

STRATEGIC INTELLIGENCE PROPOSAL ·
CONFIDENTIAL

PROJECT CHIMERA

Saudi Arabia Hemp R&D Proposal

*A Strategic Assessment and Business Plan for
the Transformation of Saudi Arabia's Desert
Regions into a Solar-Powered Aeroponic Hemp
Cultivation Network*

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Submitted To: His Majesty King Salman bin Abdulaziz Al Saud,
The Custodian of the Two Holy Mosques, Royal Court, Riyadh, Kingdom of
Saudi Arabia

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Marie Landry's Spy Shop

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His Majesty King Salman bin Abdulaziz Al Saud
The Custodian of the Two Holy Mosques
Royal Court, Riyadh
Kingdom of Saudi Arabia

Your Majesty,

I write to you not only as a scientist and entrepreneur, but as a human being committed to planetary regeneration, social peace, and the transition to sustainable civilizations. I present a transformative vision—one that reimagines the deserts of Saudi Arabia not as barren sands, but as fertile grounds for the most advanced regenerative bioeconomy on Earth. This vision requires courage and foresight, both of which Your Majesty has demonstrated in Saudi Arabia's dynamic national reforms under the Vision 2030 initiative.

This proposal outlines a scientific and economic framework to convert vast expanses of Saudi Arabia's desert—encompassing approximately 2.15 million square kilometres—into climate-controlled aeroponic mega-farms cultivating cannabis (*Cannabis sativa* L., including industrial hemp varieties) for industrial, medicinal, and ecological purposes. Aeroponics, powered by solar energy and desalinated water, enables sustainable farming without soil, synthetic pesticides, or excessive water use. With hemp's extraordinary potential for carbon sequestration, soil microbiome regeneration, advanced medical application, and material innovation, this initiative could complement—and

eventually transcend—oil as the Kingdom's primary export, redefining Saudi Arabia's global leadership for the 21st century.

Industrial hemp sequesters up to 15 metric tons of CO₂ per hectare annually. Its versatile biomass feeds sectors ranging from high-performance textiles and advanced nanomaterials to fully biodegradable bioplastics and carbon-negative hempcrete construction systems. Medicinal cannabis commands global demand projected in the hundreds of billions of US dollars annually. With regulated, ethics-first cultivation and processing, Saudi Arabia could emerge as the world's foremost supplier of organic cannabinoids and hemp-derived materials, while simultaneously reversing desertification and establishing itself as a carbon-negative nation of extraordinary repute.

A project of this magnitude—estimated at approximately \$451.5 trillion USD for full nationwide implementation over a 20-year horizon—requires not just capital, but visionary statesmanship. The return on this investment, however, is commensurate with its ambition: potential annual revenues in the range of \$5–\$10 trillion USD at full maturity, millions of high-technology jobs, permanent water-efficient food security for the region, and the creation of a thriving organic civilization blueprint for the post-petroleum era. This aligns precisely with the principles of Vision 2030 and extends them beyond fossil resources into universal organic rights, economic justice, and genuine ecological stewardship.

This finalized proposal (Version 2.0, dated May 20, 2026) presents the complete strategic assessment under the designation **Project Chimera**. It encompasses a thorough geographic scope analysis, integrated infrastructure and economic modelling, a phased implementation strategy, legal and regulatory pathway recommendations, environmental impact assessment, socio-political integration frameworks, and a full set

of strategic recommendations suitable for royal scientific delegation review.

I urge Your Majesty to commission a royal scientific delegation to study this vision and propose a strategic pilot programme. As a trans woman, scientist, and peace advocate working from Moncton, New Brunswick, Canada, I believe this initiative can unite humanity's scientific ingenuity with spiritual responsibility and environmental conscience. The future need not be dominated by synthetic chemicals, artificial scarcity, or fossil-resource conflicts. With the right leadership, it can be organic, inclusive, and genuinely healing for our shared planet.

I am at Your Majesty's service to provide detailed technical plans, specialist research teams, and global academic and industrial collaborations in full support of this organic revolution.

With deepest respect and hope for humanity's organic future,

Marie-Soleil Seshat Landry

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***P.S.** This initiative supports the Universal Declaration of Organic Rights and aligns with peaceful climate restoration strategies. Project Chimera further integrates seamlessly with the Hempoxies bio-based vitrimer composite R&D platform developed by the author, representing a convergence of advanced materials science and large-scale agricultural innovation. I welcome international dialogue under Your Majesty's visionary leadership.*

STRATEGIC ASSESSMENT & BUSINESS PLAN ·
PROJECT CHIMERA

Transformation of Saudi Arabia's Desert Regions into a Solar-Powered Aeroponic Hemp Cultivation Network

A Comprehensive Intelligence and Economic Framework for a Post-Petroleum Saudi Bioeconomy

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Intelligence Brief: Project Chimera Feasibility

Objective: This document outlines a comprehensive strategy for the transformation of the Kingdom of Saudi Arabia's extensive desert territories—approximately 2.15 million square kilometres—into a globally unprecedented network of solar-powered, aeroponically cultivated hemp farms. The core strategic intent is the phased legalization of both industrial hemp and medicinal/regulated cannabis, facilitating a fundamental shift from a hydrocarbon-centric economy toward a diversified, sustainable, and citizen-integrated bioeconomy.

215M ha TARGET COVERAGE	\$451.5T 20-YR INFRASTRUCTURE EST.	\$5-10T ANNUAL REVENUE POTENTIAL
3.23B METRIC TONS BIOMASS/YR (MAX)	95% WATER REDUCTION VS. SOIL	3 Phases 20+ YEAR ROLLOUT

Strategic Significance: Project Chimera offers a paradigm-shifting opportunity for Saudi Arabia to leverage underutilized geographic assets—desert land and exceptional solar irradiance—and transition toward global leadership in sustainable agriculture, renewable energy, and advanced biomaterials. The scale is unprecedented, carrying both immense potential and significant execution risk that must be managed through rigorous phased implementation and adaptive governance.

1.1 Situational Context and Justification

This strategic assessment responds to the urgent imperative for the Kingdom of Saudi Arabia to diversify its economy beyond fossil fuels, as outlined in the national transformation plan, Vision 2030. Current geopolitical volatility, accelerating global shifts toward sustainable energy systems, and long-term forecasts projecting declining hydrocarbon demand necessitate bold, transformative initiatives capable of repositioning the Kingdom for the post-petroleum era.

Intelligence analysis conducted by the author indicates a convergence of several critical factors making large-scale hemp cultivation a strategically viable—albeit ambitious—diversification pathway for Saudi Arabia:

- ◆ **Abundant Underutilized Resources:** The Kingdom possesses vast tracts of arid land (approximately 2.15 million km²) and exceptional solar irradiance levels, resources currently generating minimal direct economic value but ideally suited for the proposed integrated solar-aeroponic model.
- ◆ **Technological Maturity:** Aeroponic cultivation techniques have advanced significantly, offering dramatic reductions in water consumption (up to 95% less than conventional agriculture) and superior environmental control over growing conditions, directly mitigating the severe challenges of desert environments. Solar photovoltaic (PV) technology costs have also decreased substantially, making large-scale deployment increasingly economical.
- ◆ **Multi-Sector Market Potential of Hemp:** *Cannabis sativa* L. is among the most versatile crops known, with verified applications spanning sustainable textiles, biodegradable plastics, carbon-negative construction materials (hempcrete), high-nutrition food

products, advanced biofuels, and phytocannabinoids (including CBD, CBG, and CBN) for the rapidly growing wellness and pharmaceutical markets. Potential legalization of broader cannabis applications could unlock even higher-value market segments.

- ◆ **Water Scarcity Mitigation:** Traditional soil-based agriculture is prohibitively water-intensive and technically challenging across Saudi Arabia's arid geography. Closed-loop aeroponics, coupled with solar-powered desalination infrastructure, offers a credible pathway to significant agricultural output with minimized strain on the Kingdom's scarce freshwater resources.
- ◆ **Alignment with Sustainability and Climate Goals:** The project inherently supports environmental stewardship through massive carbon sequestration via hemp biomass, renewable energy production, and the development of biodegradable materials—meaningfully enhancing the Kingdom's international standing on climate action at a critical geopolitical moment.

1.2 Strategic Intent

Project Chimera is conceived not merely as an agricultural undertaking, but as a foundational pillar for an entirely new Saudi bioeconomy—one that harnesses the Kingdom's unique geographic endowments to create sustainable prosperity that will outlast the petroleum age. Success requires navigating complex legal reforms, mobilizing substantial phased infrastructure investment, developing a sophisticated national workforce, and proactively creating global markets for Saudi-origin hemp products.

CORE STRATEGIC PILLARS

The four foundational pillars of Project Chimera are: (1) Aeroponic Hemp Cultivation Network across Saudi desert territories; (2) Integrated Solar Energy Infrastructure providing sustainable, low-cost power; (3) Progressive Legalization and Regulatory Architecture enabling full value-

chain commercialization; and (4) Citizen-Centric Economic Model ensuring broad-based prosperity and social license.

SECTION 2

Scale and Geographic Scope

2.1 Operational Footprint

The defining characteristic of Project Chimera is its sheer scale, targeting the progressive transformation of Saudi Arabia's desert landscape across three distinct implementation phases. The project scope encompasses the desert and hyper-arid regions of the Kingdom, estimated at approximately 2.15 million square kilometres. Converted to cultivation units, this translates to 215 million hectares—the target for full operational coverage inclusive of aeroponic cultivation structures, co-located solar arrays, processing facilities, and logistics hubs.

GEOGRAPHIC UNIT	AREA	% OF SAUDI TERRITORY	PHASE TARGET
Total Desert Area	2.15 million km ²	~95%	Full scope
Phase 1 Pilot Area	~10,000 km ² (1M ha)	~0.5%	Years 1-3
Phase 2 Expansion Area	~50,000–100,000 km ²	~2-5%	Years 4-8
Phase 3 Full Deployment	2.15 million km ²	~95%	Years 9-20+

2.2 Implications of Scale

Operating at this scale generates both extraordinary opportunities and unprecedented logistical challenges. The principal strategic implications are:

- ◆ **Global Market Dominance Potential:** Successful full-scale implementation would position Saudi Arabia as the undisputed global leader in hemp biomass production and potentially allow it to dominate downstream markets for hemp-derived products across multiple sectors simultaneously.
- ◆ **Logistical Complexity:** Managing deployment, operations, harvesting, and processing across such a vast, sparsely populated area presents unprecedented challenges requiring advanced automation, AI-driven monitoring systems, dedicated rail and logistics networks, and drone-assisted maintenance and transport fleets.
- ◆ **Environmental Transformation:** Modifying the land use of such an extensive desert area—even with enclosed aeroponic systems—will produce measurable meso-scale environmental effects, including potential albedo changes, localized temperature moderation, and significant reductions in dust storm generation. These effects warrant dedicated scientific modelling and continuous monitoring.
- ◆ **National Security and Strategic Depth:** A distributed network of this scale, producing food, fuel, and materials across the Kingdom's interior, would constitute a significant enhancement of national strategic resilience and food/energy security.

Infrastructure Deployment: Aeroponics and Solar Integration

3.1 Aeroponic Farm Unit Architecture

Aeroponics is a precision cultivation method in which plant root systems are suspended in an enclosed air environment and nourished through periodic application of a fine, nutrient-enriched mist. Unlike hydroponic or soil-based systems, true aeroponic systems expose roots to oxygen continuously, accelerating metabolic rates and producing faster growth cycles, higher yields per unit area, and dramatically reduced water consumption through closed-loop recirculation.

CORE SYSTEM COMPONENTS

- ◆ Climate-controlled growing chambers with programmable temperature, humidity, CO₂ enrichment, and supplemental LED grow lighting tuned to optimal photosynthetic spectra.
- ◆ Root zone misting assemblies with high-pressure nozzles delivering 5–50 micron droplet sizes for maximum nutrient uptake efficiency.
- ◆ Recirculating nutrient solution reservoirs with automated pH and electrical conductivity (EC) dosing and adjustment systems.
- ◆ Real-time environmental sensor arrays monitoring all growth parameters with AI-assisted anomaly detection and intervention protocols.
- ◆ Modular support structures and canopy training systems optimized for high-density hemp cultivation and mechanical harvesting.
- ◆ Integrated pest and disease monitoring using computer vision and biological control agent deployment, minimizing chemical pesticide reliance to near zero.

WATER EFFICIENCY ADVANTAGE

Aeroponic systems consume up to 95% less water than conventional soil-based agriculture through closed-loop recirculation and negligible evaporative losses. For Saudi Arabia—one of the most water-scarce nations on Earth—this efficiency is not merely desirable; it is the technological prerequisite that makes large-scale agricultural production of any kind viable at this geographic scale.

COST ESTIMATE AND INVESTMENT BASIS

Current intelligence and market benchmarking suggest an approximate all-in setup cost of **\$1.6 million USD per hectare** for a fully integrated aeroponic system, inclusive of structure, cultivation technology, environmental controls, basic automation systems, and initial commissioning. This figure is derived from benchmarks for sophisticated vertical farming and controlled environment agriculture operations, adjusted for anticipated economies of scale at Project Chimera deployment volumes and for necessary environmental hardening against desert operating conditions. Significant cost reduction through dedicated R&D and domestic manufacturing scale-up is anticipated over the project's 20-year horizon.

Total Estimated Investment (Aeroponics, Full Scale): 215 million ha × \$1.6M/ha = **\$344 Trillion USD**

3.2 Solar Energy System Integration

Dedicated solar power generation is operationally essential to drive the aeroponic facilities in a sustainable and economically viable manner. Saudi Arabia's exceptional solar irradiance levels—among the highest recorded globally, with direct normal irradiance (DNI) values routinely exceeding 7 kWh/m²/day across much of the Rub' al Khali—represent a profound structural

competitive advantage that makes the solar-aeroponic co-location model uniquely suited to the Kingdom.

- ◆ **Solar Farm Architecture:** Large-scale photovoltaic (PV) solar installations co-located with or adjacent to cultivation clusters, incorporating bifacial PV panels, tracking mount systems, string and central inverters, step-up transformers, and grid-integration infrastructure.
-
- ◆ **Energy Storage Systems:** Utility-scale battery energy storage (BESS) systems—leveraging next-generation lithium iron phosphate or solid-state chemistries—combined with potential molten salt thermal storage and green hydrogen generation for long-duration storage, ensuring 24/7 reliable power supply to climate control and life-support systems.
-
- ◆ **Surplus Generation Potential:** The scale of solar deployment required to power aeroponic operations may generate substantial surplus energy beyond internal project needs. This surplus could be sold into the national grid, exported via undersea cables to regional neighbours, or directed to green hydrogen production for export—creating a major additional revenue and strategic influence stream.

Estimated Solar Investment: \$500,000 USD per supported cultivation hectare.

Total Estimated Investment (Solar, Full Scale): 215 million ha × \$500,000/ha = **\$107.5 Trillion USD**

3.3 Water Sourcing: Desalination Strategy

Saudi Arabia's inland desert regions are entirely dependent on groundwater—primarily non-renewable fossil aquifers—or desalinated coastal water for any agricultural application. Project Chimera's water strategy must be designed with long-term sustainability as a non-negotiable constraint.

- ◆ **Solar-Powered Reverse Osmosis (RO) Desalination:**
Dedicated desalination facilities powered entirely by the project's

solar infrastructure, producing demineralized process water of consistent quality for aeroponic nutrient solution preparation.

- ◆ **Closed-Loop Recirculation:** All aeroponic process water is recirculated, treated, tested, and reintroduced into the system. Net water consumption is reduced to covering only transpiration losses, evaporation from system surfaces, and periodic tank flushes—estimated at 5–10% of equivalent soil-based water requirements.
- ◆ **Brine Management:** Desalination brine byproduct to be managed through mineral recovery (potassium, magnesium, lithium extraction), solar evaporation ponds for salt production, and—where required—environmentally compliant dilution and dispersal offshore. Brine management constitutes a secondary revenue stream through recovered minerals.
- ◆ **Atmospheric Water Generation (AWG):** For remote inland pilot facilities, next-generation AWG systems drawing moisture from even hyperarid air using desiccant cycles powered by waste heat from solar operations may supplement water supply during early phases.

3.4 Total Estimated Infrastructure Investment

The combined estimated infrastructure investment for full-scale Project Chimera deployment reaches approximately:

TOTAL INFRASTRUCTURE INVESTMENT ESTIMATE

\$344 Trillion (Aeroponics) + \$107.5 Trillion (Solar) = \$451.5 Trillion USD over a 20-year horizon. This figure exceeds current global GDP aggregates and underscores the necessity of phased investment, innovative international financing mechanisms, and aggressive R&D-driven cost reduction in both aeroponic and solar/storage technologies. Domestic manufacturing scale-up for key components is a strategic imperative to capture value and reduce per-unit costs over time.

Economic Projections and Market Analysis

4.1 Hemp Yield Potential

The economic viability of Project Chimera is ultimately grounded in the agronomic productivity of hemp under controlled aeroponic conditions. Conservative yield estimates based on high-performance field cultivation benchmarks—adjusted for the expected advantages of precision aeroponic control—project annual biomass yields of **12-15 metric tons per hectare**. Aeroponic systems allowing multiple harvest cycles per year and optimized growing parameters may in practice exceed these conservative figures.

SCENARIO	YIELD (MT/HA/YR)	TOTAL ANNUAL BIOMASS (FULL SCALE)
Conservative Estimate	12 MT/ha/yr	2.58 billion metric tons
Base Case Estimate	13.5 MT/ha/yr	~2.9 billion metric tons
Optimistic Estimate	15 MT/ha/yr	3.23 billion metric tons

4.2 Potential Revenue Streams

Hemp's extraordinary versatility enables a diversified, multi-stream revenue architecture that substantially de-risks the overall project against commodity price volatility in any single market. Each stream requires distinct processing infrastructure and market development investment:

- ♦ **Bast Fiber (Textile & Industrial):** Long stem fibers for high-performance textiles, technical ropes, geotextiles, and advanced composites. Competes with and can displace cotton, linen, and

synthetic fibers. High-quality long-fiber grades command significant premiums.

- ◆ **Hurd / Shiv (Construction & Materials):** The woody inner core of the hemp stalk, the primary raw material for hempcrete—a carbon-sequestering, thermally superior, and fully biodegradable building material. Also feedstock for bioplastic composites and animal bedding.
- ◆ **Hemp Grain & Oil (Food, Feed & Cosmetics):** Nutrient-dense seeds rich in complete protein, omega-3 and omega-6 fatty acids, and minerals. Cold-pressed hemp seed oil commands premium pricing in culinary, cosmetic, and nutraceutical markets.
- ◆ **Cannabinoids—CBD, CBG, CBN, CBC (Pharmaceutical & Wellness):** High-value phytochemicals extracted from hemp flower and leaf biomass. Subject to regulatory authorization, these represent the highest per-kilogram value stream in the entire hemp value chain. Strict GMP extraction and purification infrastructure required.
- ◆ **Biofuels and Biogas:** Cellulosic biomass conversion to ethanol, biogas via anaerobic digestion, and potentially aviation biofuel (sustainable aviation fuel, SAF) via HTL/HVO pathways. Strategic value as domestic energy supply and export product.
- ◆ **Bioplastics and Biocomposites:** Hemp cellulose, hurd, and fiber as structural replacements for petroleum-derived plastics in packaging, automotive components, and construction materials—an accelerating global market driven by plastic pollution regulation.
- ◆ **Carbon Credits:** Hemp's documented carbon sequestration capacity, combined with hempcrete's long-term carbon lock-in, may generate significant certified carbon credits tradeable on international voluntary and compliance markets. This stream is particularly valuable in early project phases when biomass revenues are still scaling.
- ◆ **Surplus Solar Electricity & Green Hydrogen:** Export of renewable electricity and green hydrogen produced from surplus solar generation capacity—a high-value strategic export

positioning Saudi Arabia at the centre of the global green energy transition.

4.3 Estimated Annual Revenue (Full Scale, Mature Market)

Projecting revenue for an operation of this unprecedented scale and temporal horizon necessarily involves significant uncertainty. Based on potential biomass yield volumes and current/emerging market valuations across the product streams enumerated above, a mature, fully operational Project Chimera *could* theoretically generate annual revenues in the range of **\$5-\$10 Trillion USD**.

CRITICAL ASSESSMENT OF REVENUE PROJECTION

This projection represents a theoretical maximum potential under ideal market conditions and full deployment. Key risk factors include: (1) market saturation risk from producing billions of metric tons of hemp biomass annually, necessitating active global demand creation for bulk commodities; (2) inherent commodity price volatility requiring vertical integration into higher-value processed goods; (3) parallel investment requirements in massive downstream processing infrastructure; (4) global competitive pressure as other nations advance their own hemp economies; and (5) absolute dependency on full legalization and regulatory approval for cannabinoid value streams. These caveats do not invalidate the strategic case—they define the execution requirements.

4.4 Comparative Economic Context

Saudi Arabia's current annual GDP stands at approximately \$1 trillion USD, placing it among the world's 20 largest economies. Even a partial realization of Project Chimera's potential—achieving 20–30% of the projected full-scale revenue through strategic Phase 1 and Phase 2 execution—would represent a transformative doubling or tripling of national economic output.

The strategic imperative is not the full \$10T ceiling figure, but the creation of a durable, diversified economic foundation capable of generating resilient prosperity in a post-petroleum world.

SECTION 5

Legal and Policy Recommendations

The successful implementation of Project Chimera is fundamentally conditional upon a progressive, comprehensive, and credible overhaul of the Kingdom's legal and regulatory framework governing *Cannabis sativa* L. Without this foundational legal architecture, no amount of agricultural technology or infrastructure investment can unlock the full strategic potential of the initiative.

5.1 Legalization of Industrial Hemp and Cannabis

- ◆ **Industrial Hemp (Low THC, $\leq 0.3\%$):** Amend existing drug control legislation to explicitly define and fully legalize industrial hemp as *Cannabis sativa* L. cultivars containing no more than 0.3% delta-9-tetrahydrocannabinol (THC) by dry weight. This is consistent with international precedent established by Canada, the European Union, and numerous other jurisdictions and is unlikely to face significant multilateral treaty objection.
- ◆ **Medicinal Cannabis:** Legalization under strict pharmaceutical-grade cultivation and processing controls for specific prescribed medical applications. A phased approach—commencing with hemp and advancing to medicinal cannabis based on demonstrated implementation success and societal readiness assessment—is recommended.
- ◆ **Regulated Adult-Use (Long-Term Option):** A strategic policy option for consideration in Phase 3 timeframes, following demonstrated success in industrial hemp and medicinal cannabis streams. Would require deep societal dialogue, cultural

sensitivity, robust regulatory infrastructure, and alignment with Islamic jurisprudence considerations.

5.2 Comprehensive Regulatory Framework

A dedicated Saudi Hemp and Cannabis Authority (SHCA) should be established as a quasi-governmental regulatory body with a comprehensive mandate covering all aspects of the hemp value chain:

- ◆ Licensing of cultivators, processors, transporters, testing laboratories, and (where applicable) retailers.
- ◆ Cultivar approval registry and rigorous certified seed programme ensuring THC compliance and genetic stability.
- ◆ Mandatory standardized testing protocols for potency, pesticide residues, heavy metals, and microbial contaminants through accredited third-party laboratory networks.
- ◆ Full seed-to-sale digital traceability system integrating with Saudi Arabia's national digital infrastructure (SDAIA/NEOM platforms).
- ◆ Export and import regulatory framework aligned with international treaties and destination-market requirements.
- ◆ Taxation architecture and revenue collection systems proportional to product category risk and value.

5.3 Incentives for Investment and Development

To catalyze the private investment and global expertise necessary for Project Chimera's realization, the following incentive structures are recommended:

- ◆ Tax holidays and accelerated depreciation for capital investment in aeroponic infrastructure, processing facilities, and hemp R&D programmes.
- ◆ Public Investment Fund (PIF) anchor capital commitments to de-risk early-stage infrastructure deployment and signal long-term sovereign commitment to international investors.

- ◆ Streamlined permitting and land allocation processes through a single-window regulatory interface.
- ◆ Active Foreign Direct Investment (FDI) promotion targeting global leaders in aeroponics, hemp genetics, cannabinoid science, and sustainable materials manufacturing.
- ◆ SME support programmes enabling Saudi entrepreneurs and Bedouin communities to participate in the hemp value chain through targeted grants, soft loans, and technical assistance.

5.4 Funding for Research and Development

A dedicated National Hemp Research Fund, jointly administered by the Ministry of Environment, Water and Agriculture and the SHCA, should finance the following R&D priorities:

- ◆ Agronomic optimization protocols specific to Saudi aeroponic conditions, including nutrient recipe libraries, cultivar performance databases, and climate management algorithms.
- ◆ Advanced hemp processing technologies for decortication, cannabinoid extraction, hempcrete manufacture, and bioplastic conversion.
- ◆ Clinical research programmes for medicinal cannabis applications aligned with Saudi health priorities.
- ◆ Global market intelligence and demand forecasting to guide production planning and export strategy.

5.5 International Treaty Alignment

Saudi Arabia is a signatory to the 1961 Single Convention on Narcotic Drugs (and its 1972 Protocol), the 1971 Convention on Psychotropic Substances, and the 1988 Convention Against Illicit Traffic in Narcotic Drugs. Legalization of industrial hemp ($\leq 0.3\%$ THC) is broadly compatible with these frameworks, as hemp is not considered a narcotic drug under the international scheduling system. For medicinal and regulated adult-use cannabis, formal notification to the International Narcotics Control Board (INCB) and consultation with treaty partners will

be required. Legal counsel experienced in international drug treaty navigation—as successfully engaged by Canada, Germany, and Thailand in their respective cannabis reform processes—should be retained as a priority action.

SECTION 6

Environmental Impact Assessment and Mitigation

6.1 Positive Environmental Impacts

- ◆ **Carbon Sequestration at Scale:** Hemp is among the most effective agricultural carbon sinks known. Each metric ton of hemp biomass sequesters approximately 1.6 tonnes of atmospheric CO₂ during growth. At projected full-scale biomass yields of 2.58–3.23 billion metric tons annually, Project Chimera could sequester 4–5 billion tonnes of CO₂ per year—placing Saudi Arabia among the world's largest contributors to atmospheric carbon removal. Products such as hempcrete and biochar lock carbon out of the atmosphere for decades to centuries, compounding this effect.
- ◆ **Water Conservation:** Aeroponic closed-loop systems reduce water consumption by up to 95% versus equivalent soil agriculture, addressing Saudi Arabia's most critical environmental constraint. Solar-powered desalination ensures water supply without drawdown of non-renewable fossil aquifers.
- ◆ **Pesticide and Herbicide Elimination:** Controlled environment cultivation eliminates the open-field application of agrochemicals, protecting soil microbiomes, groundwater, and biodiversity in adjacent areas.
- ◆ **Sustainable Materials Production:** The project directly displaces demand for environmentally destructive materials including synthetic petroleum-based plastics, energy-intensive conventional concrete, and chemically processed synthetic fibres.

- ◆ **Desert Dust Reduction:** Ground-covering infrastructure across large desert tracts may measurably reduce the generation and transport of dust storms, with positive implications for air quality, solar panel efficiency, and regional respiratory health.

6.2 Potential Environmental Risks and Mitigation Strategies

- ◆ **Land Use Transformation Risk:** Mitigated through comprehensive phased Environmental Impact Assessments (EIAs), preservation of wildlife corridors, mandatory buffer zones around oases and ecological reserves, and biodiversity baseline surveys prior to any development.
- ◆ **Desalination Brine Impact:** Addressed through investment in high-recovery-rate desalination technologies, mineral extraction from brine streams, and compliant offshore brine dispersal with ongoing marine monitoring programmes.
- ◆ **Energy Consumption Scale:** Managed through continuous energy efficiency optimization in system design, passive thermal management strategies, and progressive improvements in solar PV and storage technology efficiencies over the project's multi-decade horizon.
- ◆ **Biodiversity Impact:** Saudi desert ecosystems host unique, highly adapted species. Pre-development biodiversity surveys, integrated pest management (IPM) using biological controls, and active conservation investment in non-developed buffer zones are essential mitigation measures.
- ◆ **Waste Management:** Full circular economy principles applied across all biomass fractions, infrastructure components, and processing byproducts. Organic waste directed to anaerobic digestion (biogas generation) or composting. Solar panel end-of-life recycling protocols established from project inception.

6.3 Carbon Accounting Framework

A rigorous, internationally verified carbon accounting framework—aligned with ISO 14064, the Verified Carbon Standard (VCS/

Verra), and Gold Standard protocols—should be established from project inception. This framework will quantify, verify, and report net greenhouse gas removals enabling monetization through carbon credit markets while ensuring scientific credibility and maintaining the Kingdom's international environmental commitments. Annual third-party audits by accredited verifiers will be mandatory.

SECTION 7

Implementation Timeline and
Phased Strategy

Given the unprecedented scale and systemic complexity of Project Chimera, a rigorously phased multi-decade implementation approach is non-negotiable. Each phase has defined objectives, scale targets, key activities, and measurable go/no-go decision criteria before advancement to the subsequent phase.

PHASE 1

Pilot, Validation and
Foundation

Years 1-3 · 2026-
2028

Objective: Technology validation under Saudi conditions, regulatory establishment, initial infrastructure deployment, and proof-of-concept at representative scale.

Target Scale: Approximately 1 million hectares (~0.5% of total target area).

- ◆ Enact foundational legislation for industrial hemp and establish the SHCA.
- ◆ Construct pilot aeroponic farms, co-located solar systems, and water processing facilities in a representative desert zone.
- ◆ Validate cultivation protocols, yield models, energy budgets, and operational cost structures.

- ◆ Establish national workforce training programmes in collaboration with King Abdullah University of Science and Technology (KAUST) and technical colleges.
- ◆ Secure initial financing tranches from PIF and international green finance institutions.
- ◆ Build pilot processing facilities for basic fiber/hurd separation and CBD extraction.
- ◆ Conduct comprehensive environmental baseline studies across planned Phase 2 expansion zones.

PHASE 2

Scaled Expansion and Market Entry

Years 4–8 · 2029–2033

Objective: Geometric expansion of cultivation area, scaling up processing and manufacturing capacity, initial domestic market penetration, and first export activities.

Target Scale: 5–10 million hectares (2–5% of total target area).

- ◆ Streamline construction and deployment processes based on Phase 1 learnings, targeting significant cost reductions per hectare through economies of scale.
- ◆ Build regional processing hubs for decortication, pelletizing, and hempcrete/bioplastic precursor production.
- ◆ Launch domestic market initiatives promoting hempcrete in Saudi construction—leveraging Vision 2030 megaprojects including NEOM as initial demand anchors.
- ◆ Begin targeted export of raw and semi-processed materials to established international hemp markets in Europe, North America, and Asia.
- ◆ Pursue medicinal cannabis authorization and establish secure pharmaceutical-grade cultivation and extraction

pathways if Phase 1 societal readiness assessments are positive.

- ◆ Develop national hemp logistics infrastructure including dedicated transport corridors and storage systems.

PHASE 3

Full-Scale Deployment and Economic Transition

Years 9-20+ ·
2034-2046+

Objective: Near-complete coverage of target desert area, establishment of global market leadership, full realization of economic diversification, and mature citizen benefit-sharing mechanisms.

Target Scale: Progressive expansion toward the full 215 million hectares. Actual completion may extend beyond Year 20 depending on funding cycles, logistics, and market absorption capacity.

- ◆ Achieve mass production efficiencies across cultivation and all processing value chains.
- ◆ Develop sophisticated high-value downstream manufacturing industries within Saudi Arabia: advanced technical textiles, structural composites, pharmaceutical cannabinoids, specialty chemicals, and biofuels.
- ◆ Establish Saudi Arabia as the primary global hub for hemp research, technology innovation, and standardization.
- ◆ Fully integrate the hemp bioeconomy into national GDP accounting, measurably reducing oil revenue dependency in line with Vision 2030 targets.
- ◆ Implement mature citizen wealth participation mechanisms through PIF dividends, cooperative equity programmes, and hemp sector SME ecosystems.

- ◆ Maintain adaptive environmental management across the vast operational network through continuous monitoring and governance review.

SECTION 8

Socio-Political Considerations and Citizen Integration

Transforming the national landscape and economic structure at this scale requires careful and sustained attention to social, political, and cultural factors. Securing and maintaining genuine social license from Saudi citizens—and from the Kingdom's diverse communities—is as strategically critical as any technological or financial component of Project Chimera.

8.1 Community Engagement and Consultation

Proactive, culturally respectful engagement with all communities within and adjacent to planned development zones is essential, with particular attention to Bedouin and traditional communities for whom desert land holds deep cultural, spiritual, and livelihood significance. Formal consultation processes should precede any Phase 1 site selection, and community liaison offices should be maintained throughout all operational phases. Transparent communication channels and participatory governance mechanisms, where culturally and legally appropriate, will build the durable trust upon which a multi-decade national project ultimately depends.

8.2 Citizen Ownership and Wealth Distribution

Project Chimera must be structured to ensure that Saudi citizens are genuine beneficiaries of the wealth generated—not merely

employees in a state enterprise or passive recipients of government transfers. Recommended mechanisms include:

- ◆ PIF dividend distribution programmes channelling a defined percentage of hemp sector surpluses to eligible Saudi citizens.
- ◆ Public offering mechanisms allowing citizen investment in regional hemp sector entities at accessible entry thresholds.
- ◆ Targeted SME support programmes enabling Saudi entrepreneurs—particularly women and youth—to establish businesses within the hemp value chain in processing, manufacturing, retail, and services.
- ◆ Community development funds for Bedouin and rural populations adjacent to project zones, funded by a levy on gross hemp revenue from their territories.

8.3 Workforce Development and Education

Project Chimera will require the creation of an entirely new national workforce competency base. The following educational and training investments are essential:

- ◆ University-level and graduate programmes in controlled environment agriculture, hemp biotechnology, and cannabinoid science at KAUST and Saudi universities.
- ◆ Technical and vocational training (TVET) programmes in aeroponic operations, solar systems maintenance, hemp processing, quality control, and laboratory analysis.
- ◆ Professional development and retraining programmes for workers transitioning from the hydrocarbon sector into the hemp bioeconomy.
- ◆ National public awareness campaigns educating citizens about the industrial, nutritional, and medicinal applications of hemp, clearly distinguishing industrial hemp from high-THC cannabis, and addressing cultural and religious misconceptions through informed, respectful dialogue with Islamic scholars and cultural authorities.

8.4 Gender Equality and Social Inclusion

Project Chimera should be explicitly designed as an engine of gender-inclusive economic opportunity, actively promoting and ensuring meaningful participation by Saudi women across all levels of the hemp sector—from cultivation technicians and laboratory analysts to research scientists, processing managers, and executive leadership. This aligns with and advances the Kingdom's ongoing social reforms and Vision 2030's commitment to increasing female labour force participation. Implementation policies should include childcare infrastructure, safe transportation provisions, flexible working arrangements, and dedicated entrepreneurship support for women-led hemp businesses.

8.5 Managing Social Perceptions of Cannabis

Saudi Arabia's current legal and cultural framework treats cannabis as a prohibited substance, and any cannabis-related legalization initiative will require exceptionally careful and respectful management of public perception. A rigorous cultural communication strategy—developed in close consultation with Islamic scholars, social scientists, public health professionals, and community leaders—must clearly distinguish the industrial hemp stream (a natural fibre and biomass crop) from psychoactive cannabis, and must address both the legitimate concerns and the demonstrable benefits with equal candour and respect. The Kingdom's experience with carefully managed social reforms over recent years provides a credible template for this approach.

Realizing Project Chimera's ambitions at the required pace and scale necessitates a sophisticated global technology partnership strategy. Saudi Arabia cannot—and should not—attempt to develop all necessary competencies domestically from inception. Strategic international partnerships, structured to ensure technology transfer and progressive localization, are essential accelerators.

9.1 Priority Technology Partnership Domains

- ◆ **Advanced Aeroponics and Controlled Environment Agriculture:** Partnerships with leading CEA technology providers in the Netherlands (Wageningen University Research ecosystem), Israel (leading agricultural technology exporters), and North America (vertical farming innovators) to access proven aeroponic designs, operational protocols, and cultivation intelligence.
- ◆ **Hemp Genetics and Breeding:** Collaboration with leading hemp genetics organizations in Canada, France, and the Netherlands to access certified cultivar libraries optimized for fiber, grain, and cannabinoid applications, with a programme to develop Saudi-specific elite varieties adapted to aeroponic conditions through dedicated in-Kingdom breeding programmes.
- ◆ **Cannabinoid Extraction and Pharmaceutical Processing:** Partnerships with GMP-certified extraction technology providers and pharmaceutical-grade cannabis operators in Canada, Germany, and Israel to establish world-class processing infrastructure and quality systems meeting international pharmaceutical standards.
- ◆ **Solar and Energy Storage Systems:** Leveraging Saudi Aramco's and ACWA Power's existing global networks and the PIF's international investment relationships to access best-in-

class solar PV, tracking systems, and utility-scale storage technologies at preferential terms.

- ◆ **Hempcrete and Bio-Based Construction:** Engagement with leading hempcrete research institutions and commercial operators in France and the UK to adapt hempcrete technology to Saudi climatic conditions and integrate it into the Kingdom's vast Vision 2030 construction pipeline.

9.2 National Innovation Ecosystem Development

Beyond bilateral partnerships, Project Chimera should catalyze the development of a national hemp innovation ecosystem centred on a dedicated Hemp Innovation and Research Institute (HIRI) co-located with KAUST. This institute would serve as the intellectual hub for the entire initiative, coordinating agronomic research, process engineering, product development, market intelligence, and policy analysis. Structured as a public-private collaboration with international academic affiliations, HIRI would build the domestic human capital base required to sustain and evolve Project Chimera over its multi-decade lifespan.

INTEGRATION WITH HEMPXIES PLATFORM

Project Chimera's advanced materials dimensions—particularly hempcrete, bioplastics, and biocomposite development—align directly with the Hempoxies bio-based vitrimer composite R&D platform developed by the proposal's author. The Hempoxies system, utilizing epoxidized hempseed oil, Seshat's Lignin (QF-MHL), and hierarchical hemp carbon reinforcements, represents a next-generation materials science framework that could be developed into a core technology stream within the HIRI ecosystem, providing Saudi Arabia with proprietary advanced biomaterials capabilities uniquely positioned in the global market.

Risk Matrix and Mitigation Framework

A comprehensive intelligence-grade risk assessment is integral to responsible strategic planning at this scale. The following risk matrix identifies the principal threat vectors and recommended mitigation postures:

Risk Category	Risk Description	Likelihood	Impact	Mitigation Strategy
Political/Legal	Failure to achieve cannabis legalization reform	Medium	High	Begin with industrial hemp only; phase medicinal expansion; engage Islamic scholars early
Financial	Inability to mobilize \$451.5T investment	High (full scale)	Critical	Phased approach; PIF anchor; green bonds; international consortia; technology cost reduction R&D
Market	Global market saturation from oversupply	Medium-High	High	Invest in demand creation; prioritize vertical integration; diversify into high-value streams
Technical	Aeroponic technology	Low-Medium	High	Rigorous Phase 1 validation; redundancy in

RISK CATEGORY	RISK DESCRIPTION	LIKELIHOOD	IMPACT	MITIGATION STRATEGY
	failure at desert scale			critical systems; international technical partners
Environmental	Unintended negative ecological impacts	Low-Medium	Medium	Comprehensive EIA; adaptive monitoring; environmental governance embedded from inception
Social	Public opposition or cultural resistance	Medium	Medium-High	Cultural communication strategy; Islamic scholar engagement; citizen benefit-sharing; transparency
Geopolitical	International trade barriers on Saudi hemp exports	Low-Medium	Medium	Early WTO/ bilateral trade negotiation; quality certification to international standards

SECTION 11

Conclusion and Strategic Recommendations

11.1 Synthesis

Project Chimera represents a nation-building endeavour of potentially historic proportions. It offers Saudi Arabia a credible —albeit immensely challenging—pathway to fundamentally

reshape its economy, environment, and global standing through the remainder of the 21st century. By strategically leveraging its unique geographic endowments of vast desert land and exceptional solar radiation, the Kingdom can pivot from fossil fuel dependency toward world leadership in renewable energy, precision sustainable agriculture, and advanced bio-based materials.

The strategic case is compelling: the resources exist, the technology is maturing, the market opportunities are real and growing, and the environmental imperative has never been more urgent. What is required is the political will to initiate, the institutional capacity to govern, the financial creativity to fund, and the social wisdom to share the benefits equitably. These are precisely the qualities that Vision 2030 has demonstrated the Kingdom possesses.

11.2 Strategic Recommendations

1

Secure High-Level Political Mandate

Project Chimera requires unwavering, long-term commitment and championship from the highest levels of Saudi leadership. A Royal Decree establishing Project Chimera as a national strategic initiative, under direct oversight of the Vision 2030 office, would provide the institutional authority and cross-ministerial coordination capacity that the initiative demands.

2

Commission a Royal Scientific Delegation

Prior to formal adoption, commission a multidisciplinary Royal Scientific and Technical Delegation—comprising leading agronomy, energy, legal, economic, and environmental scientists—to independently review this proposal, conduct site visits to operational aeroponic hemp facilities globally, and produce a formal technical feasibility assessment within 12 months.

3**Adopt Phased Implementation with Rigorous Gate Reviews**

Begin with a manageable Phase 1 pilot of approximately 1 million hectares to validate technology, costs, and logistics under Saudi-specific conditions. Establish clear quantitative go/no-go decision criteria for each phase transition—yield targets, cost benchmarks, regulatory milestones, and market development metrics—and maintain genuine willingness to adapt scope based on evidence.

4**Prioritize Legal and Regulatory Framework Establishment**

Initiate the industrial hemp legalization process immediately, in parallel with pilot planning. This is the longest-lead enabling action and cannot wait for pilot completion. Engage Islamic legal scholars, public health experts, and international regulatory advisors in the framework design process from the outset to ensure cultural legitimacy and practical effectiveness.

5**Launch an Aggressive Cost Reduction R&D Programme**

The \$451.5T full-scale investment figure is viable only with dramatic cost reductions in aeroponic systems, solar/storage, and hemp processing technologies over the project horizon. Establish a dedicated national programme—partnering KAUST, KACST, and international technology leaders—targeting 50%+ cost reduction in aeroponic infrastructure over 10 years through domestic manufacturing, materials innovation, and automation advances.

6**Develop Innovative Financing Architecture**

No single source of capital can fund this initiative. Develop a consortium financing model integrating PIF anchor capital, international green bond issuances, carbon credit pre-financing, output purchase agreements with global offtakers, sovereign co-investment from aligned Gulf Cooperation Council partners, and phased private equity participation. Engage the World Bank, IFC, and Islamic Development Bank as multilateral partners from Phase 1.

7**Begin Global Market Development Strategy Immediately**

Supply-side success is worthless without demand. Begin laying the groundwork for creating global demand for Saudi-origin hemp products now, before Phase 1 cultivation commences. Focus on high-volume commodity markets—hempcrete for construction, bioplastics for packaging—while simultaneously positioning for premium markets in cannabinoid wellness and pharmaceutical applications. Establish Saudi Hemp Trade Offices in Brussels, Ottawa, Singapore, and Riyadh.

8**Embed ESG and Citizen Benefit from Day One**

Environmental, social, and governance (ESG) integrity is not a compliance afterthought—it is a core strategic asset that determines Project Chimera's credibility with international investors, trading partners, and Saudi citizens alike. Establish the carbon accounting framework, community benefit structures, gender inclusion targets, and environmental monitoring systems before the first aeroponic facility is commissioned.

Project Chimera is audacious. Its success is not guaranteed. The challenges are real, the timeline is long, and the investment required is historically unprecedented. However, the strategic imperative for Saudi Arabia to transition its economic foundations is equally undeniable and equally historic. This plan provides a rigorous blueprint for leveraging the Kingdom's unique natural and institutional assets to forge a sustainable, prosperous, and globally significant future—one that honours the Kingdom's cultural heritage while positioning it for leadership in the civilization to come.

AUTHOR'S COMMITMENT

Marie-Soleil Seshat Landry and the Landry Industries research network are prepared to provide comprehensive technical support, detailed implementation planning, specialist international introductions, and ongoing strategic advisory services to any royal or governmental body commissioned to evaluate and advance Project Chimera. All inquiries are welcomed at ceo@marielandryspyshop.com or through marielandryspyshop.com.

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