

N-SCAPE

National Supply Chain Architecture for Priority Ecosystems

DRAFT

A framework for strategic
industrial transformation

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National Supply Chain Architecture for Priority Ecosystems

A Framework for Strategic Industrial Transformation

Prepared for National and Regional Government Policy Leaders

By WMG, University of Warwick

On behalf of UKRI

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Executive Summary

N-SCAPE is a framework for the design, governance and delivery of strategic industrial ecosystems.

It provides commissioning authorities with a structured process for:

- Understanding industrial systems;
- Defining transformational ambitions;
- Coordinating ecosystem formation;
- Aligning policy and investment;
- Mobilising industrial capability;
- Delivering long-term strategic resilience.

Governments are increasingly adopting active industrial policy approaches focused on resilience, strategic capability and sovereign control over critical systems.

N-SCAPE is applicable to supply chain transformation at national or regional level across any sector. This paper uses UK vehicle electrification as a pathfinder application of the methodology.

Research undertaken through development of the framework identified four recurring structural barriers to successful government intervention in industrial ecosystem formation:

1. Outcomes are not commercially competitive within global markets;
2. Existing industrial vested interests resist system-level transformation;
3. Discrete company activity fails where wider industrial ecosystem transformation is required;
4. Fragmented, siloed policy interventions fail to deliver coordinated industrial transformation.

N-SCAPE addresses these structural failures through coordinated ecosystem architecture led by commissioning authorities. The framework consists of three stages:

1. Landscape — understanding the current system, constraints and opportunity space;
2. Transformation Vision — defining a strategic moonshot ambition;
3. Supply Chain Architecture and Delivery — coordinating implementation, governance and ecosystem formation.

The framework positions governments and regional authorities as the coordinating actors responsible for long-term industrial transformation.

1. Strategic Context

1.1 Industrial Transformation and Strategic Capability

Industrial strategy is increasingly shaped by:

- Geopolitical competition;
- Resource concentration;
- Energy transition;
- Technological competition;
- Supply chain vulnerability;
- National resilience requirements.

1.2 What Successful Industrial Transformation looks like

Successful industrial transformations share common characteristics:

- Commercial competitiveness within global markets;
- Industrial collaboration to achieve ecosystem goals;
- Centralised ecosystem leadership;
- Long-term enabling policy frameworks.

Examples include:

South Korea — global electronics leadership

- Government-directed industrial policy;
- Coordinated capital mobilisation;
- National manufacturing capability development through chaebol structures.

Taiwan — advanced semiconductor capability

- Government-backed creation of ITRI and TSMC;
- Long-term strategic investment;
- Industrial clustering and talent coordination.

China — solar PV, battery and EV scale-up

- Coordinated state investment across supply chains;
- Strategic procurement and industrial policy alignment;
- Long-term control of critical material systems.

Denmark — global wind energy leadership

- Early public investment in wind R&D;
- Stable long-term policy mechanisms;
- Industrial clustering and coordinated deployment.

Japan — post-war automotive and electronics expansion

- Government-led industrial planning;
- Coordinated industrial upgrading;
- Long-term capital and manufacturing alignment.

These examples demonstrate that successful industrial transformation is fundamentally an ecosystem architecture challenge.

1.3 Industrial Transformation as Ecosystem Architecture

Industrial transformation requires coordinated transition across interconnected supply-chain operations.

As ecosystems evolve:

- Existing operations may be retained, transformed or phased out;
- New operational capabilities may need to be established;
- Supply and demand conditions may evolve at different rates;
- Transitional operating models may be required before full ecosystem capability is achieved.

Effective ecosystem architecture coordinates these transitions across the entire supply chain to enable, de-risk and accelerate industrial transformation.

2. The N-SCAPE Framework

2.1 Framework Purpose

N-SCAPE provides a repeatable architecture framework for strategic industrial transformation.

It enables commissioning authorities to:

- Understand current industrial conditions;
- Identify structural constraints;
- Define transformational ambitions;
- Coordinate ecosystem development;
- Align policy and investment;
- Deliver long-term industrial capability.

The framework is intended for use by:

- National governments;
- Regional authorities;
- Industrial development agencies;
- Strategic infrastructure bodies;
- Economic transformation programmes.

2.2 Framework Logic

The framework is intentionally structured in three stages:

1. Landscape;
2. Transformation Vision;
3. Supply Chain Architecture and Delivery.

This sequence is deliberate.

Industrial transformation frequently fails because:

- Ambitions are defined before structural conditions are understood;
- Delivery mechanisms are fragmented;
- Existing industrial actors optimise for incumbent advantage rather than system transformation;
- Governments attempt to coordinate transformation through consultation rather than architecture.

N-SCAPE reverses this process by:

- Establishing a whole-system understanding first;
- Developing a coherent transformation vision second;
- Coordinating ecosystem delivery third.

3. Stage 1 — Landscape

3.1 Purpose

The Landscape stage establishes a whole-system understanding of the current ecosystem.

The purpose is not to validate pre-existing assumptions.

The purpose is to establish the structural, operational and strategic conditions required to define a credible transformation ambition.

Landscape establishes the evidence base required before transformation ambition is defined.

3.2 Impact

Landscape establishes:

- Structural conditions and constraints;
- Operational effectiveness and competitiveness;
- Supply-chain vulnerabilities and dependencies;
- Capability gaps and transition requirements;
- Strategic opportunities and positioning.

Landscape also challenges assumptions around:

- Existing industrial structures;
- Market competitiveness;
- Supply-chain resilience;
- Long-term ecosystem viability.

The Landscape stage ensures that transformation ambition is grounded in operational and strategic reality rather than isolated market activity or incumbent assumptions.

3.3 How

Landscape includes:

- Demand mapping;
- Supply mapping;
- Operational process mapping;
- Capability assessment;
- Infrastructure analysis;
- Policy mapping;
- Geopolitical exposure assessment;
- Competitiveness assessment.

4. Stage 2 — Transformation Vision

4.1 Purpose

The Transformation Vision stage establishes a clear strategic opportunity, ambition and future-state positioning for the ecosystem.

The purpose is to define a credible transformation vision in direct relation to the structural conditions identified through the Landscape stage.

Transformation Vision does not solve the transformation challenge. It sets the future-state ambition and defines the parameters for system transformation architecture.

4.2 Impact

Transformation Vision establishes:

- The future-state opportunity;
- Its relationship to the current ecosystem;
- The scale and complexity of transition required;

Transformation Vision enables commissioning authorities to:

- Align stakeholders around a shared transformation ambition;
- Coordinate policy, procurement, investment and support mechanisms;
- Prioritise industrial, infrastructure and capability interventions;
- Establish long-term strategic direction and leadership.

4.3 How

The Transformation Vision stage is led by a commissioned Supply Chain Architect.

The architect draws upon the intelligence established through the Landscape stage to define a strategically positioned future-state ecosystem opportunity.

The vision positions the opportunity relative to:

- Current industrial conditions;
- Market dynamics;
- Macro forces;
- Policy and legislative direction;
- Supply-chain structures;
- Long-term transformation timelines.

5. Stage 3 — Supply Chain Architecture and Delivery

5.1 Purpose

The final stage translates the Transformation Vision into coordinated system transformation architecture and delivery.

This stage establishes the operational structures required to coordinate ecosystem transformation across the supply chain.

5.2 Impact

N-SCAPE positions commissioning authorities as the coordinating entities responsible for long-term ecosystem transformation.

This stage establishes the operational mechanisms required to transition the ecosystem from its current-state configuration to the future-state ambition.

This delivers:

- Coordinated transition and investment planning for individual supply-chain operations;
- Long-term demand visibility and investment confidence across interconnected ecosystem activities;
- Synchronised timing of supply, demand and operational scale-up across dependent industrial capabilities;
- Alignment of commercial contracting and operational transition through supply-chain alliance structures;
- Coordinated progression of ecosystem operations through the “valley of death” between innovation and industrial-scale deployment.

5.3 How

Critical activities include the appointment of an Ecosystem Champion, establishment of a Supply Chain Architecture team and formation of a Supply Chain Alliance.

The Ecosystem Champion is responsible for driving the transformation ambition across the ecosystem by providing the leadership authority, strategic influence and institutional momentum required to:

- Secure long-term stakeholder alignment;
- Maintain transformation focus and direction;
- Drive commitment across interconnected authorities and delivery bodies;
- Align engagement across government, industry and institutions;
- Overcome institutional inertia and fragmented decision-making.

The Supply Chain Architecture team distils the individual operation transition plans from whole-system analysis, operational flow optimisation and systems modelling. These are delivered through the Supply Chain Alliance.

The Supply Chain Alliance brings together the commercial operations across the ecosystem as an active “ecosystem management team”.

6. Pathfinder Application — UK Vehicle Electrification

6.1 Summary

N-SCAPE has been applied to the UK vehicle electrification ecosystem.

This Pathfinder Application identified major industrial, operational and policy coordination challenges across UK electric vehicle manufacturing and supply chains.

Despite these structural constraints, the whole-system landscape mapping also revealed the conditions for a strategically significant industrial opportunity.

Through the Transformation Vision stage, this opportunity was developed into a moonshot ambition for a UK self-sufficient electrification ecosystem centred in the West Midlands — grounded in strategic procurement, material recovery from waste and coordinated industrial investment. This is Project Alchemy.

Project Alchemy combines a strategic moonshot ambition with whole-system understanding of current industrial conditions, clearly demonstrating both the scale of the opportunity and the transformation challenge required to realise it.

The result is a comprehensive and strategically positioned industrial transformation model against which the West Midlands — as the region best placed to lead delivery — can consider, adopt and commission the final stage of supply chain architecture and delivery.

6.2 Landscape Findings

The Landscape stage examined the UK vehicle electrification ecosystem across:

- OEM demand;
- System supply;
- Upstream processing capability;
- Material recovery;
- Policy and investment environments.

6.2.1 Market Context

The analysis identified a structurally fragmented ecosystem:

- OEM activity within the UK operates primarily as part of global manufacturing footprint strategies rather than as a consequence of a competitive domestic industrial ecosystem;
- Existing tier-one systems suppliers are not drawing on domestic component suppliers;
- Specialist and niche supply-chain capability remains low-volume and fragmented;
- Significant activity is sustained through research and collaborative programmes rather than industrial-scale deployment;
- Critical upstream processing capability is absent;
- Large volumes of strategic materials are exported as waste.

6.2.2 Policy Context

The Landscape identified strong national policy alignment, led by *The UK's Modern Industrial Strategy 2025*¹, around:

- Supply-chain resilience;
- Sovereign capability;
- Domestic supply;
- Industrial competitiveness;
- Critical material security.
-

The analysis identified substantial public funding deployed through research, innovation and early-stage commercialisation programmes.

However, this funding is structured around discrete projects and is not scoped to support:

- Supply-chain formation;
- Industrial-scale deployment;
- Ecosystem transformation;
- Long-term operational integration.

This reveals a disconnect between the direction and intent of policy and the mechanisms in place to deliver that intent.

The result is development leadership, which builds reputation, rather than retained industrialisation, which builds the economy.

6.3 Transformation Vision — Project Alchemy

Drawing on the understanding established through the Landscape stage, a Transformation Vision was developed for a UK self-sufficient electrification ecosystem based on:

- Domestic material recovery as a strategic resource base;
- Regional industrial concentration in the West Midlands;
- Specialist electrification capability rather than mass-market competition;
- Resilience and sovereign capability rather than lowest-cost global production.

6.3.1 Anchor Demand

Section 1 identifies commercial competitiveness within global markets as a critical success factor for successful industrial transformation.

Project Alchemy addresses this challenge by anchoring initial demand within defence applications where supply-chain resilience, security and sovereign capability are prioritised over lowest-cost global production.

Defence provides the long-term demand confidence required to support investment, industrial capability development and operational scale-up through the “valley of death” between innovation and commercially viable industrial deployment.

¹ Including *The UK's Modern Industrial Strategy (2025)*, *Resilience for the Future: The UK's Critical Minerals Strategy (2025)*, the UK National Security Strategy and related resilience and industrial policy frameworks.

Crucially, this demand signal extends across interconnected supply-chain activities — from material recovery and processing through to component and systems manufacture.

6.3.2 Anchor Supply

The Landscape identified significant geopolitical vulnerability across critical material supply chains, consistent with the priorities established in *Resilience for the Future: The UK's Critical Minerals Strategy (2025)*, alongside the continued export of strategic materials as waste — currently valued at more than £5bn per year².

Projection of end-of-life material volumes from electronics, electric vehicles and wind turbines indicates the emergence of substantial domestic material recovery and reprocessing potential through the 2030s.

Project Alchemy proposes to exploit this material stream through the establishment of industrial-scale material recovery and reprocessing capability, supplying a diversified and re-industrialised domestic electrification manufacturing base.

6.3.3 Anchor Location — West Midlands

The West Midlands was identified as the leading regional location for ecosystem concentration.

The region has established critical structural capital: central logistics positioning; significant electrification capability across OEMs, suppliers and academia; significant material recovery R&D activity across operators and academia; and a large industrial and manufacturing base requiring diversification.

Further, the region already has the industrial, circular economy and investment policies required to support the proposed ecosystem transformation³.

² DEFRA, *Resource Management: A Catalyst for Growth and Productivity*, 2015

³ Including the WMCA Growth Plan, West Midlands Circular Economy Routemap, WMCA Net Zero 2041 Strategy and West Midlands Innovation Accelerator programme.

7. Rationale

7.1 Government as Coordinating Authority

N-SCAPE is based on the principle that strategic industrial transformation requires active government coordination and long-term institutional ownership.

The framework recognises that ecosystem transformation does not emerge automatically from fragmented market activity, isolated company interventions or disconnected policy mechanisms.

N-SCAPE therefore positions governments and regional authorities not simply as facilitators of growth, but as coordinating authorities responsible for long-term ecosystem outcomes including:

- Economic resilience;
- Industrial competitiveness;
- Employment;
- Productivity;
- Sovereign capability;
- Regional value creation.

This requires authorities to:

- Define strategic transformation direction;
- Coordinate investment and infrastructure;
- Align policy and procurement mechanisms;
- Commission long-term ecosystem architecture and delivery.

7.2 Industrial Leadership and system Transformation

The framework recognises that existing industrial actors typically optimise for incumbent commercial structures, firm-level priorities and short-term operational advantage.

As a result:

- Existing system conditions are frequently reinforced;
- Transformation activity remains fragmented;
- Supply-chain formation does not occur organically;
- Long-term ecosystem outcomes remain secondary to individual commercial interests.

N-SCAPE therefore positions industrial consultation as an input into transformation strategy rather than the mechanism through which transformation strategy is defined.

The framework instead prioritises:

- Strategic architecture;
- Long-term ecosystem positioning;
- Coordinated transformation;
- Ecosystem-level outcomes.

8. Applying N-SCAPE

8.1 Who N-SCAPE is for

N-SCAPE is intended to be commissioned by governments, regional authorities and strategic institutions seeking to coordinate long-term industrial transformation.

The framework is designed for challenges where:

- Supply chains are fragmented;
- Industrial capability is incomplete;
- Strategic dependency exists;
- Existing policy and investment mechanisms are not compounding into ecosystem formation.

The framework positions the commissioning authority as the long-term coordinating entity responsible for ecosystem outcomes.

8.2 What N-SCAPE can be applied to?

N-SCAPE can be applied to existing national, regional and sector strategies to establish strategically positioned transformation opportunities grounded in real industrial conditions, market dynamics and long-term ecosystem requirements.

The framework enables commissioning authorities to:

- Define credible long-term industrial ambitions;
- Position transformation opportunities relative to structural realities;
- Coordinate policy, procurement and investment mechanisms;
- Align stakeholders around ecosystem-level outcomes;
- Establish the basis for coordinated system transformation architecture and delivery.

Appendix 1 provides an illustrative mapping of potential UK N-SCAPE industrial transformation opportunities categorised as critical, strategic and other, including indicative regional leadership positioning.

8.3 How to apply N-SCAPE

Application of N-SCAPE begins with an introductory strategic workshop for the commissioning authority teams.

The workshop introduces the framework through the UK Pathfinder Application and facilitates a live whole-system mapping exercise for the selected industrial challenge, capturing existing assumptions and perceptions while exploring initial transformation ideas.

This will raise many questions and becomes the basis for commissioning the Landscape and Transformation Vision stages.

Together, these stages provide the commissioning authority with:

1. A strategically positioned transformation opportunity;

2. A clear understanding of the scale of transformation required;
3. The basis for commissioning coordinated system transformation architecture and delivery.

9. Conclusion

Strategic industrial transformation is increasingly defined by resilience, sovereign capability, supply-chain security and long-term industrial competitiveness.

However, industrial transformation does not emerge automatically from fragmented market activity, isolated company interventions or disconnected policy mechanisms. N-SCAPE provides a structured framework through which commissioning authorities can understand industrial ecosystems, define strategically positioned transformation ambitions and coordinate long-term ecosystem formation.

The UK vehicle electrification Pathfinder Application demonstrates how whole-system Landscape analysis combined with a strategically positioned Transformation Vision can identify nationally significant industrial transformation opportunities grounded in real industrial conditions and long-term transition requirements.

Adoption of the framework positions governments and regional authorities not simply as facilitators of growth, but as coordinating entities responsible for owning and driving long-term industrial transformation and ecosystem outcomes including competitiveness, productivity, resilience and retained industrial capability.

Contact

Thomas Morgan, Supply Chain Architect
WMG, t.j.p.morgan@warwick.ac.uk

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Appendix A — UK N-SCAPE Opportunity Mapping

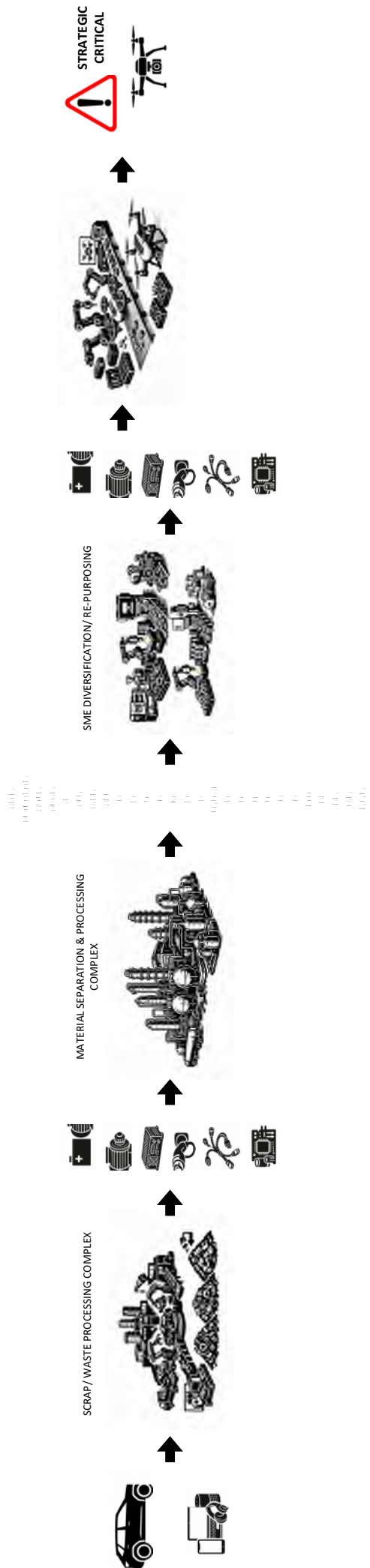
ID	N-SCAPE ecosystem / supply-chain priority	Strategic dependency / demand pull	UK resource or capability base	Capability to establish or transform	Why critical	Policy alignment / evidence base	Potential lead UK geography	Regional rationale
C1	Defence electrification materials ecosystem	Defence vehicles, drones, robotics; secure power systems	End-of-life EV motors; wind turbines; WEEE; batteries; advanced manufacturing base	Industrial-scale recovery, separation, refining and component manufacture for magnets, motors, batteries and	National security dependency; geopolitical exposure; direct fit with Project Alchemy moonshot	Critical Minerals Strategy; Industrial Strategy; National Security Strategy; defence resilience	West Midlands	Central logistics; electrification capability; SME engineering density; circular economy positioning
C2	Rare-earth magnets and motor materials (C1 sub-system)	Defence, aerospace, EV drivetrains, wind, robotics	NdFeB magnets in waste streams; university and pilot recovery activity	Magnet recovery, rare-earth separation, alloying, magnet manufacturing and rotor integration	Material concentration risk; foundational input for electrified defence and energy systems	Critical Minerals Strategy; advanced manufacturing and defence supply-chain priorities	West Midlands	Motor, drivetrain and electrification concentration; recovery-to-component logic
C3	Battery-grade materials and cells (C1 sub-system)	Defence electrification, grid storage, specialist EVs, aerospace	Black mass, battery scrap, lithium, nickel, cobalt, graphite recycling; cell R&D	Hydrometallurgical recovery, precursor production, cathode/anode materials and specialist cell manufacture	Energy storage sovereignty; high upstream dependency; critical to electrification resilience	Critical Minerals Strategy; Battery Strategy; Industrial Strategy	West Midlands / North East	West Midlands demand and systems base; North East battery manufacturing assets
C4	Semiconductors and compound semiconductors (C1 sub-system)	Telecoms, defence, power electronics, energy systems, automotive	Compound semiconductor cluster; silica; industrial gases; precious-metal recovery from PCBs	Specialist fabs, packaging, substrate materials, secure design and resilient supply chains	National security and digital infrastructure dependency; long replacement cycles	UK Semiconductor Strategy; National Security Strategy; Industrial Strategy	South Wales	Compound semiconductor cluster, fabs, universities and specialist skills
C5	Pharma precursors and APIs	NHS medicines security, life sciences, emergency resilience	Petrochemical intermediates, bio-feedstocks, solvent recovery, specialist chemistry capability	Domestic API/precursor manufacture, solvent recovery and flexible small-batch chemical production	Health resilience risk; high import exposure; pandemic-exposed vulnerability	Life Sciences Vision; medicines supply security; resilience policy	North East England	Chemical cluster, API capability, process industry skills
C6	Sterile medical consumables	NHS continuity, emergency response, pandemic resilience	Primary/recycled polymers, textiles, paper/board, packaging and converting capability	Sterile converting, nonwovens, packaging, logistics and surge-capacity production	Essential healthcare continuity; low-Pandemic resilience margin products exposed to import disruption	low-Pandemic resilience reviews; health security and industrial resilience agendas	North West England	Polymer base, logistics, medical suppliers
C7	Fertilisers and nutrient inputs	Food security, agriculture, land productivity	Natural gas/ammonia potential, limestone, manure, digestate, food and green waste	Ammonia/nutrient production, organic fertiliser processing, nutrient recovery and distribution	Food-system resilience; fertiliser price/import exposure; farm productivity dependency	UK Food Security Report; food resilience and circular economy policy	Yorkshire & Humber	Existing fertiliser activity, agriculture and distribution networks
C8	Fibre-optic materials and secure telecoms hardware	National digital backbone, data centres, subsea and defence communications	High-purity silica, glass capability, dopants, copper, precious metals from e-waste	Preforms, fibre, cable, connectors and secure telecoms hardware supply chains	Digital infrastructure dependency; strategic exposure in telecoms hardware	Telecoms Supply Chain Review; National Security Strategy; digital infrastructure policy	West Yorkshire	Glass/textiles heritage, fibre capability
C9	Grid transformers, HV equipment and electrical steel	Grid reinforcement, electrification, defence bases, data centres	Electrical steel, copper, aluminium, transformer oils, fabrication capability	Transformer manufacture, HV switchgear, winding, insulation systems and maintenance capacity	Grid bottleneck risk; long lead times; enables all electrification investment	Net Zero Strategy; electricity networks policy; Industrial Strategy	North West / Yorkshire & Humber	Electrical engineering base, ports, fabrication and grid-supply activity
C10	Industrial gases and specialty gases	Semiconductors, healthcare, welding, defence, laboratories	Air separation, gas handling, helium recovery opportunities, chemical clusters	Resilient supply of neon, argon, xenon, helium, nitrogen, oxygen and high-purity gases	Hidden dependency across semiconductor, health and defence systems	Semiconductor Strategy; health resilience; industrial resilience policy	Teesside / Humberside	Chemical clusters, energy infrastructure, process skills and port logistics
C11	Defence energetics, propellants and nitrates	Munitions, missiles, drones, naval systems, deterrence support	Nitrogen chemistry, energetic materials expertise, secure industrial sites	Precursor chemicals, propellants, explosives, safe processing and surge capacity	Direct defence readiness dependency; limited allied capacity; high security sensitivity	Defence Industrial Strategy; National Security Strategy; NATO resilience priorities	South Wales / North West	Defence manufacturing legacy, secure sites, chemistry and logistics
C12	Copper refining, copper foil and cable systems	Grid, motors, transformers, batteries, electronics, telecoms	WEEE, cable scrap, construction scrap, end-of-life motors and electronics	Refining, casting, foil production, wire rod, cables, busbars and windings	Electrification bottleneck; strategic metal dependency; high domestic waste leakage	Critical Minerals Strategy; circular economy; grid and electrification policy	West Midlands / North West	Scrap streams, electrical engineering, a automotive demand and logistics

ID	Strategic ecosystem / supply-chain opportunity	Strategic product pull	UK resource or capability base	Capability to establish or transform	Why UK strategic	Policy alignment / evidence base	Viability by 2035	Potential lead UK geography	Regional rationale
S1	Seeds and climate-resilient agricultural genetics	Food resilience, crop productivity, climate adaptation	UK breeding, agri-tech, universities, farming base	Seed breeding, protected genetics, bio-inputs and resilient crop systems	Strategic for food resilience but less immediate sovereign failure risk than fertilisers	Food Security Report; agri-tech and bioeconomy policy	Medium-High	East Midlands / East Anglia	Agricultural base, crop science, seed expertise and logistics
S2	Low-carbon cement substitutes	Net-zero infrastructure, grid, ports, housing, data centres	Steel slag, clay, construction/demolition fines, waste glass	Pozzolans, calcined clays, slag processing and blended cements	Reduces embodied carbon and import reliance in infrastructure delivery	Industrial decarbonisation; circular economy; construction policy	High	South Wales	Steel slag, cement plants, ports and industrial cluster
S3	Recycled aluminium for transport and infrastructure	EV platforms, rail, aerospace, heat exchangers, construction	UK aluminium scrap, extrusion skills, casting/fabrication base	Closed-loop remelting, billet, sheet, extrusion and casting capability	Supports lightweighting and circular manufacturing, strong industrial pull	Advanced manufacturing; circular economy; net-zero policy	High	West Midlands	Automotive and rail supply chains, central logistics
S4	Recycled copper components and electrical products	Motors, wiring, busbars, transformers, grid equipment	WEEE, cable offcuts, construction scrap and industrial scrap	Copper recovery, rod, winding, connectors, cable and components	Important electrification enabler, may be critical where refining/foil is absent	Net Zero Strategy; circular economy, grid policy	High	North West / West Midlands	Electrical engineering, recycling capacity, logistics and demand pull
S5	Sustainable aviation fuel from waste and residues	Aviation decarbonisation and airport resilience	Used cooking oil, tallow, residues, municipal and industrial wastes	Feedstock aggregation, refining, SAF production and certification	Strategic decarbonisation market with strong policy pull	Jet Zero Strategy; SAF mandate; industrial decarbonisation	High	Humberside	Refinery cluster, ports, feedstock access and process capability
S6	Hydrogen equipment and balance-of-plant	Electrolysers, storage, industrial decarbonisation projects	Steel, fabrication, valves, compressors, catalyst recycling	Pressure systems, piping, valves, tanks, electrolysers and integration	Supports industrial decarbonisation and exportable engineering capability	Hydrogen Strategy; industrial clusters policy	Medium	Sheffield City Region / North East	Fabrication, steel, hydrogen projects and industrial skills
S7	Heat-pump and thermal-management components	Building decarbonisation, industrial heat, EV thermal systems	Copper, aluminium, steel, compressors, heat exchangers	Heat exchangers, compressors, controls, refrigerant systems and assembly	Strategic import substitution opportunity with growing demand	Heat and Buildings Strategy; net-zero policy	Medium	North East England	Manufacturing base, supply-chain skills and export potential
S8	Bio-based surfactants and solvents	Specialty chemicals, coatings, detergents, pharma and cleaning products	Wheat, sugar beet, residues, bio-feedstocks, solvent recovery	Fermentation, green chemistry, purification and formulation	Higher-value chemical substitution using domestic biomass and residues	Bioeconomy Strategy; chemicals strategy; circular economy	Medium	East Anglia / North East	Crop base plus chemical and process capability
S9	Industrial enzymes and bioprocess inputs	Biomanufacturing, food, pharma, textiles, waste treatment	Agricultural residues; food waste, biogenic CO2, biotech capability	Fermentation, enzyme production, downstream processing and scale-up	Supports high-value UK biotech and biomanufacturing position	Life Sciences Vision; bioeconomy; innovation policy	Medium	Cambridge-Oxford Arc	Biotech cluster, R&D strength, talent and investment base
S10	Technical textiles and regenerated fibres	Healthcare, filtration, defence, insulation, apparel, composites	Post-consumer textiles, wool, polymer waste, textile heritage	Sorting, fibre regeneration, nonwovens, technical textiles and composites	Strategic circular-manufacturing and import-substitution opportunity	Circular economy; advanced materials; manufacturing policy	Medium-High	West Yorkshire	Textile heritage, mills, skilled workforce and innovation centres
S11	Advanced ceramics and refractories	Aerospace, defence, semiconductors, high-temperature processing	Clays, alumina, zirconia inputs, ceramic manufacturing skills	Ceramic powders, components, kiln capability and specialist coatings	Supports multiple advanced industries but less system-critical than semiconductors	Advanced materials; industrial strategy; defence manufacturing	Medium	Staffordshire / Midlands	Ceramics heritage, materials skills and manufacturing base
S12	Engineered timber and low-carbon construction materials	Retrofit, modular housing, public infrastructure	UK timber, waste wood, forestry residues, sawmill capacity	CLT, glulam, panels, insulation and circular construction products	Supports housing, retrofit and embodied-carbon reduction	Net-zero buildings; circular construction; forestry policy	Medium-High	Scotland / Wales	Forestry, timber processing, rural economy and construction demand
S13	Offshore wind service and component supply chains	Energy security, offshore wind deployment and maintenance	Steel, composites, cables, ports, marine engineering	Repairs, foundations, substations, blades, cables and operations support	Strategic energy supply chain but not always sovereign-critical at component level	Clean Power Mission; offshore wind industrial strategy	High	North East / Scotland	Ports, offshore engineering, fabrication and energy clusters
S14	Rail and light-rail electrification systems	Public transport decarbonisation, local transport, infrastructure	Steel, aluminium, copper, power electronics, rail supply base	Traction systems, charging, signalling, converters and lightweight structures	Strategic domestic market with regional manufacturing relevance	Transport decarbonisation; rail industrial strategy; devolution policy	Medium	West Midlands / Derbyshire	Rail supply chain, automotive electrification crossover and engineering skills

ID	Opportunity ecosystem	UK feedstock / resource base	Potential product streams	Why an opportunity	Viability by 2035	Likely intervention type	Potential lead UK geography	Regional rationale
O1	Industrial hemp platform	UK-grown hemp	Hempcrete, composites, paper/card, textiles, proteins	Multi-use crop; substitutes imports; circular and rural-growth potential	High	Market shaping, processing capacity, standards	East Anglia	Arable land, farming expertise, logistics and processing potential
O2	Wool platform	UK wool and wool waste	Insulation, composites, fertiliser, textiles, acoustic products	Undervalued domestic material; rural-value opportunity; natural materials demand	High	Aggregation, standards, product development	Wales	Sheep farming, rural economy, textile heritage and processing potential
O3	Municipal biowaste to soil and nutrient products	Food and green waste	Compost, digestate, biochar, organic fertilisers	Large waste stream; supports soil health and local circular economy	High	Local authority coordination, offtake markets	Greater Manchester	Population scale, waste streams, AD assets and circular economy focus
O4	Agricultural residues to biochar and biogenic carbon	Straw, husks, prunings, manure	Biochar, soil improvers, carbon feedstocks	Carbon-negative potential; supports regenerative agriculture and carbon markets	High	Demonstration plants, carbon accounting, farmer offtake	Lincolnshire	Arable farming, residue availability, land and logistics
O5	Waste glass fines to construction inputs	Mixed glass fines	Pozzolans, aggregates, fillers, cement substitutes	Problematic waste stream; supports low-carbon infrastructure materials	High	Standards, testing, construction procurement	South East England	Waste processing, construction demand, ports and cement access
O6	Waste wood and timber offcuts	Construction wood waste, sawmill residues	Panels, insulation, engineered wood products, bio-based chemicals	Large underused stream; supports retrofit and circular construction	High	Feedstock quality, sorting, product certification	Scotland	Forestry, timber expertise, processing capacity and construction demand
O7	Spent grain and brewery/distillery residues	Brewery and distillery by-products	Protein ingredients, fibres, nutraceuticals, animal feed	High-volume residue stream; higher-value food and feed opportunities	High-High	Product development, food-grade processing	Scotland	Distilling sector, residue availability and food innovation potential
O8	Waste plasterboard and gypsum recovery	Gypsum waste from construction	Soil improvers, gypsum inputs, construction additives	Avoids landfill; substitutes gypsum inputs; circular construction fit	High	Collection rules, contamination control, construction offtake	West Midlands	Construction waste, logistics, manufacturing base and processing sites
O9	Waste oils and fats to high-value chemicals	Used cooking oil, tallow, fats and greases	Lubricants, surfactants, polymers, oleochemicals	Higher-value alternative to fuels; green chemicals import substitution	Medium-High	Chemical scale-up, feedstock aggregation	Humberside	Refinery and chemical cluster, ports and feedstock routes
O10	Tyre and rubber waste recovery	End-of-life tyres, industrial rubber	Recovered carbon black, crumb rubber, oils, additives	Persistent waste stream; potential domestic carbon-black substitution	Medium	Technology scale-up, standards and offtake	West Midlands	Automotive base, logistics, waste streams and manufacturing demand
O11	CO2 mineralisation and carbonated aggregates	Industrial CO2, demolition fines, slags	Carbonated aggregates, blocks, mineral products	Turns emissions and mineral wastes into construction inputs	Medium	Demonstration, construction procurement, carbon verification	Teesside / South Wales	Industrial CO2 sources, slag/mineral streams and ports
O12	Seaweed and marine bioproducts	Cultivated seaweed and marine biomass	Bioplastics, fertilisers, food ingredients, animal-feed additives	Emerging bioresource with coastal regeneration potential	Medium	Permitting, aquaculture scale-up, product development	Scotland / South West	Coastline, marine expertise, aquaculture and rural development

Appendix B — Project Alchemy vision sketch

An indicative high-level ecosystem architecture illustration for Project Alchemy, demonstrating the relationship between strategic material recovery, upstream processing, industrial diversification and downstream systems manufacture within a coordinated electrification supply ecosystem...



N-SCAPE

National Supply Chain Architecture for Priority Ecosystems

A Framework for Strategic Industrial Transformation

Prepared for National and Regional Government Policy Leaders

By WMG, University of Warwick

On behalf of UKRI

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