined four socio-technical transitions across agrifood and built environment value chains, identifying where business model innovations can accelerate nature positive outcomes while reinforcing European competitiveness, resilience and growth. The analysis indicates that technological feasibility is no longer the principal constraint:

- In agrifood, alternative proteins and bio-based inputs – supported by developments in advanced manufacturing technologies, and digital technologies – demonstrate strong potential and technical momentum. Yet scaling is constrained by factors such as infrastructure gaps, regulatory fragmentation, weak demand signals in intermediate markets and challenges over citizen buy-in.

- In the built environment, bio-based construction materials and integrated green-grey infrastructure – supported by emerging technology and financial solutions – are similarly compelling. Yet barriers such as conservative decision-making, fragmented governance and underdeveloped performance metrics currently constrain scaling.

While there are many technical challenges remaining, it is clear that the current technology landscape is rich in opportunities that can be scaled – we have enough to act now. But the rate-limiting barriers currently exist in wider markets, economies and societies. This indicates that the central challenge in accelerating nature positive business models at the moment is not in technical invention or innovation, but in *co-ordination*.

Strategic pathways for scaling: substitution and co-ordination

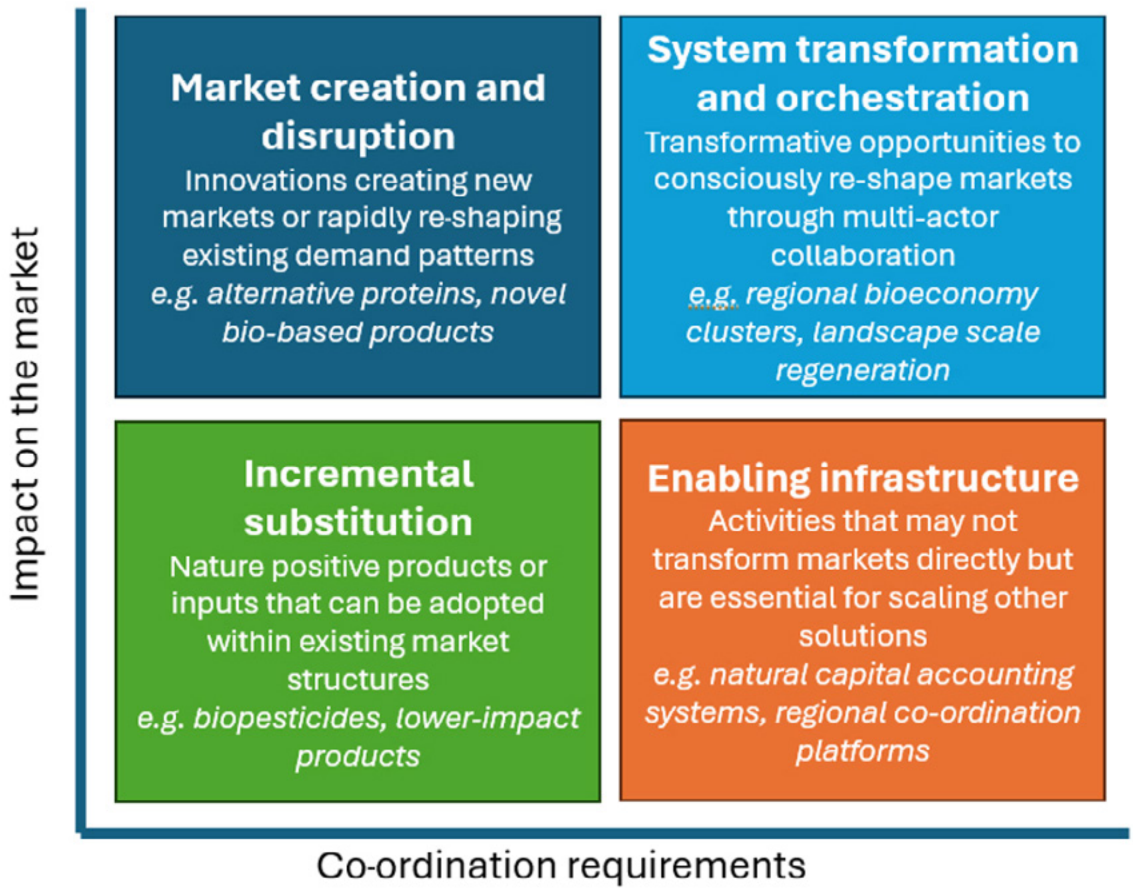
While the analysis explores a wide range of approaches, two pathways (Table 6) for scaling nature positive innovations and business models stand out as offering the most potential: **substitution (sustaining) strategies** and **co-ordination (disruptive) strategies**. These strategies frame how individual business models (and their archetypes, i.e., A1–7) can be scaled. **Neither strategy is absolute: they represent end points on a continuum, which is illustrated below, and should provide a starting point for planning nature positive transitions with business models (and hence competitiveness, resilience and growth) at their core.**

Table 6: Summary of strategies

	Substitution (sustaining) strategies	Co-ordination (disruptive) strategies
What?	Replace high-impact materials, inputs or products with lower-impact alternatives while keeping existing value chains largely intact. Generally analogous to 'sustaining' strategies (scaling incremental innovations) but can also scale radical innovations.	Restructure how value chains are organised, creating new (cross-sector) operating models, infrastructure and institutional architecture. Generally analogous to disruptive innovation (scaling radical innovations).
Why?	Lower technology, market, policy and financial risk; can be integrated into existing systems with minimal disruption, offering near-term opportunities for firms to reduce environmental impacts.	Can enable deeper systemic change, build new supply and demand ecosystems, and present bigger commercial and impact benefits in the long term.
Key challenges	Can be less likely to deliver the transformative scale of change required to address biodiversity loss and ecosystem degradation. Often still associated with substantial technology, market, policy and financial risk.	Higher implementation risk; requires new financing mechanisms, governance arrangements and scarce capabilities to orchestrate complex multi-sector transitions.
Co-ordination requirements	Low to moderate	High
How	Largely business to business but active multi-stakeholder co-ordination often also required.	Heavily reliant on active multi-stakeholder co-ordination.
Examples:	• Food reformulation services (A2, A6) incorporating alternative proteins. • Reformulated fertiliser manufacturing (A1). • Integration of natural capital into institutional investment portfolios (A6). • Bio-based insulation materials (A1, A3).	• Industrial clusters (A5) that aggregate biorefineries, food processors, waste handlers, etc. • Circular bio-based fertiliser production models (A1, A5). • Landscape initiatives (A6, A7) that broker agreements, provide transparency and build trust across sectors. • Regional bio-based construction materials clusters (A5).

Substitution strategies focus on replacing high-impact materials, inputs or products with lower-impact alternatives while leaving existing value chain structures largely intact. Examples include reformulation of processed foods using plant-based proteins, blending of biological or circular ingredients into synthetic fertilisers, or bio-based and circular insulation materials. These strategies tend to involve lower technology and market risk and can often be integrated into existing value chains with relatively limited disruption. As a result, they may offer attractive near-term opportunities for incumbent firms seeking to reduce environmental impacts without fundamentally restructuring their value chains. However, systemic barriers to scaling can still be substantial – for example, insect proteins in animal feed and timber frame construction are associated with substantial policy risk and perceived technology and financial risk.

Figure 1: Summary of scaling strategies



Substitution strategies cannot deliver the scale of transformation required to address biodiversity loss and ecosystem degradation. Many of the most significant opportunities identified in this report, such as circular construction materials, integration of green and grey infrastructure and precision fermentation, require more fundamental changes to how value chains are organised. In practice, the greatest gains for nature and resilience tend to arise when new forms of collaboration, infrastructure and market organisation are created, rather than when lower-impact alternatives are inserted into existing systems.

Co-ordination strategies are key to deploying nature positive innovations at scales sufficient to meet societal nature positive goals. For example, open-access biorefineries and co-located processing clusters can help overcome the capital intensity and infrastructure constraints associated with fermentation-based protein production. Similarly, regional bio-based material clusters can integrate farmers, processors and construction firms into co-ordinated supply chains for renewable building materials. In the case of nature-based infrastructure, ecosystem service markets and natural capital asset managers can aggregate fragmented restoration projects into investment-grade assets capable of attracting institutional finance.

Despite their promise, such models require capabilities that remain relatively scarce in the economy. Co-ordination strategies involve higher levels of orchestration and often require new collaboration ecosystems, financing mechanisms and economic incentives, intellectual frameworks and metrics, organisational capabilities, and supportive policy and regulation. This complexity results in greater implementation risk. Many organisations have strong expertise in technological development or commercial innovation, but far fewer possess the skills required to orchestrate large-scale transitions across multiple sectors, industries and governance systems.

Institutional architecture to support co-ordination

Scaling nature positive business models will require development of collaboration mechanisms that align strategic direction among multiple actors (often across different cultures, industries and sectors), manage uncertainty, promote regulatory alignment and co-ordinate the re-organisation of value chains. Because nature positive transitions address market failures and complex interactions between ecological systems, infrastructure and economic activity, they cannot be delivered through private enterprise alone.

- *Governments* play a critical role in shaping the enabling environment through regulation, standards, procurement policies and financial incentives.
- *Businesses* (particularly startups and early adopter corporates) develop and deploy the technologies and business models that translate these signals into operational solutions that can be financed.
- *Financial institutions* enable the flow of capital and availability of insurance to these solutions to fund and de-risk scaling.
- *Civil-society organisations* and research institutions act as intermediaries to build trust, co-ordinate action, and support diffusion of information and resources.

This dynamic is particularly important in emerging bioeconomy value chains where market rules and infrastructure are still evolving and value chains are characterised by critical interdependencies. For example, effective nature positive biomanufacturing clusters could require successful integration of biotechnology plant, agricultural and waste inputs, specialised logistics services and renewable (localised) energy supply. Similarly, regulatory frameworks, standards and measurement frameworks relating to food and feed safety, biotechnology, bio-based construction materials and environmental markets are complex and highly interdependent but currently fragmented and immature relative to market needs.

The institutional architecture for this is beginning to emerge in Europe. For example, the EU Bioeconomy Strategy provides an example of a policy framework designed to align innovation, industrial policy, environmental objectives and emerging delivery mechanisms across sectors. The challenge lies in implementation: high-level policy will need to be downscaled to states and regions. Patterns in implementation and enabling conditions such as local regulatory and political templates are highly variable within the EU. Beyond the EU, institutional architecture remains patchy: in the UK for example, there is currently no comprehensive bioeconomy strategy.

National Biodiversity Strategies and Action Plans (NBSAPs) can play an important role in addressing this challenge by linking biodiversity goals with industrial and economic policy. However, as yet they are rarely explicitly linked to bioeconomy strategy, likely as a result of siloed working and lack of trans-disciplinarity at all levels of government from EU to Member States and local governments. If effective delivery is to be achieved, experience from broader sustainability challenges such as climate change suggests that arenas for public–private collaboration are a vital ingredient for whole of economy transitions.

Nature-Positive Transition Pathways – currently in development for the UK – provide a potential mechanism around which to orient national planning. They provide a practical, science-based framework to identify what business action is needed, sector by sector, in order to meet national and global nature targets, and what policies are required to support businesses. Adopting such approaches across Europe offers substantial potential for scaling nature positive business models, but effective delivery will be dependent on aligned collaboration mechanisms to co-develop strategy, co-ordinate delivery and crowd in investment across sectors.

Most relevant, perhaps, might be the concept of *integrated transition planning ecosystems* – whole-of-government, whole-of-system platforms to direct, finance, incentivise, co-ordinate and enable private sector action. While much activity in this area is currently focused on climate, the model was conceived to support a transition to a just, low-emissions, climate-resilient and nature-positive economy. Integration of nature into current climate-focused transition planning activity at national levels is a clear priority for enabling scaling of nature positive business models and building competitiveness, resilience and growth.

Any national-level architecture needs to be translated into action at the regional or sectoral level, where most delivery and implementation will take place. This means empowering local actors to deliver on the ground through place-based innovation and development. While co-ordination and orchestration may draw on national frameworks and institutions, it will benefit from application at a more granular level.

Financial innovations to catalyse scaling

Ultimately, innovations scale when their price, attractiveness and accessibility become competitive with incumbent alternatives. Price – or economic viability more broadly – is now a key constraint. While broader action is needed to address economic viability, financial mechanisms can play a useful role in enabling this. Nature positive technologies and business models can often offer comparable performance and benefits such as improved security of supply (eg, in the case of alternative proteins) while not being cost competitive with incumbent products. That cost competitiveness improves dramatically if environmental externalities and nature-related financial risks are priced and internalised into markets.

Several financial mechanisms emerge as particularly helpful for scaling nature positive business models:

- **Nature markets** provide sources of revenue that make investment in nature restoration and conservation commercially viable. When linked to regulatory requirements they create predictable demand suitable for institutional investment.

- **Blended finance platforms** help mobilise capital for nature positive business models by combining public and philanthropic funding with private investment to improve risk-return profiles (and hence bankability).

- **Insurance solutions** can improve the bankability of emerging nature positive business models and are fundamentally necessary for the development and functioning of new nature positive markets.

- **Accounting innovations** are also profoundly important in scaling nature positive business models and wider decision-making in business, finance and government.

Financial innovations, including nature markets, blended finance, and natural capital accounting, can improve the commercial viability of nature positive business models by helping make nature-related risks, costs and benefits visible and investable. Successful deployment of these innovations is, however, also highly dependent on systemic co-ordination, for example across standard setters, accountants, auditors, regulators, investors, businesses, scientists and civil society.

Accounting for nature to drive transformation

A number of innovations in impact accounting can enable and support such a nature positive transition. **Natural capital assessment** provides a broad, holistic and forward-looking view of nature-related risks and opportunities (and highlights which are material) to inform decision-making and reporting. By doing so, it increases the visibility of nature in business decision-making. **Natural capital accounting** builds on this assessment to provide structured, consistent, comparable and auditable information on nature-related impacts and dependencies which can be used alongside other financial data to inform decision-making and reporting. These tools have gained traction, for example under the umbrella of 'putting nature on the balance sheet' (see Box 3) and through corporate assessments and disclosures relating to TNFD and CSRD.

Impact accounting, nature positive business models and the scaling strategies discussed here are therefore inseparable. Integration of nature into financial statements will need to be accompanied by concerted actions among business, finance, government and the third sector to actively build new markets that enable the new business models.

Box 3: Putting nature on the balance sheet

Nature Broking worked with law firm Clyde & Co to develop a pioneering approach to financing carbon removal that reframed sustainability spending as a strategic balance sheet asset rather than a short-term expense. Through a five-year partnership, they secured forward purchases of nature-based carbon removal credits to address 10,000 tonnes of projected residual emissions annually from 2038, positioning the firm ahead of emerging regulatory expectations and anticipated supply constraints in carbon removal markets. The partnership demonstrates the potential for connected financial innovations across nature markets, procurement and insurance to overcome barriers to adoption of nature positive practices and business models.

- **Forward procurement: Credits secured in advance to hedge against rising prices and supply constraints, projected to triple or more by 2038.**
- **Balance sheet capitalisation: Credits are treated as assets under International Accounting Standards (IAS) provisions, avoiding profit and loss (P&L) penalties and enhancing longer term financial performance.**
- **Risk-mitigated portfolio: Insurance via Kita and rigorous due diligence ensure high-integrity projects aligned with Clyde & Co's operations.**

This represents a significant breakthrough in nature positive innovation – it mitigates the disincentives of investment in nature positive solutions and business models created by the mismatch between short-term financial incentives and long-term environmental benefits.

To maximise their scaling potential, concerted adaptations across the public and private sectors will be required. For example, achieving widespread adoption of the accounting innovations deployed by Nature Broking can be accelerated by adapting cultural 'hardware' and 'software' among accounting, finance and audit professionals, and stable, consistent demand underpinned by regulatory requirements.

Successful deployment of these accounting innovations depends on addressing technical impact accounting issues relating to nature. For example, reliable measurement of impacts and dependencies is foundational to effective integration because it provides a basis for recognition on the balance sheet and for decision-useful data on costs and benefits linked to nature. Improved measurement methods and information pathways[33] for nature impacts and dependencies, as currently developing through A-Track's work on biodiversity and ecosystem services footprinting[34], can strengthen the business case for nature positive business models by enabling better risk assessment, performance monitoring and financial valuation.

Successful deployment is, however, also highly dependent on systemic co-ordination, for example across standard setters, accountants, auditors, regulators, investors, businesses, scientists and civil society. Technical interventions alone will not resolve the challenge: improved methods, datasets and accounting treatments will only change capital allocation if they are trusted, comparable, auditable and connected to real market demand. This creates co-ordination challenges of its own, including alignment on methodologies, assurance requirements, valuation approaches, professional capabilities and regulatory expectations. The third sector can help bridge these gaps by convening actors across disciplines, supporting methodological convergence, building confidence in emerging approaches, and linking technical accounting innovation to the wider market-making, policy and institutional activities needed to scale nature positive business models.

Conclusions

Nature positive business models are emerging as a strategic component of Europe's future competitiveness, resilience and green growth. This report's central finding is that co-ordination is now the binding constraint on scaling of nature positive technologies and associated business models. Across agrifood and built environment value chains, many of the technologies, business model innovations and financing mechanisms already exist. What is lacking is the capacity to align actors, incentives, infrastructure and institutions around shared transition pathways.

Some transitions may be driven by disruptive innovations that create entirely new markets and value chains. However, even where innovation is disruptive, successful scaling often depends on co-ordination across infrastructure, finance, regulation and supply chains. The challenge therefore is not disruption or co-ordination, but how co-ordination enables disruption to achieve systemic scale.

Effective co-ordination does not occur spontaneously; it requires deliberate efforts to orchestrate change across government, business, finance and civil society within particular places and value chains. Building this orchestration capacity – and helping it to proliferate – is the enabling layer on which the transitions described in this document depend. This is the practical means through which nature positive technologies, business models, roadmaps and transition pathways are actually delivered.

Experience from public–private sustainability collaboration elsewhere points to a consistent set of design features. Effective collaborations:

- align partners around clear, time-bound missions
- are convened by trusted, independent orchestrators – 'honest brokers' able to build confidence and manage tension across very different cultures and interests
- tailor governance, accountability and resourcing to local realities
- pair deep technical and industry knowledge with facilitation, relationship-building, design and delivery skills
- assemble a full solution stack of policy, finance, technical, organisational and market measures rather than relying on technology alone.

Two features make this capacity difficult to supply through existing channels – and define where support is most needed:

1. Mission-driven collaboration is most credible when housed in dedicated intermediaries that sit outside government, insulated from political cycles, and governed to prevent capture by any single interest; this constrains how far industry bodies can lead delivery directly.

2. The required blend of capabilities is genuinely scarce, and tends to be scarcest precisely in the regional and sectoral settings where co-ordination is hardest.

Emerging initiatives – including GoNaturePositive!'s sector roadmaps, WWF's Nature Positive Pathways, and EU platforms such as the Circular Bio-based Europe Joint Undertaking and the Circular Economy Stakeholder Platform – provide foundations to build on. But coverage remains thin and uneven. The priority is not to duplicate or compete with these efforts, but to make them more effective and to fill the gaps in regions and sectors where orchestration capacity is absent. The findings of this research and the wider A-Track programme underscore the importance of embedding natural capital data and accounting into existing and new orchestration platforms.

There is a clear need for targeted, catalytic investment in co-ordination capacity. It is not a permanent subsidy or a burden on public budgets, but time-limited pump-priming at the nodes of the economy where collaboration must take root. Given that, as this report shows, around two-thirds of EU gross value added is moderately or highly dependent on nature and that modest public contributions can leverage private capital several times over, comparatively small investments in orchestration capacity offer outsized returns for both nature and society, and competitiveness, resilience and growth. Realising this will require a co-ordinated, Europe-wide effort to build, connect and replicate the needed capacity.

This implies a number of roles of different actors:

- Policy should focus both on supporting innovation and enabling co-ordination, through stable transition frameworks, market-shaping interventions and institutions that support collaboration.
- Businesses should recognise nature positive business models as strategic responses to emerging risks and opportunities, investing in collaborative innovation and value-chain co-ordination rather than solely sustainability initiatives.
- Financial innovation should help make nature-related risks and benefits visible and investable, while supporting broader market development and transition pathways.
- Civil-society organisations can provide trusted data, convening power and stewardship, helping ensure transitions deliver genuine environmental and social outcomes.

The analysis in this report demonstrates that many of the technologies and business model innovations required already exist, with substantial opportunities across agrifood and built environment value chains. Scaling these innovations will depend less on technological breakthroughs than on the ability of businesses, governments, financial institutions and civil society to co-ordinate transition pathways, align incentives and build the intellectual, institutional and financial architecture needed to support systemic change.

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