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How Emerging Technologies Can Drive Saudi Vision 2030

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Vision 2030 and the Frontier of Technology

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Saudi Arabia's Vision 2030 is one of the most ambitious transformation agendas in modern history. It is not simply about diversifying the economy away from hydrocarbons; it is about repositioning the Kingdom as a global hub of innovation, investment, and influence. From giga-projects like NEOM and Qiddiya to sovereign wealth fund investments through the Public Investment Fund (PIF), Saudi Arabia is signalling to the world that it intends to lead, not follow, in the industries of the future.

Yet at the heart of Vision 2030 lies a crucial truth: infrastructure, capital, and policy are necessary but not sufficient. The real accelerant of transformation is the strategic adoption and localisation of frontier technologies. Emerging technologies are no longer abstract concepts confined to laboratories. They are actionable levers that can shape economies, societies, and global systems.

The World Economic Forum's (WEF) Top 10 Emerging Technologies of 2025 provides a timely lens into the innovations most likely to reshape industries in the coming decade. These technologies span healthcare, energy, biotechnology, digital trust, and environmental sustainability, all central to Vision 2030's priorities.

At Aldar Audit Bureau, Grant Thornton, we believe the Kingdom is uniquely positioned to act not merely as a consumer of these technologies but as a testbed, producer, and exporter. With giga-projects, sovereign wealth funds, and regulatory modernisation already underway, Saudi Arabia can leapfrog traditional models and establish global leadership in fields as diverse as clean energy, biotech, digital trust, and food security.

In this article, we examine the WEF's ten highlighted technologies through a Saudi lens, exploring how they intersect with Vision 2030 and where Saudi Arabia can achieve global leadership. For each, we provide a Grant Thornton perspective on the fiscal, regulatory, and strategic enablers required to unlock their full potential.

Chapter 1:
The Energy & Infrastructure Frontier.

Structural Battery Composites (SBCs): Powering Transport and Beyond

TThe WEF's Top 10 Emerging Technologies of 2025 highlights structural battery composites as a breakthrough in materials science, integrating energy storage directly into structural components. These "massless" batteries could transform transport and aerospace, enabling lighter, more efficient vehicles and aircraft. The WEF notes both the promise of systemic energy efficiency gains and the challenges of safety standards, recycling, and regulatory frameworks. This is not just a product innovation; it signals a rethinking of how infrastructure and mobility are designed worldwide.

For Saudi Arabia, this technology has clear relevance. The Kingdom's investments in electric mobility, sustainable aviation, and giga-project construction provide ideal testbeds. NEOM's green hydrogen-powered transport systems and the localisation of EV manufacturing through partnerships with global automakers create fertile ground for SBC deployment. In aerospace, Riyadh's ambitions to develop aviation hubs align with the efficiency gains SBCs could bring a 10% reduction in vehicle weight can increase EV range by up to 70%.

The value of SBCs for Saudi Arabia is not in incremental efficiency gains but in the strategic reconfiguration of entire supply chains. If the Kingdom embeds this technology into its EV and aerospace ambitions early, it can reposition itself from being a downstream assembler to a critical node in the global materials economy.

The challenge lies in governance, ensuring safety standards, testing protocols, and certification regimes match those of the FAA or EASA, otherwise Saudi products will remain confined to domestic use. Policymakers will need to balance industrial policy with credibility in global regulation, a delicate act where transparent oversight matters as much as industrial capacity.

Osmotic Power Systems: Turning Water into Energy

According to the WEF, osmotic power systems drawing energy from salinity gradients could provide nearly a fifth of global electricity needs if deployed at scale. They are particularly compelling because of their steady output, unlike intermittent solar and wind. Early commercial pilots in France, Denmark, and Japan demonstrate feasibility, but costs and technical hurdles remain. Globally, osmotic power is seen as both a renewable energy innovation and a pathway to integrated water–energy systems.

With one of the world's largest desalination footprints, Saudi Arabia faces high energy demands for water security. Osmotic power, generating electricity from salinity differences, offers the Kingdom an opportunity to transform a cost centre into a value creator.

Imagine Red Sea desalination plants not only producing fresh water but also generating renewable power from saline effluent. In industrial clusters, osmotic systems could complement solar and wind energy, stabilising supply in energy-intensive sectors like petrochemicals and mining.

The Kingdom already invests billions in desalination. Turning that infrastructure into a dual-purpose asset producing both fresh water and renewable energy could shift the economics of water security entirely. The risk is that osmotic power remains commercially immature. The Saudi approach should not be to pursue standalone megaprojects, but to treat osmotic pilots as adjacent experiments within existing desalination clusters, reducing cost exposure while accelerating learning.

The strategic play is to create an ecosystem where water becomes a platform, not a cost centre, generating power, recovering minerals, and advancing circular economy leadership. This requires early engagement with regulators and financiers to create frameworks where failure of pilot projects is tolerated as part of long-term capability building.

GLP-1 therapies demonstrate how repurposed science can address demographic and social resilience challenges.

Advanced Nuclear Technologies: A Role for Small modular Reactors (SMRs)

The WEF report underlines how next-generation nuclear technologies, including small modular reactors (SMRs) and gas-cooled reactors, are advancing as safe, flexible complements to renewables. Their modular design lowers costs, improves safety, and enables deployment in new geographies. Nuclear is framed as a critical enabler of net-zero ambitions, but the report stresses supply chain bottlenecks, workforce gaps, and public trust as barriers to scale.

Saudi Arabia has already announced its ambition to develop nuclear power as part of its clean energy mix. The WEF highlights small modular reactors (SMRs) and next-generation gas-cooled designs as potential breakthroughs.

For the Kingdom, SMRs could be strategically deployed in remote mining regions, hydrogen production hubs, and giga-project cities, where reliable, carbon-free power is essential. Gas-cooled reactors could provide the high-temperature process heat required for green steel and ammonia industries central to Vision 2030's industrial diversification.

For Saudi Arabia, nuclear is less about technology and more about sovereign capability and energy independence. SMRs in particular could enable distributed, carbon-free baseload power across mining, hydrogen, and industrial hubs.
But nuclear trust is hard won and easily lost. The key will be building globally benchmarked governance frameworks covering safety, security, and transparency before construction begins.

The success of Saudi nuclear policy will be measured not in megawatts but in credibility with the IAEA and with capital markets. Without trust, financing will be scarce, and international partnerships will remain politically fraught. Saudi Arabia must invest in talent pipelines, regulatory sophistication, and risk communication strategies as heavily as it invests in reactors.

Chapter 2:

Healthcare & Biotechnology Transformation.

Engineered Living Therapeutics (ELTs): From Importer to Innovator

The WEF identifies ELTs as one of the most disruptive biotechnologies on the horizon. By reprogramming microbes to produce drugs inside the human body, ELTs could reduce pharmaceutical manufacturing costs by up to 70%. They also promise more adaptive therapies for chronic diseases. Yet, the WEF flags significant concerns around biosafety, ethical oversight, and regulatory frameworks, making governance as important as science in determining their future.

ELTs are genetically modified microbes that produce therapies directly within the human body, reducing reliance on global pharmaceutical supply chains. For Saudi Arabia, this innovation strikes at the heart of Vision 2030's localisation agenda.

Today, Saudi Arabia imports the most advanced pharmaceuticals. ELTs offer a pathway to domestic production, regional export, and industrial biotech leadership. NEOM's biotech clusters and Riyadh's clinical trial ambitions can serve as hubs for ELT development.

ELTs represent a shift from pharmaceuticals as products to biological processes as infrastructure. For Saudi Arabia, the strategic opportunity lies in localisation: building clusters where biotech research, clinical trials, and data generation converge. But the Kingdom cannot afford to treat this purely as a healthcare matter; it is an industrial policy issue.

To succeed, ELTs must be embedded into fiscal frameworks, education strategies, and sovereign investment portfolios. The advisory caution is clear: global competition is fierce, and credibility will depend on regulatory legitimacy. If Saudi Arabia wants to be seen as a trusted originator of biotech, it must prioritise transparent trial governance, ethical oversight, and international recognition of its standards. Otherwise, it risks being a fast follower rather than a first mover.

GLP-1s for Neurodegenerative Disease: Addressing an Ageing Challenge

In Riyadh, collaborative sensing can transform urban mobility. The Riyadh Metro, one Repurposing GLP-1 receptor agonists for Alzheimer's and Parkinson's is described by the WEF as one of the decade's most transformative health opportunities. Originally developed for diabetes and obesity, these drugs are showing potential to modify the course of neurodegenerative disease. The report highlights their economic impact, dementia care costs run into trillions globally, but cautions that affordability, regulatory approval, and long-term trial results will shape their role.

For Saudi Arabia, facing a rising ageing population, this innovation offers both social and economic relief. By establishing Riyadh as a Centre of Excellence for Neuro-Health, the Kingdom could anchor clinical trials, attract pharmaceutical partners, and create domestic capacity in precision medicine.

The trialling of GLP-1s for Alzheimer's and Parkinson's is not only a medical opportunity but a societal resilience strategy. Saudi Arabia faces rising life expectancy and increasing chronic disease burden; the fiscal implications of institutional elderly care are vast. If the Kingdom positions itself as a hub for neuro-health research, it can shape global innovation cycles while reducing long-term healthcare liabilities.

The economics of these therapies will initially be prohibitive. Governments will need to design pricing, reimbursement, and incentive models that bridge the gap between high upfront costs and long-term savings. Moreover, success depends on integration into national health strategy: without trained neurologists, data infrastructure, and reimbursement pathways, breakthroughs will remain confined to clinical journals rather than everyday practice.

Autonomous Biochemical Sensing: Predictive Healthcare for the Kingdom

The WEF stresses the leap from single-use diagnostics to continuous, autonomous biochemical sensing as a cornerstone of predictive healthcare. Continuous monitoring of biomarkers could transform chronic disease management and environmental monitoring alike. Success, however, hinges on advances in sensor durability, data governance, and public trust. For global healthcare systems, this signals a move away from reactive treatment towards anticipatory care

Wearable and implantable devices that continuously monitor biomarkers can shift halthcare from reactive to preventive. For Saudi Arabia, the implications are vast.

Consider the Hajj and Umrah pilgrimages: real-time monitoring could detect infectious outbreaks before they spread. Women's health, a Vision 2030 priority, could be revolutionised by continuous monitoring of fertility and menopause. Integration into SEHA Virtual Hospital could extend predictive healthcare across rural communities.

The promise of continuous, predictive monitoring goes beyond healthcare. For Saudi Arabia, this is about population-scale resilience. During Hajj and Umrah, millions of pilgrims converge in close quarters, autonomous sensing could transform disease surveillance and crisis management. Equally, women's health monitoring could reinforce the Kingdom's inclusion agenda under Vision 2030. But with this promise comes risk: continuous monitoring produces vast amounts of sensitive biometric data.

Without globally credible governance frameworks for privacy, ethics, and cybersecurity, adoption will stall, and international trust will erode. Advisory perspective: the Kingdom should treat biochemical sensing as both a healthcare innovation and a data sovereignty project, embedding trust frameworks that ensure data is both protected and responsibly monetised.

Chapter 3:

Industrial & Environmental Innovation.

Green Nitrogen Fixation: Food Security at Scale

The report highlights green nitrogen fixation as a way to decarbonise one of the world's most emissions-intensive industrial processes: fertiliser production. By harnessing renewable energy for ammonia synthesis, this technology offers a path to food security without the carbon penalty. Pilot projects in Europe and Asia are progressing, but the WEF points to scalability, cost competitiveness, and resource alignment as key challenges

Agriculture is a critical vulnerability for Saudi Arabia, heavily reliant on imports. Green nitrogen fixation, converting atmospheric nitrogen into fertiliser with minimal carbon footprint, could transform Saudi agriculture. Applied in desert farming, mega-greenhouse projects, and regional food security hubs, this technology reduces import dependency and enhances sustainability.

Food security is a structural vulnerability for Saudi Arabia. Green nitrogen fixation could reduce dependency on imported fertilisers and align with sustainability commitments. But the opportunity is larger: to build the Kingdom into a regional fertiliser hub serving GCC, Africa, and Asia. Advisory insight: localisation here is not simply about technology adoption; it requires integrating agriculture policy, sovereign investment, and industrial strategy.

The risk lies in executing the scaling of production without undermining cost competitiveness. This is where targeted fiscal incentives and public–private partnerships become critical, ensuring production capacity grows in tandem with global market credibility. The Kingdom must resist the temptation to over-subsidise; the aim is not just self-sufficiency but export competitiveness.

Nanozymes: Industrial Efficiency and Environmental Remediation

Nanozymes, described in the WEF report as “lab-produced nanomaterials with enzyme-like properties,” offer more stability, scalability, and lower costs than natural enzymes. Their potential spans healthcare, petrochemicals, and environmental remediation. The report notes their ability to accelerate industrial processes but warns of early-stage IP concentration and the need for safety testing frameworks.

For Saudi Arabia, applications include petrochemicals, wastewater treatment, and environmental remediation. By localising nanozyme production, Saudi Arabia can reduce costs for its industrial base while creating export capacity to GCC and African markets.

Nanozymes could transform industries from petrochemicals to healthcare by providing low-cost, stable catalytic alternatives. For Saudi Arabia, this represents an opportunity to upgrade industrial processes while reducing environmental footprints. The advisory perspective is that Saudi firms should pursue nanozyme localisation not as standalone ventures but as embedded enhancements within existing sectors, such as petrochemicals, wastewater treatment, and environmental remediation. The strategic risk lies in intellectual property: most nanozyme breakthroughs are emerging from Asia and Europe.

If Saudi Arabia wishes to lead, it must invest early in licensing, joint ventures, and eventual IP generation, ensuring it is not locked into perpetual dependence. The challenge will be creating an industrial ecosystem where nanozymes are integrated into existing production chains, not developed in isolation.

Chapter 4:

Trust, Data & Digital Transformation.

Collaborative Sensing: Smart Cities and Beyond

The WEF frames collaborative sensing as the connective tissue of smart cities, where distributed sensors feed into AI-driven systems to monitor and manage urban life. Its promise lies in systemic efficiency from traffic to climate to security but governance challenges around data ownership, privacy, and bias are central risks. It represents not just a technological advance, but a societal trade-off between efficiency and individual rights.

Saudi Arabia is investing heavily in smart cities from NEOM to Riyadh's digital infrastructure. Collaborative sensing, where distributed sensors feed into AI-driven systems, is the backbone of these initiatives.

Applications range from traffic management and climate monitoring to logistics and national security. For the Kingdom, collaborative sensing is not just about efficiency; it is about positioning itself as a global benchmark for urban innovation.

Smart cities like NEOM and Riyadh depend on interconnected sensor networks. Collaborative sensing is less about individual devices and more about the trustworthiness of integrated data systems. For Saudi Arabia, the stakes are high: collaborative sensing underpins traffic, security, environmental monitoring, and energy management.

The advisory perspective is clear: the success of these systems will not be judged by their technical sophistication but by public trust and global credibility. Governance of data accuracy, algorithmic transparency, and system resilience will define whether Saudi Arabia becomes a global benchmark in urban digital infrastructure or risks scepticism over surveillance and privacy. The Kingdom must build regulatory and ethical frameworks in parallel with infrastructure to ensure adoption is inclusive and internationally respected.

Generative Watermarking: Safeguarding Digital Trust

As the WEF stresses, generative watermarking could be a cornerstone of digital trust in the AI era. By embedding invisible authenticity markers into text, audio, and visuals, it could combat misinformation and safeguard institutions. Yet, the report notes the challenge of interoperability, enforcement, and global adoption. Watermarking is less about technology maturity and more about international coordination and governance.

For Saudi Arabia, this innovation is particularly relevant in finance, government communication, and media. By adopting watermarking as part of its AI governance frameworks, the Kingdom can build trust in digital services and protect against reputational risks.

As Saudi Arabia digitises government services and expands its media and financial ecosystems, the risk of misinformation and AI-manipulated content grows. Generative watermarking offers a safeguard, embedding invisible authenticity markers into digital outputs. The advisory perspective: this is less a technical challenge than a governance imperative.

The Kingdom's credibility in digital trust will depend on whether watermarking becomes systematically embedded into regulatory regimes, from financial reporting to government communications. The risk lies in partial adoption, if watermarking is used selectively, trust gaps remain. The strategic play is to position Saudi Arabia not merely as a user but as a standard-setter for digital authenticity in emerging markets, exporting governance frameworks as much as technology.

The WEF concludes that scaling these technologies requires more than science; it depends on ecosystem readiness across policy, finance, talent, and culture. It highlights the need for regulatory sandboxes, sovereign investment, and public engagement. The core finding is that the nations that win will not be those who invent first, but those who orchestrate trustworthy, adaptable ecosystems that allow technologies to move from pilot to mainstream.

Chapter 5:

Grant Thornton Perspectives: Enabling Vision 2030 through Emerging Tech.

The common thread across these technologies is that none can succeed in isolation. Saudi Arabia will need to orchestrate three systemic enablers:

1. Sovereign Wealth Fund Catalysis

   PIF and Sanabil must operate not just as financiers but as conveners of ecosystems bringing together global technology firms, local regulators, and academic partners into structured clusters.

2. Regulatory Innovation

   The Kingdom must establish globally benchmarked frameworks that make Saudi Arabia a preferred jurisdiction for piloting, scaling, and exporting frontier technologies. Without recognised legitimacy, capital and talent will not flow.

3. Knowledge Ecosystem Development

   Long-term success depends on embedding innovation within talent pipelines, research institutions, and knowledge transfer structures. Without this, Saudi Arabia risks building projects without people, infrastructure, and intellectual capital.

Saudi Arabia's true opportunity lies not just in adopting technologies, but in shaping the global rules and ecosystems that govern them. Vision 2030 is therefore less about domestic transformation and more about positioning the Kingdom as a standard-setter in the industries of the future.

From Adoption to Global Leadership

Saudi Arabia stands at a unique convergence moment. The alignment of Vision 2030's ambition, sovereign wealth fund capacity, giga-project scale, and regulatory reform provides the foundation for global leadership in emerging technologies.

The WEF's top ten innovations are not distant possibilities; they are actionable opportunities. If pursued strategically, Saudi Arabia will not only integrate them but also set global standards for their deployment.

From energy to healthcare, from digital trust to food security, the Kingdom has the chance to shift the global narrative from being a consumer at the end of the value chain to a producer, regulator, and exporter shaping the frontiers of innovation.

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