In collaboration with Centre for the Fourth Industrial Revolution Saudi Arabia

WORLD ECONOMIC FORUM

Deployment Pathways for Advanced Air Mobility: Lessons from Early Implementation in Saudi Arabia

WHITE PAPER

OCTOBER 2025

Images: Getty Images, Unsplash

Contents

Foreword

Arunima Sarkar
Head of Frontier Technologies,
World Economic Forum

Basma AlBuhairan
Managing Director,
Centre for the Fourth Industrial Revolution Saudi Arabia

Advanced Air Mobility (AAM) is no longer a future vision. It is a reality that is being driven by demand for faster, cleaner mobility and advances in propulsion systems and autonomy. For Saudi Arabia, this transformation represents more than a technological shift: it is a strategic opportunity to advance the goals of the country's Vision 2030 development programme.

Through giga-projects and a regulatory mindset open to real-world testing, the Kingdom is putting in place the groundwork to ensure that Advanced Air Mobility matters globally. Early demonstrations, from medical drone logistics during Hajj to autonomous aerial surveying in the energy sector, illustrate the potential of these technologies to deliver tangible public benefits, validate operational readiness and build trust among regulators and communities.

This paper, developed by the Centre for the Fourth Industrial Revolution Saudi Arabia, in collaboration with the World Economic Forum and the Centre for the Fourth Industrial Revolution Saudi Arabia network stakeholders, captures insights from these early steps and translates them into pathways for deployment. Its purpose is to document progress, as well as to create a dialogue, share lessons learned and help shape a coherent operational model that will allow AAM to advance responsibly, build trust and deliver sustained public benefit.

The journey ahead requires partnership and collaboration in addition to a willingness to innovate. By aligning ambition with coordinated action, Saudi Arabia can convert its early leadership into lasting influence and set a benchmark for how ambition can be translated into readiness and real-world impact.

Executive summary

Early AAM successes highlight the potential, but scaling the industry will require shared learning, seamless coordination and inclusive collaboration.

Saudi Arabia is beginning to define its role in the future of Advanced Air Mobility (AAM). Around the world, AAM is moving rapidly from concept to implementation, and Saudi Arabia has unique advantages that enable it to experiment at scale: purpose-built giga-projects,[1] vast low-density airspace and proactive regulators. But early progress will only translate into lasting impact if fragmented efforts are aligned into a coherent operational model.

This paper provides a forward-looking framework for that transition. Drawing on community workshops, stakeholder interviews and lessons from early-stage implementation, it highlights how AAM in Saudi Arabia can move beyond isolated pilots to system-wide readiness. The paper reveals that the barriers to adoption are less about technology and more about coordination, including isolated operations and limited mechanisms to share learnings or align incentives.

To address this, the paper proposes a neutral, community-led collaboration model. Rather than creating new layers of regulation or duplicating infrastructure, this model emphasizes:

– Capturing and codifying learnings from early deployments in a form that is repeatable and accessible to all actors

– Facilitating collaboration through shared templates, shared knowledge, resource-matching and anonymized data exchange under clear governance

– Aligning commercial incentives with national priorities, ensuring that even smaller players can contribute to and benefit from network growth

Precedents from sectors such as offshore wind and agritech, for example, demonstrate the power of community-led frameworks to accelerate industry maturity while safeguarding competitive interests. Applying these lessons to AAM could help consolidate early success efforts and set a reference point for other emerging markets.

Now, Saudi Arabia can convert its early pilots into a solid global position by embedding collaboration and learning into the operational fabric of AAM. The cost of inaction, however, is a fragmented network in which valuable knowledge remains isolated and forward momentum stalls. This paper, therefore, calls for stakeholders to act now – by embracing coordination, codifying operational insights and institutionalizing continuous knowledge-sharing – to ensure that Saudi Arabia achieves Vision 2030's mobility ambitions.

Introduction

From initiatives to actions to impact, Saudi Arabia is building an AAM network that advances its Vision 2030 ambitions.

Advanced Air Mobility (AAM) is evolving quickly from an experimental concept to having real-world applications. Enabled by electric propulsion, vertical take-off and landing systems and digital airspace management, among other innovations, AAM offers new alternatives for transporting people and goods. According to the IMARC Group, as of 2024, the global AAM market size was valued at $9.9 billion, with estimates that the market will reach $77.03 billion by 2033, reflecting a compounded annual growth rate (CAGR) of 23.6% from 2025 to 2033.[2]

As momentum continues to build, many countries are incorporating AAM into their national transportation and innovation strategies. For example, five leading aviation regulators (Australia, Canada, New Zealand, the United Kingdom and the United States) are collaborating on a shared roadmap for the efficient certification of AAM aircraft.[3] In the context of Saudi Arabia, AAM provides a strategic opportunity to strengthen transportation systems and drive economic diversification, directly supporting the goals of Vision 2030 to build a thriving economy, enhance quality of life and position the Kingdom as a global hub for innovation.[4]

Saudi Arabia is shaping its own AAM network through practical, early-stage use cases. These efforts are designed to clarify regulatory priorities, test operational feasibility and demonstrate tangible public value, and, in doing so, lay the foundations for advancing adoption. This paper has the following prime objectives:

- Articulate the strategic factors that uniquely position Saudi Arabia as a frontrunner in AAM adoption
- Demonstrate how early use cases are already delivering tangible impact across key sectors
- Extract achievable enablers and insights to support a national rollout and industry growth

Strategic national foundations for AAM implementation in Saudi Arabia

Saudi Arabia's rapid urbanization, expanding population and ambitious tourism and logistics plans under Vision 2030[5,6,7,8] are creating new mobility demands that could benefit from novel modes of transport. AAM offers a potential solution, enabling faster, more sustainable connectivity across cities, industrial hubs and giga-projects. If successfully deployed, AAM could generate up to $38 billion in economic opportunities by 2040, spanning infrastructure, manufacturing, air traffic management and operations.[9] To capture this potential, the General Authority of Civil Aviation (GACA) has developed a dedicated AAM roadmap[10] in collaboration with leading stakeholders, including regulators, original equipment manufacturers (OEMs), infrastructure developers, academic institutions and prospective operators.

The roadmap outlines a set of national enablers spanning regulation, infrastructure technology and cross-sector collaboration that provide the strategic foundations needed to move from ambition to deployment-ready mobility. These enablers ensure that early pilot projects can generate real-world lessons and, critically, be scaled into investable and sustainable AAM services.

Together, these developments prepare Saudi Arabia for operational deployment and align directly with the broader aspiration of Vision 2030. Figure 1 highlights the pivotal role of GACA in shaping initiatives (under the roadmap), illustrating their impacts and alignment with Vision 2030 pillars.

FIGURE 1 | **Advanced Air Mobility initiatives under the GACA roadmap**

GACA

Initiatives led by GACA	Impact	Vision 2030 targets alignment
Demonstrated pilots – Passenger eVTOL for hard-to-reach or underserved areas – Medical transport trials during Hajj **Public engagements** – Public accessibility studies and pilot engagement to build trust	– Enhances personal and logistical connectivity through new transport modes – Improves emergency response – Boosts mobility equity – Supports environmental goals	**A vibrant society** – Quality of life – Connectivity – Sustainability
Strategic partnerships – Vertiport and UAV production partnerships **Localization initiative** – Domestic manufacturing capacity and talent development programmes	– Promotes foreign direct investment – Builds domestic industry – Employs giga-projects for economic growth	**A thriving economy** – Non-oil GDP – Foreign direct investment – Localization
Policy and regulation – GACA's phased regulatory roadmap **Global diplomacy** – International memorandums of understanding with FAA, EASA, Singapore and others for standard-setting and regulatory alignment – Structured trade missions cultivating foreign partnerships and regulatory diplomacy	– Demonstrates leadership in regulatory innovation – Positions Saudi Arabia as regional AAM hub – Builds institutional credibility	**An ambitious nation** – Governance – Global position – Institutional modernity

Sources: Federal Aviation Administration,[11] Vision 2030 (Government of Saudi Arabia),[12,13,14,15] General Authority of Civil Aviation[16]

Geographical and institutional advantages supporting Vision 2030-aligned developments

While Figure 1 highlights how Saudi Arabia's AAM initiatives directly align with Vision 2030 pillars, these efforts are supported by a set of structural enablers, which facilitate conditions for moving from vision to operational readiness. Together, they make it possible to translate strategic initiatives into tangible, investable deployment efforts. The three main structural enablers for Saudi Arabia are as follows:

1. **Giga-projects as testbeds**

Saudi Arabia's flagship developments – including, for example, NEOM and the Red Sea Project – are purpose-built, next-generation cities designed with advanced mobility in mind. These projects offer a clean slate for integrating AAM from the ground up. Unlike dense urban environments that must retrofit new infrastructure, these giga-projects can embed vertiports, drone corridors and other required infrastructure directly in their master plans. This reduces the friction of implementation and creates opportunities to test and integrate AAM solutions in real-world environments. Moreover, because these sites currently have minimal residential populations, multiple trials can be conducted with very low risk.

2. **Low-density airspace**

Saudi Arabia possesses vast underused airspace, particularly around its giga-project zones and industrial clusters such as Rabigh, King Abdullah Economic City (KAEC) and Jazan, to name a few. These are emerging economic and logistical clusters with real potential operational demand. These environments are especially valuable for enabling beyond visual line of sight (BVLOS) operations (see Box 1). This geographical advantage allows for the designation of expansive testing corridors without interfering with commercial air traffic or densely populated areas. Such environments are especially valuable for regulators and operators to advance expertise in complex operations through controlled experimentation in areas that matter. Specific testing environments include:

- Gated, master-planned zones or managed operational areas that offer managed airspace and integrated infrastructure, enabling safer trials. Examples of this could include the Red Sea Project, Roshan gated communities and the Holy Sites in Makkah and Medinah, among others.

- Hub-to-hub corridors between ports, logistics hubs and/or healthcare clusters are well suited for mid-mile drone delivery, minimizing urban navigation and regulatory friction.

- Designated demonstration areas provide an opportunity to build public awareness, gather feedback and allow regulators to observe operations in action.

3. **Regulatory enablement**

Saudi Arabia is implementing a phased and use case-driven regulatory approach that allows for controlled testing while maintaining aviation safety standards[17] under the GACA Part 107 framework (see Box 1). What differentiates it from other jurisdictions is the way regulatory efforts are being linked to Vision 2030 priorities and giga-projects (as demonstrated in Figure 1), where advanced mobility is built into long-term planning. GACA has also signed international cooperation agreements with authorities such as the European Aviation Safety Agency (EASA) and Federal Aviation Administration (FAA), ensuring that Saudi regulations remain aligned with global practices while positioning the Kingdom as an early mover in the region.

BOX 1

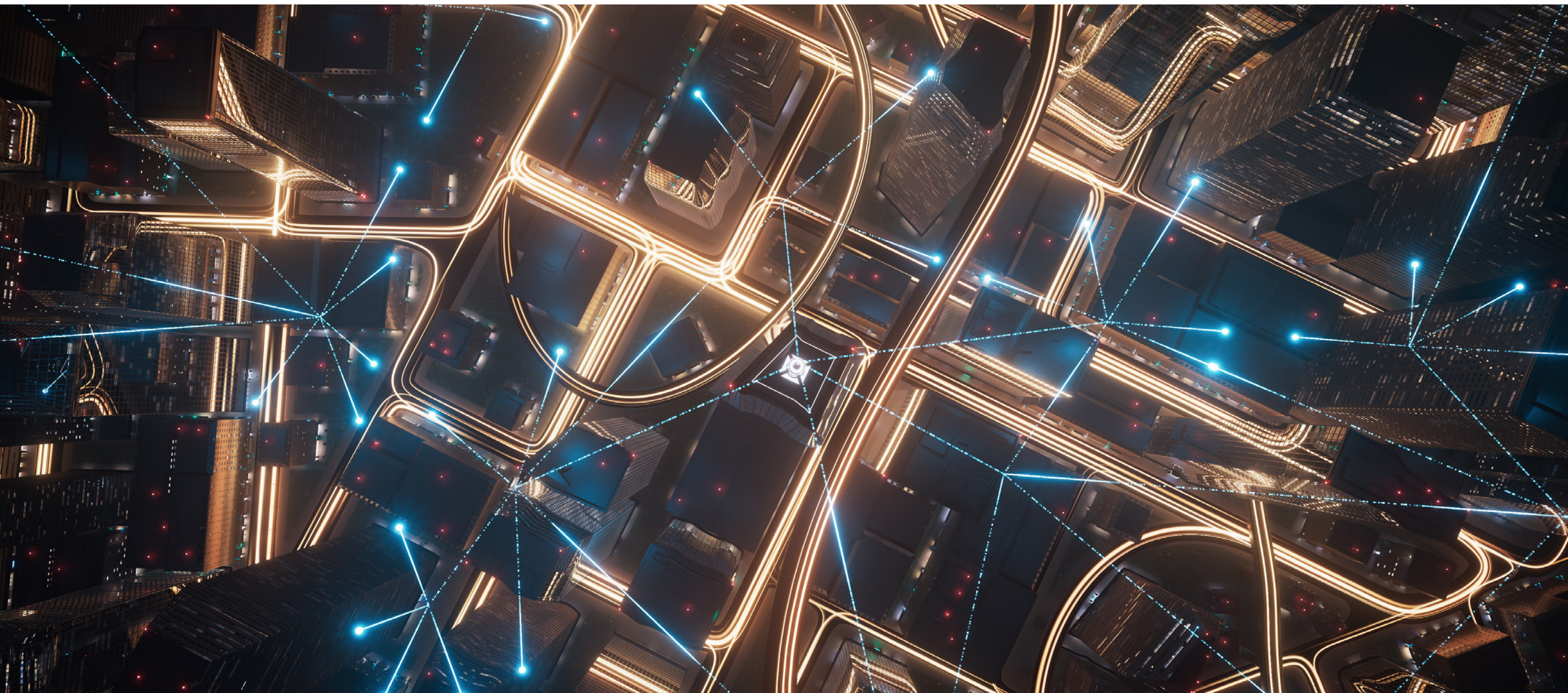
BVLOS under GACA Part 107

BVLOS operations are a critical step for scaling mid-mile cargo delivery and autonomous missions. Unlike visual line of sight (VLS) flights, BVLOS allows drones to cover meaningful distances and connect real economic clusters. Unlocking BVLOS requires advanced safety assurance, reliable communications and robust regulatory approvals, which are barriers difficult to overcome in high-traffic airspaces. Saudi Arabia's low-density skies lower these barriers, offering a conducive environment to test and validate BVLOS while linking real points of demand, such as NEOM, with major distribution hubs.

In Saudi Arabia, BVLOS operations fall under the Specific Category of GACA's Part 107 regulations. Unlike the Open Category, which only covers low-risk flights under strict limitations, BVLOS is not permitted by default. Instead, operators must obtain an operational authorization (OA) or a UAS operator certificate (UOC), supported by a detailed operational risk assessment (ORA) that demonstrates how risks will be managed.

When BVLOS flights rely on segregated or temporary corridors, additional approval from local air traffic control (ATC) is required before GACA can issue authorization. Because standard scenarios for BVLOS have not yet been published, every approval is considered case by case, requiring close coordination between operators and regulators. This careful, phased approach functions as a regulatory sandbox, allowing innovation in BVLOS while maintain high levels of safety and oversight.

Source: General Authority for Civil Aviation[18]



1

Practical use cases for early AAM deployment in Saudi Arabia

From medical logistics to environmental monitoring, early AAM use cases deliver on ambitious goals, shaping Saudi Arabia's ecosystem.

With these foundational elements in place, Saudi Arabia has positioned itself to move from strategic alignment to practical implementation. Around the world, early AAM deployments have shown that success depends on solving tangible problems and delivering clear public benefits. This is supported by findings from the EASA,[19] for example, which has found that social acceptance is a vital driver of success, and that acceptance increases significantly when deployments visibly address real-world needs and improve quality of life. This global insight reinforces stakeholder inputs from Saudi Arabia, who emphasized that successful early use cases must start where:

- Public benefits are prioritized
- Stakes are high, but the risks are manageable
- Regulations are taking shape in ways that allow room for innovation
- Models are repeatable, enabling pilots to be replicated across regions with minimal adjustments

1.1 Emerging use cases and sector opportunities

Based on workshop insights and stakeholder interviews, four types of missions consistently emerged as promising near-term opportunities (see Table 1). These missions are not ends in themselves; they are bridges to regulatory maturity, public confidence and market readiness. They are likely to earn public trust by demonstrating immediate benefits (such as emergency response or ecological protection). Furthermore, they focus on use cases that require less complex infrastructure and certification than passenger transport use cases. They can be tested in low-density environments (such as NEOM or the Red Sea Project) with limited airspace or ground conflict.

TABLE 1 **Early AAM use cases aligning with key attributes**

Use case	Public benefit first *Solve a real problem for people, such as improving health, safety or access*	Low complexity, low risk *Start with missions that are simple to operate and safe to implement*	Regulatory readiness *Select areas where regulators can engage constructively and build on existing rules*	Scalable and repeatable *Choose models that can be replicated across regions with minimal adjustments*
Medical and emergency logistics	Improves health access and emergency response in hard-to-reach areas	Operates in controlled environments (e.g. Hajj zones)	Backed by initial pilots and regulator interest	Replicable across healthcare hubs and rural regions
Mid-mile parcel delivery	Improves logistics efficiency and customer experience	Avoids ground congestion by using aerial corridors	Supported by BVLOS corridor planning and agency backing	Applicable across e-commerce (serving business-to-business and business-to-consumer needs) and industrial zones
Infrastructure inspection	Enhances public and operator safety and operational efficiency of critical infrastructure	Conducts routine missions in isolated or fenced zones	Recognized by regulators familiar with inspection missions	Transferable to sectors such as energy, utilities and roads
Environmental monitoring	Supports conservation and disaster response efforts	Operates in low-population biodiversity areas	Employs growing regulatory acceptance for ecological monitoring	Adaptable to diverse environments (e.g. coasts, forests)

Source: Centre for the Fourth Industrial Revolution Saudi Arabia.

1.2 Use case attributes in practice

While Table 1 outlines the attributes of promising early use cases, these principles are clearer when examined in practice. The following examples from Saudi Arabia demonstrate how pilot projects are already delivering benefits, operating in manageable environments, gaining regulatory support and establishing repeatable models for future scaling.

CASE STUDY 1

Blood transport by drones during the Hajj season 1444 AH (June–July 2023)

Lead entities: Ministry of Health (MoH), Saudi Post SPL, iot squared and Prince Sultan University

Context: Hajj is one of the world's largest annual mass gatherings, bringing millions of pilgrims to Makkah over a short period. The event places pressure on healthcare logistics, where timely access to medicines and equipment is critical but often constrained by congestion and security protocols.

Description: During the Hajj season 1444 AH, SPL, in collaboration with the Saudi Ministry of Health, iot squared and Prince Sultan University, conducted the first ever proof-of-concept (POC) in Saudi Arabia for transporting blood units using drones at Hajj. This pioneering POC paved the way for future drone-enabled logistics operations in sensitive and high-demand environments across the Kingdom.

Temporary hospitals in Mina during Hajj season face significant mobility challenges once pilgrims settle into their accommodation, with medical teams experiencing delays in moving between sites. To address this, drones were deployed to transport blood units and plasma between Mina Emergency Hospital and Mina Al-Share'a Al-Jadeed Hospital. Over two days, 10 trial flights were conducted including both dummy samples and actual prepared blood units. The results demonstrated a dramatic reduction in transport time, from the traditional 2.5–4 hours on the ground to just two minutes by drone.

This initiative, the first of its kind in Saudi Arabia, supports both the Health Sector Transformation Program and the Pilgrim Experience Program under Vision 2030. It demonstrates how drone technologies can enhance healthcare responsiveness, improve medical logistics and ensure the safety and well-being of pilgrims in highly congested and time-sensitive environments.

Operations and technology: Rotary-wing drones, predefined mission zones, standardized emergency protocols, integration into controlled pilgrimage airspace, phased approval process.

Impact and success factors:

1. Public benefits were clear: faster delivery improved emergency responsiveness.

2. Operations were phased in controlled, high-stakes zones under regulatory oversight including the MoH and GACA. They demonstrated how integrated unmanned aircraft system traffic management (UTM) systems can enable drone ops in complex, high-density environments.

3. The mission demonstrated regulatory flexibility, showing how approvals can adapt to temporary, complex environments. It also involved oversight from multiple agencies.

4. The initiative establishes a repeatable operational template for healthcare logistics in other high-demand events, such as **Riyadh Season** and upcoming major global events such as the **2029 Asian Winter Games, Riyadh Expo 2030** and the **2034 FIFA World Cup**.

UAV parcel delivery

Sources: Ministry of Health, SPL, iot squared and Prince Sultan University

CASE STUDY 2

Autonomous seismic acquisition device (ASAD) – UAVs for near-surface surveying and characterization

Lead entity: Saudi Aramco's EXPEC Advanced Research Center

Context: Seismic data acquisition in remote and harsh terrain is costly due to the time-consuming and resource-intensive effort required to navigate such hazardous environments. Through automation and robotization, Aramco were able to reduce manual labour in the field and limit exposure to field hazards.[20]

Description: Aramco researchers developed an autonomous robotic system using a swarm of UAVs equipped with seismic sensors to support exploration efforts. Missions were conducted in challenging environments such as deserts to demonstrate technology during various development phases. This showcased the performance enhancement in comparison to ground-cabled systems, delivering precise placement of sensors with efficient UAV swarm deployment.

Operations and technology: The system consists of 20 UAVs that were custom made with on-board seismic sensor and digitizing units. It is operated by an autonomous navigation system built on swarm robotic technology to enable swarm communication and adjustment of flight plans in the event of any unit failures and programmed with internal fail-safe measures for faulty UAVs to safely return home and/or perform emergency landings.

Impact and success factors:

1. Public benefit in reducing the environmental footprint of exploration efforts, minimizing disruption to suburban structures and farms while improving efficiency in a vital national industry.

2. Missions took place in remote, low-risk zones.

3. The project validated UAV-based surveying within a framework familiar to regulators.

4. The approach demonstrated scalability and repeatability, offering a transferable model for multi-vehicle coordination relevant to future AAM operations.

Aramco EXPEC ARC deploys autonomous UAS swarm for near-surface seismic surveying to assist in data acquisition

Sources: Aramco EXPEC ARC; Timoshenko, A., et al.[21]

CASE STUDY 3

Drone usage to monitor critical afforestation/reforestation activities with Gharsa

Lead entity: FalconViz

Context: Saudi Arabia has embarked on one of the most ambitious environmental programmes in the world under Vision 2030, the Saudi Green Initiative and the Kingdom's commitment to net zero by 2060. Central to these programmes is large-scale afforestation and reforestation, with the goal of 10 billion native trees being planted across inland ecosystems. Monitoring the survival, health and distribution of these trees is mission-critical to ensuring success. Traditional monitoring approaches are costly, slow and resource-intensive, making them unsuitable for repeated, high-frequency monitoring across vast geographical areas.

Description: FalconViz developed Gharsa.AI, an advanced drone-powered AI monitoring platform designed specifically to track afforestation and reforestation efforts. Gharsa integrates drone-mounted multispectral and LiDAR sensors with AI-powered analytics to measure vegetation health, canopy density, soil moisture indices and survival rates of newly planted trees. This solution has already been successfully deployed in national-level projects, providing repeatable and scalable monitoring that ensures decision-makers receive accurate insights into the progress of green initiatives.

To achieve reliable results, drone flights must be repeated frequently over the same afforestation zones, generating consistent time-series data. This is where streamlined AAM regulations and permissions are critical. With more flexible and adaptive permitting processes, Gharsa operations could be scaled rapidly, ensuring real-time data delivery to stakeholders and enabling corrective interventions when needed.

Operations and technology: Drone-based (VTOL drones) multispectral and LiDAR capture (normalized difference vegetation index [NDVI], soil-adjusted vegetation index [SAVI], optimized soil-adjusted vegetation index [OSAVI], canopy density, elevation models). AI-powered feature extraction and growth trend analysis; standardized mission zones with repeated flight corridors over reforestation sites; integration with government dashboards to support Vision 2030, Saudi Green Initiative and net zero 2060 KPIs for reforestation and net-zero tracking.

Impact and success factors:

1. Public benefit is clear: Gharsa provides essential insights into the Kingdom's green commitments, ensuring public and international trust in Saudi Arabia's climate leadership.
2. Operations are in controlled, critical zones: flights are repeatable over designated reforestation areas, making them ideal for regulatory adaptation under AAM frameworks.
3. The mission demonstrates regulatory flexibility needs: highlighting how streamlined approvals for repeat flights in the same zones can accelerate environmental monitoring of critical national interest.
4. The initiative establishes a repeatable operational template: providing a scalable model for how drones and AAM technologies can be embedded in national environmental programmes, ensuring accountability and supporting long-term sustainability goals.

Taken together, these early use cases illustrate how Saudi Arabia can move from ambition to implementation. By focusing on public benefit, manageable risks, regulatory engagement and repeatability, they provide the building blocks for scaling AAM adoption. Section 2 turns from early use cases to the broader system-level enablers.

Without these, promising pilots risk remaining isolated demonstrations; with them, Saudi Arabia can evolve from performing scattered tests into a mature AAM sector that delivers repeatable services, stakeholder confidence and impacts aligned with Vision 2030.

2 Enabling system-level readiness for AAM

Saudi Arabia's early AAM pilots highlight opportunities to employ coordination and shared learning for future system development.

Transitioning from pilot project to real-world operations demands more than technical feasibility; it requires clear regulatory pathways, coordinated planning and strong multistakeholder collaboration. While early pilots have validated the potential of AAM technologies in controlled environments, the next phase requires focus on building the system enablers that allow deployments to advance across sectors. The successful deployment of medical logistics during Hajj, for example, demonstrates the Kingdom's readiness to apply the strategic ambitions articulated earlier in this paper.

2.1 From pilots to system readiness: A systematic approach

Building on the contextual enablers and early use cases outlined in the Section 1, this section offers an operational pathway to translate strategic ambition into systematic readiness. Specifically, it addresses two essential components:

– Solving operational challenges: providing achievable responses to the recurring issues that emerge during real-world deployment, from airspace management and airspace conflicts to maintenance and safety protocols

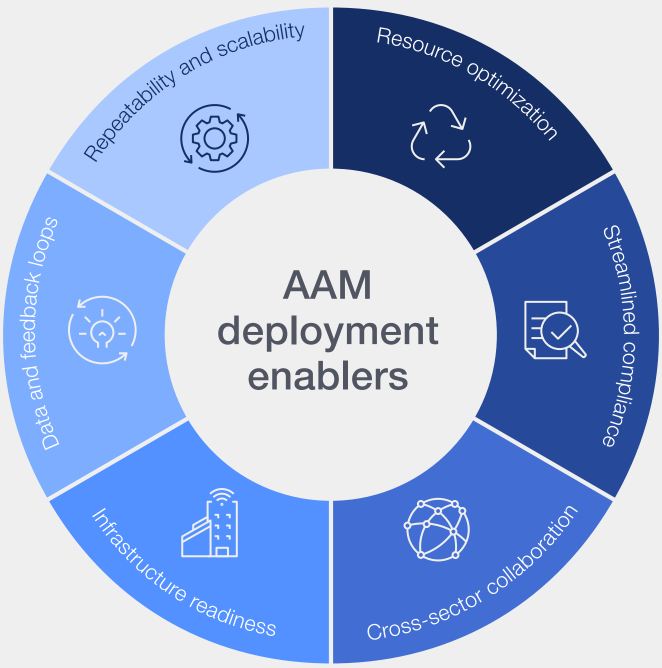
– Institutionalizing peer learning and coordination: creating informal, cross-actor collaboration mechanisms that enable network-wide learning and transparent communication, which complement formal regulatory pathways

Together, these approaches offer a practical bridge between Saudi Arabia's strategic potential, its early testing grounds and the system that needs to be in place to move towards commercial AAM deployment.

2.2 Deployment enablers: Making the system work

Six interdependent enablers were repeatedly identified through stakeholder interviews and community workshops, including experts among operators, academics, manufacturers and public-sector workers, as crucial to effective AAM deployment. As shown in Figure 2, these enablers form a reinforcing cycle, where progress in each domain helps unlock improvement in the others, accelerating the shift from isolated pilots to sector-wide, scalable operations.

FIGURE 2 **Six interdependent operational enablers to achieve effective AAM deployment**



Resource optimization
Streamlining workflows and removing redundancies allows operational teams to maximize both time and talent, directly reducing operational friction and bottlenecks

Streamlined compliance
Clear regulatory frameworks and practical approval pathways help teams swiftly meet field requirements, ensuring operations remain grounded and well-governed

Cross-sector collaboration
Mechanisms to foster collaboration and reduce misalignment, enabling the pooling of insights and resources from diverse teams, including manufacturers, start-ups and public-sector partners

Infrastructure readiness
Upgrading both physical and digital infrastructure ensures reliable, efficient AAM operations by removing logistical obstacles and boosting resilience

Data and feedback loops
Continuous operational learning underpins improvement; structured reviews and lessons gleaned from pilots are formalized into repeatable guidance and planning tools

Repeatability and scalability
Proven operational models become templates for expanding from demonstration projects to industry-wide best practices, supporting safe and efficient large-scale deployments

Source: Centre for the Fourth Industrial Revolution Saudi Arabia

AAM deployment enablers work together as a cycle: streamlining resources and compliance helps operations run smoothly, while strong collaboration and infrastructure give teams what they need to perform reliably. Data and feedback loops drive improvement, and the sharing of clear documentation about what works lets everyone, from start-ups to operators, learn and scale more quickly. That way, lessons from successful pilots become standard tools and checklists everyone can use, turning isolated wins into repeatable, trusted industry practices.

The Saudi Data and Artificial Intelligence Authority's (SDAIA) AI registry offers a model for how shared documentation and standards can support AAM. By maintaining centralized and trusted records, such as approved mission profiles and checklists, SDAIA's approach could help ensure that best practices and compliance requirements are clearly defined and accessible. Linking the six enablers to such a system means that lessons, tools and standards from successful AAM operations are not isolated; they are brought together and reused across teams, promoting consistent, safe and scalable growth in the industry.

The SDAIA's AI registry is a national platform managed by the Saudi Data and Artificial Intelligence Authority to register AI systems developed, deployed or used in Saudi Arabia. It maintains an inventory of approved solutions, ensures compliance with national AI ethics and data protection requirements and provides a governance mechanism that encourages transparency and trust. While designed for AI, its registry model could be adapted for AAM to maintain a centralized record of, for example, approved mission profiles, checklists and operational templates.

2.3 Spearheading learning: AAM community-led collaboration model

While deployment enablers play a crucial role, Saudi Arabia's emerging AAM network faces several persistent challenges, including stakeholder fragmentation, underused capacity, limited visibility for smaller, innovative players and isolated operational insights in individual projects. These barriers delay network readiness and limit the potential for AAM to expand into new use cases and markets. One way to identify and address some of these challenges is by creating synergy among network players by sharing precompetitive learnings that can support the industry as a whole. Box 2 highlights some lessons from peer-led collaborations in other sectors. Overall benefits include:

- Reduces fragmentation across stakeholders
- Reduces duplication and unlocks underused resources
- Increases trust, transparency and market access
- Accelerates growth of the entire network

BOX 2 Lessons from peer-led collaborations across sectors

The AAM network is not alone in facing fragmentation and scaling hurdles. Lessons from other industries highlight how peer-led coordination can accelerate maturity.

Example 1: **Drone industry – Global Unmanned Traffic Management Association (GUTMA)**

- **Challenge:** Competing manufacturers and service providers were building proprietary interfaces, threatening interoperability and slowing UTM adoption
- **Approach:** Created a neutral consortium that facilitates working groups and task forces to co-develop standards and operational roadmaps
- **Impact:** Enabled cross-provider data exchange, allowed small and medium-sized enterprises (SMEs) to integrate with national UTM trials and established a foundation for global standards

Example 2: **Offshore wind – Offshore Renewable Energy (ORE) Catapult**

- **Challenge:** Subsea cable failures were common and costly, but developers were reluctant to share data due to competitive sensitivities
- **Approach:** Facilitated anonymized, aggregated data-sharing on failures through a trusted innovation centre
- **Impact:** Provided sector-wide benchmarking, reduced repeat failures and accelerated learning curves for new entrants, lowering operational risk across the industry

Example 3: **Agritech – AgGateway**

- **Challenge:** Farmers and agritech providers were facing fragmented data standards, making it hard to integrate tools and limiting market access for SMEs
- **Approach:** Coordinated members to jointly create open data exchange standards for agriculture
- **Impact:** Improved industry-wide improvements in cost efficiency, inventory traceability and operational interoperability across tools; also resulted in the release of a unified, syntactic open-data standard created collaboratively by multiple stakeholders that facilitates smoother data integration across platforms

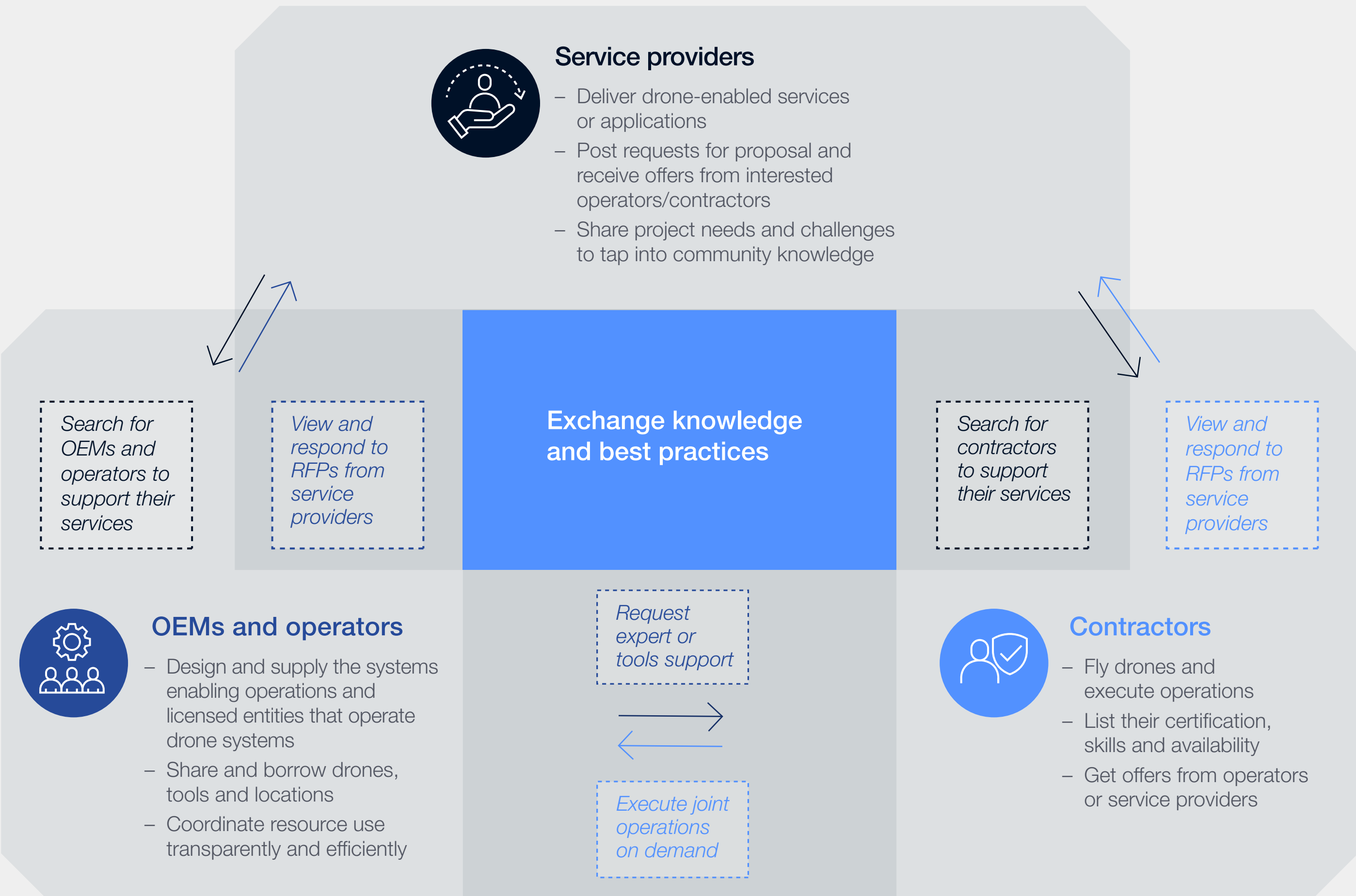
These collaboration models demonstrate that competitors can share non-sensitive, anonymized insights under clear governance to raise baseline performance without eroding competitive advantage. Like offshore wind, AAM is at an early stage but scaling quickly, and many players resemble cleantech start-ups – small, resource-constrained and in need of visibility. Like GUTMA and AgGateway, the sector will require shared operational frameworks and interoperability to achieve growth.

Sources: GUTMA,[22] ORE,[23] AgGateway[24]

Building on these insights, Figure 3 proposes a shared model for a neutral, structured collaboration model that connects service providers, operators and contractors in the AAM field in order to:

- Share non-sensitive, anonymized, aggregated insights and generic operational templates
- Signal current and emerging operational needs
- Access and contribute to a shared knowledge base of templates, tools and methodologies

FIGURE 3 **AAM collaboration model: A neutral platform linking providers, operators and contractors to share best practices and spearhead innovation**



Source: Centre for the Fourth Industrial Revolution Saudi Arabia

Should such a platform be created, it would best be governed by a neutral host, such as an industry association, academic partner or public–private coordination body. It would require clear participation parameters defining:

– **What can be shared:** Clearly defined categories for non-sensitive information stripped of any company-specific or commercially sensitive details

– **How contributions are validated before distribution:** A review process, managed by the platform's neutral host, to verify that submissions are reliable, accurate and relevant, and conform to agreed formats to ensure that all shared materials are high-quality, usable by others and do not contain proprietary or confidential content

– **How confidentiality and competitive interests are safeguarded:** Strict governance measures, including data anonymization, aggregation and controlled access protocols, to prevent disclosure of competitive strategies, unique technological methods or commercially sensitive business information

An effective collaboration model that ensures alignment with national priorities could be strengthened by aligning commercial incentives with national mobility priorities. Figure 3 highlights how different stakeholders would benefit from such collaboration. For example, service providers benefit from lower transaction costs and better access to qualified operators; operators improve use of their fleets by tapping into pooled demand signals; contractors increase their visibility in the market and gain access to a wider range of jobs.

While a shared collaborative operational model can help overcome fragmentation, several limiting factors and risks need to be acknowledged, should such a collaborative model be implemented:

1. **Stakeholder engagement uncertainty:** The model depends on active participation from operators, OEMs, regulators and service providers. If stakeholders do not perceive clear value (or see sharing as a distraction from core business) participation will remain low.

2. **Sensitivity of data:** Even with anonymization, some players may fear that sharing operational templates or aggregated insights could expose competitive advantage or strategic priorities, which limits the scope and effectiveness of contributions.

3. **Trust in data quality:** Without a robust validation and review mechanism, stakeholders may question accuracy, relevancy and/or applicability.

4. **Neutrality challenges:** Selecting and sustaining a truly neutral host organization can be difficult. Governance must be carefully designed to avoid perceptions of bias.

5. **Replication limits:** While lessons from offshore wind and agritech are instructive, the specific safety, regulatory and airspace constraints in aviation make direct replication more complex.

Ultimately, unlocking these enablers requires more than ad hoc collaboration. It calls for a structured mechanism that consolidates knowledge, aligns incentives and ensures that the network grows inclusively.

Conclusion

From isolated pilots to system-wide readiness, Saudi Arabia can convert early AAM leadership into lasting global influence.

Saudi Arabia's trajectory for AAM is entering a decisive stage. With giga-projects designed for next-generation transport, expansive low-density airspace and a regulatory approach that encourages purposeful testing, the Kingdom of Saudi Arabia is in a position to shape a globally relevant AAM model. Early deployments, from medical drone logistics during Hajj to Aramco's autonomous seismic surveying swarms, have already demonstrated how targeted missions can generate public benefit, validate technical readiness and build confidence among regulators and operators. The central challenge now is turning these individual successes into a coherent operational model that can scale. This requires more than additional pilots; it calls for a framework that:

- Employs early operational insights to guide sector-wide practices
- Connects diverse actors (from SMEs to giga-project operators) in a coordinated value chain
- Aligns commercial incentives with national mobility objectives

Without stronger collaboration across the network, there would be a missed opportunity to convert early leadership into lasting sector-wide influence. While the Kingdom's forward-thinking regulatory efforts have laid the groundwork for innovation and learning, there is a need for a robust system to capture and share operational insights. As highlighted throughout this paper, progress hinges on developing reinforcing enablers, such as resource optimization, compliance, collaboration and data-driven feedback, which create a virtuous cycle for scaling reliable AAM operations. Without a coordinated mechanism to embed these lessons into clear standards and repeatable processes, valuable knowledge will remain isolated and overall momentum may stall.

The paper also proposes a community-led, collaborative model to connect today's isolated achievements into a unified, continuously improving network. By having a neutral and trusted entity such as an industry association, university partner or public–private coordinating body host a structured exchange, the sector can routinely share documentation, best practices and compliance templates. This approach could not only enable the broad adoption of proven models but also support ongoing learning, governance and operational improvement, turning single successes into industry-wide progress.

Saudi Arabia has the strategic assets, early validations and stakeholder momentum needed to become a global reference point for AAM implementation. But leadership will depend on more than technology adoption; it will hinge on its ability to operationalize AAM in a way that balances innovation with safety and competition with collaboration. By coordinating execution around a clear operational model, Saudi Arabia can set the benchmark for how emerging aviation markets move from vision to viable, sustainable reality – and, in doing so, help define the next chapter in global mobility.

Contributors

World Economic Forum

Maria Alonso
Lead, Autonomous Systems, World Economic Forum

Waleed Gowharji
Project Fellow, Autonomous Systems, World Economic Forum, Switzerland, and Project Lead, Centre for the Fourth Industrial Revolution Saudi Arabia

Pierre Maury
Strategic Integration Specialist – Aviation, World Economic Forum

Centre for the Fourth Industrial Revolution Saudi Arabia

Abdulmalik H. Alghonaim
Project Fellow, Centre for the Fourth Industrial Revolution

Maha W. Alkanhal
Seconded Fellow, Centre for the Fourth Industrial Revolution

Acknowledgements

Nada AboAlnaja
Business Development Expert, iot squared

Ahmad Abuhaimed
Technology Development Specialist, Ministry of Communications and Information Technology (MCIT)

Mubarak AlAbdullatif
Key Account Manager, FalconVis

Abdulmohsen AlAmer
Director of Strategic Partnerships and Cooperation, Ministry of Transport and Logistic Services (MOTLS)

Hala AlAsmri
Research Geophysicist, Aramco

Bander Aldegaither
Drone Unit Project Lead, King Abdullah University of Science and Technology (KAUST)

Ezzedeen AlFataierge
Focus Area Champion, Aramco

Abdulmalik AlGarayis
Drones Sector Head, Saudi Federation for Cybersecurity, Programming and Drones (SAFCSP)

Abdulrahman AlHashemi
Product Manager, Jahez International Company

Samar AlHazmi
MENA Direct Investments, Saudi Arabia Public Investment Fund (PIF)

Haitham AlJahdali
Director of Coastal and Marine Resources Core Lab, King Abdullah University of Science and Technology (KAUST)

Ahmad AlJundi
Product Manager, TÜV SÜD

Mohammed AlMohammadi
Strategic Planning and Execution, Saudi Telecom Company (stc)

Ghadah AlQahtani
Director, Service and Experience Design, Saudi Post (SPL)

Fadi AlShammary
Senior Vice-President, Saudi Arabia Public Investment Fund

Mohammed AlShebani
Planning and Integration Director, General Authority of Civil Aviation (GACA)

Abdulrahman Alshuhail
Chief Technologist of Geophysics, Aramco

Omaimah Bamasag
Deputy of Transport Enablement, Transport General Authority (TGA)

Kenneth Chircop
Director Regulatory Strategy and Strategic Partnerships , Dronamics

Abdulrahman Habib
Deputy Chief Strategy Officer, Saudi Data and Artificial Intelligence Authority (SDAIA)

Mohammed Mashnouk
Senior Business Developer, FalconVis

Tariq Nasraldeen
Founder and Chief Executive Officer, Firnas Aero

Mohammed Rajih
Civil and Military Cooperation Supervisor, Saudi Air Navigation Services (SANS)

Sami Sarhan
Chief Adviser, National Industrial Development Center

Taher Tayeb
Business Development and Innovation Section Head, Saudi Air Navigation Services (SANS)

Production

Michela Liberale Dorbolò
Designer, World Economic Forum

Simon Smith
Editor, Astra Content

Endnotes

1. Public Investment Fund. (n.d.). *Giga-Projects*. https://www.pif.gov.sa/en/our-investments/giga-projects/
2. IMARC Group. (2024). *Advanced air mobility market: Global industry trends, share, size, growth, opportunity and forecast 2024–2032*. https://www.imarcgroup.com/advanced-air-mobility-market
3. Federal Aviation Administration. (2025, June 17). *FAA, international partners collaborate on advanced air mobility.* https://www.faa.gov/newsroom/faa-international-partners-collaborate-advanced-air-mobility
4. Vision 2030. (n.d.). *Saudi Vision 2030*. Government of Saudi Arabia. Retrieved September 11, 2025, from https://www.vision2030.gov.sa/en
5. Ibid.
6. Vision 2030. (n.d.). *A vibrant society*. Government of Saudi Arabia. Retrieved September 11, 2025, from https://www.vision2030.gov.sa/en/overview/pillars/a-vibrant-society
7. Vision 2030. (n.d.). *A thriving economy*. Government of Saudi Arabia. Retrieved September 11, 2025, from https://www.vision2030.gov.sa/en/overview/pillars/a-thriving-economy
8. Vision 2030. (n.d.). *An ambitious nation*. Government of Saudi Arabia. Retrieved September 11, 2025, from https://www.vision2030.gov.sa/en/overview/pillars/an-ambitious-nation
9. eVTOL.news. (2024, January 22). *AAM mission to Saudi Arabia*. https://evtol.news/news/aam-mission-to-saudia-arabia
10. General Authority of Civil Aviation (GACA). (2024, January 22). *Enabling advanced air mobility in Saudi Arabia*. https://gaca.gov.sa/-/media/Files/PDF/Reports/Air-Mobility-Reports/2024-01-22-Air-Mobility-Report-Vision-EN.pdf?
11. Federal Aviation Administration. (2025, June 17). *FAA, international partners collaborate on advanced air mobility*. US Department of Transportation. https://www.faa.gov/newsroom/faa-international-partners-collaborate-advanced-air-mobility
12. Vision 2030. (n.d.). *Saudi Vision 2030.* Government of Saudi Arabia. Retrieved September 11, 2025, from https://www.vision2030.gov.sa/en
13. Vision 2030. (n.d.). *A vibrant society*. Government of Saudi Arabia. Retrieved September 11, 2025, from https://www.vision2030.gov.sa/en/overview/pillars/a-vibrant-society
14. Vision 2030. (n.d.). *A thriving economy*. Government of Saudi Arabia. Retrieved September 11, 2025, from https://www.vision2030.gov.sa/en/overview/pillars/a-thriving-economy
15. Vision 2030. (n.d.). *An ambitious nation*. Government of Saudi Arabia. Retrieved September 11, 2025, from https://www.vision2030.gov.sa/en/overview/pillars/an-ambitious-nation
16. General Authority of Civil Aviation (GACA). (2024, January 22). *Enabling advanced air mobility in Saudi Arabia*. https://gaca.gov.sa/-/media/Files/PDF/Reports/Air-Mobility-Reports/2024-01-22-Air-Mobility-Report-Vision-EN.pdf?
17. Ibid.
18. General Authority of Civil Aviation (GACA). (2025, June 3). *Advisory circular AC 107-01: Advanced operations with unmanned aircraft syste*ms (Version 1.0). https://www.gaca.gov.sa/-/media/Files/PDF/LawsAndRegulation/Aviation-Safety-and-Environmental-Sustainability/Safety-and-Aviation-Standards-Advisory-Circulars/GACA-AC-107-01-Advanced-Operations-with-Unmanned-Aircraft-Systems.pdf
19. European Union Aviation Safety Agency. (2021, May 19). *Study on the societal acceptance of urban air mobility in Europe*. https://www.easa.europa.eu/sites/default/files/dfu/uam-full-report.pdf
20. Timoshenko, A., Yashin, G., Serpiva, V., Hamadov, R., Fedotov, D., Kartashova, M., & Golikov, P. (2025). Seismic data acquisition utilizing a group of UAVs. *Drones, 9*(3), Article 156. https://doi.org/10.3390/drones9030156
21. Ibid.
22. Global UTM Association. (n.d.). *USS data sharing and governance agreement template*. GUTMA. Retrieved August 17, 2025, from https://gutma.org/uss-data-sharing-and-governance-agreement-template/
23. Strang-Moran, C. (2023, November 7). *Introducing ELECTRODE: Connecting the dots on subsea cable failures*. ORE Catapult. https://ore.catapult.org.uk/resource-hub/blog/introducing-electrode-connecting-the-dots-on-subsea-cable-failures
24. AgGateway. (n.d.). *Mission*. Retrieved August 17, 2025, from https://aggateway.org/AboutUs/Mission.aspx.

COMMITTED TO
IMPROVING THE STATE
OF THE WORLD

The World Economic Forum, committed to improving the state of the world, is the International Organization for Public-Private Cooperation.

The Forum engages the foremost political, business and other leaders of society to shape global, regional and industry agendas.

World Economic Forum
91–93 route de la Capite
CH-1223 Cologny/Geneva
Switzerland

Tel.: +41 (0) 22 869 1212
Fax: +41 (0) 22 786 2744
contact@weforum.org
www.weforum.org