

# UAS Integration Framework



A unifying approach to comprehensive UAS readiness across National, State and Local Governments, UAS Operators, and Citizens.

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Published  
11/16/2022

V1.1

An aerial photograph of a suburban neighborhood. The houses are mostly two-story structures with various roof colors, including brown, grey, and blue. The trees are in various stages of autumn, with some showing bright yellow and orange foliage, while others are still green. The streets are paved and have yellow and white markings. The overall scene is bright and clear, suggesting a sunny day.

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## CEO Foreword

Since Airspace Link was founded in 2018, we've been on a mission to safely integrate drones into the national airspace.

We're excited to take the knowledge we've gathered through success, failures, projects, partnerships, and technology we've experienced over the past few years to provide the industry with a unifying framework that we genuinely believe will help reduce complexity, drive innovation and advance the industry.

As an industry, we can go much farther, faster, and safer when we work together.



Michael Healander

Co-Founder, CEO & President  
Airspace Link

# Framework Charter: A Shared Vision

In the nascent days of any industry, the lack of foundations, processes and regulations leave room for extensive innovation and experimentation. However, without a framework or process to align stakeholders, there is a risk of unintended consequences and lack of cohesive objectives.

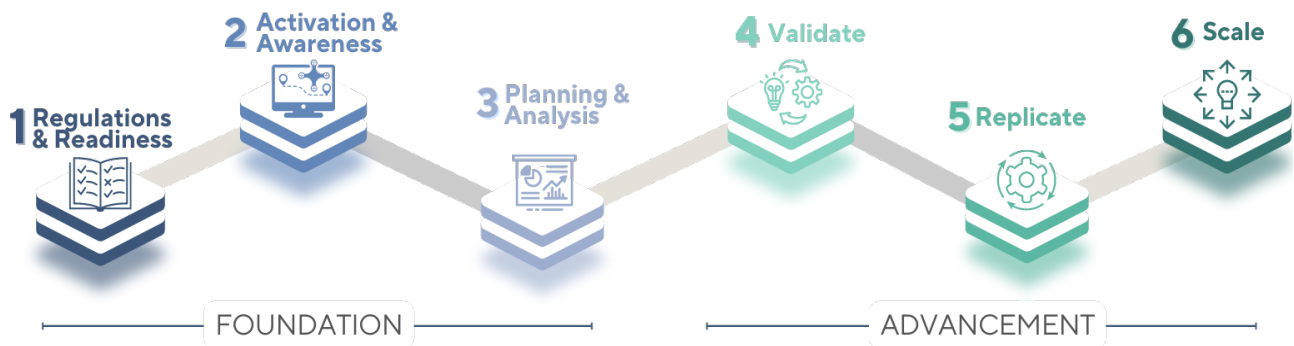
For example, the electric scooter industry revolutionized micromobility. Cities, however, were left scrambling to adjust to abandoned vehicles on sidewalks, respond to citizen concerns, and rapidly develop guidelines to ensure safety. Ridesharing came with similar benefits and challenges, enabling a new gig economy while simultaneously creating an immediate need for enhanced regulations and traffic planning.

Drones are being integrated into global communities across diverse industries to improve safety, efficiency, quality of life, and grow economies. Safety minded organizations such as the FAA and NASA, along with private industry, are collaborating on concepts and programs to support drone integration in regulated and unregulated low-altitude airspace.



## UAS Integration Framework

A unifying approach to comprehensive UAS readiness



### NATIONAL / FEDERAL GOVERNMENT

Responsible for overall airspace rules, regulations and management



### STATE & LOCAL GOVERNMENT

Responsible for community integration, communications and engagement



### UAS OPERATOR

Responsible for abiding by all airspace rules and regulations and engaging with state and local communities

UAS Operators, all levels of government and industry organizations, have developed a wide array of programs and models to showcase their unique approach to the market, and plans to operate and integrate drones. Even if all parties comply with pertinent rules and regulations, they are not necessarily working synergistically or with awareness of one another.

This fragmented approach has led to increasing complexity in the market for all stakeholders.

The UAS Integration Framework provides a unifying approach to comprehensive UAS readiness, outlining UAS Operator, and National, State, and Local Government considerations at each milestone; reducing complexities, accelerating the benefits and ensuring safe, legal UAS operations that are in harmony with the communities they serve.

Stakeholders across the UAS ecosystem are currently in varying stages of readiness. This framework provides stakeholders with a common language to harmonize capabilities and objective outcomes across framework levels to understand gaps, requirements, and associated benefits and risks.



# Applying the Framework

## Assessing Opportunities & Minimizing Risk

When community-focused solutions or infrastructure are provided by Federal, State, or Local government agencies, UAS operators are empowered to fly at a more complex level than they may be able to on their own. Conversely, governments may not be equipped to effectively manage inquiries and prioritize safety for residents when interfacing with advanced operators utilizing their own private processes and infrastructure.

In the example scenario listed below, the government agencies in a shared geography are at varying levels of readiness. Two unique operators propose Concepts of Operation to begin offering their services in that geography. The difference in levels between stakeholders illustrates a readiness gap and signals a risk to optimal outcomes.

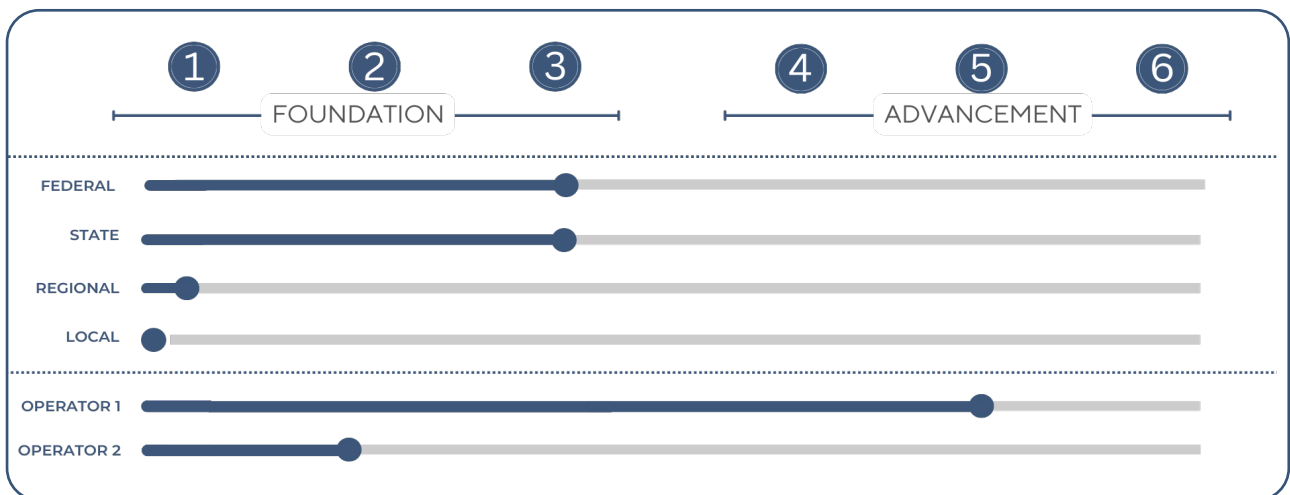


Figure 1.2: UAS Integration Framework - Applied Levels Example

By applying the framework, it becomes clear to the local and regional government that they will need to implement capabilities to proactively address awareness, safety, and security concerns that may arise as the operations continue to scale. These foundational capabilities will also position the regions as ideal geographies for further infrastructure investment and provide opportunities to progress advanced operations.



- Effectively understand their unique airspace and ground risk data for planning and compliance
- Provide authoritative local data to the operators for planning safer operations and security concerns












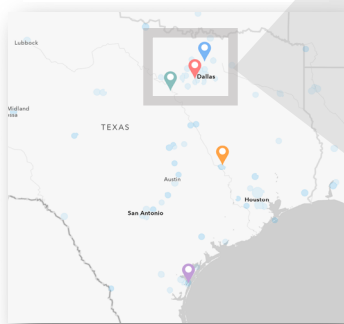
- Establish detection capabilities to manage safety and security concerns

# Real-World Application

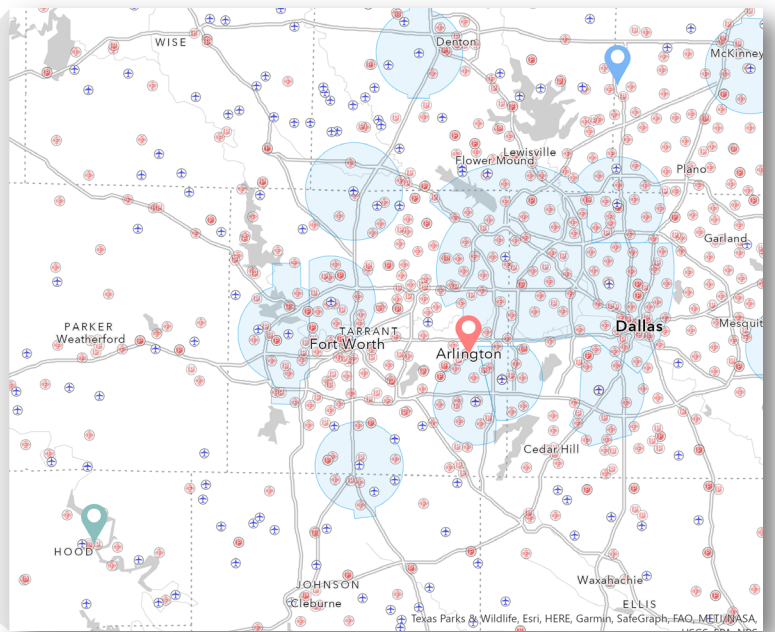
A real-world look into the framework application can be seen below, focusing on the state of Texas, where commercial drone delivery operations are steadily expanding through pilot programs in suburban areas to prove their safety and effectiveness.

## Case Study: State of Texas

-  Arlington, TX - Flysafe
-  College Station, TX - Amazon
-  Frisco, TX - Alphabet Wing
-  Granbury, TX - Flytrex
-  Lone Star UAS Center of Excellence
-  US Airports
-  US Police Stations
-  US Fire Stations
-  FAA class airspace



## Broader Dallas/Fort Worth



+ Federal



+ State & Local



+ UAS Operator



Several operators are at advanced readiness levels, looking for forward-leaning communities to bring their services to. Stakeholders across Texas can apply the framework to understand their readiness, compare with other stakeholders, and address potential opportunities and risks accordingly.

# Level 1 Regulations & Readiness

Building a foundation of safety in UAS integration begins with all stakeholders understanding the airspace rules and regulations at the federal, state, and local levels. Public stakeholders will support programs that increase understanding and adherence to those regulations, reducing barriers to operators executing safe and compliant flights in harmony within the community.



## FAA UAS Civil Integration Roadmap

"As safety is everyone's responsibility, the FAA encourages you to help share the safety message and join the discussion as we work to expand UAS integration in our nation's skies"

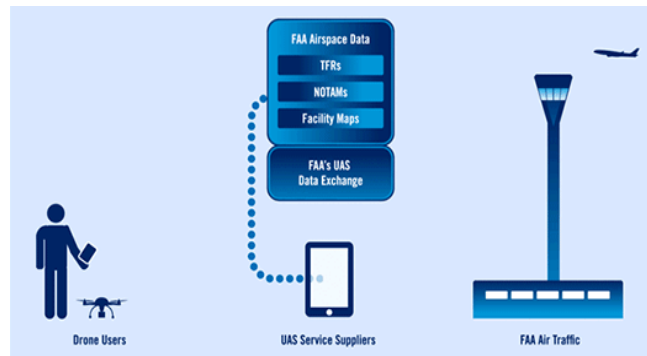
## National / Federal

In the United States, Level 1 has the most comprehensive tools and support from a federal perspective, as it was the first step in establishing a safe roadmap for drone integration. These tools include the below.

### UAS Data Exchange

The Federal Aviation Administration (FAA) introduced the Low Altitude Authorization and Notification Capability (LAANC) as the first step in integrating UAS into the National Airspace. LAANC allows pilots to apply for authorization when flying in controlled airspace, along with the additional benefits of:

- Awareness of where pilots can and cannot fly
- Access to controlled airspace at or below 400 feet
- Visibility into where and when drones will operate for Air Traffic Control



### Drone Zone

Resources to help you stay compliant, register your drone and apply for waivers.

LAANC Providers – UAS Service Suppliers provide LAANC and support with unique services and capabilities. For example, after receiving LAANC authorization, pilots still need to check for NOTAMs/TFRs to ensure compliance.

Tools like [AirHub® Portal](#) provide additional layers of safety and situational awareness.

### Certifications

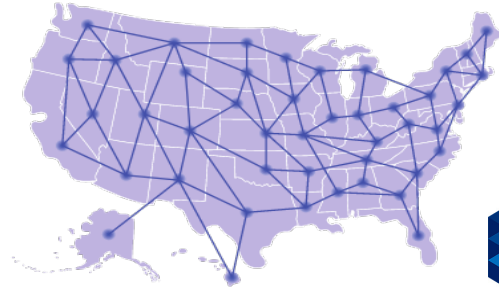
- Recreational Pilots - TRUST
- 14 CFR Part 107 Certification





## State & Local

State and local governments must have an in depth understanding of all Federal rules, regulations and State laws as well as the means to communicate them to operators and their constituents. The understanding of the rules and regulations established in this initial phase equips the community with data to answer constituent questions, understand unique traits of their airspace, and begin to unlock low-altitude airspace as another community asset.



State and local agencies have begun creating policies, laws, and regulations within their jurisdictional authority in regard to UAS.

While they are not the final airspace authority, state and local governments have a role to play in furthering the safe integration of drones into their communities. For example, some of these policies seek to clarify privacy and zoning laws, as well as additional localized considerations to help manage and prepare for the growing drone economy in harmony with community interests.

## UAS Operator

UAS Operators must understand the rules and regulations while supporting any given use case. With an ever growing list of use cases from recreational enjoyment to the beginning stages of utilizing drones for commercial use under Part 107 licenses, it can be overwhelming to locate and abide by all of the rules and regulations. While compliance is always the operator's responsibility, providing easily accessible tools and communication will continue to support safe and compliant operations by everyone in the community, and help operators and citizens avoid [hefty fines and penalties](#).

In addition to local community tools, private drone training programs continue to proliferate and broaden their offerings, providing safety information, and recreational and professional certifications.



## Level 2 Activation & Awareness

The headlines we see about drones can often be negative. Such as, flying where they shouldn't, a neighbor concerned about privacy, or a recreational flyer accidentally entering controlled airspace without authorization. When citizens are reporting those issues or asking questions about what they're seeing, they are not reporting directly to the FAA; nor does the FAA have the resources or capacity to answer that volume of inquiries. Instead, the burden falls to the state and local government contacts that are more accessible and familiar, despite the fact that they aren't directly responsible for airspace.

The first step for local government in answering any of these inquiries is understanding the rules and regulations with data readily available from Level 1 to confirm if UAS are allowed to fly in that area. Referencing those rules and obtaining awareness of these flights is required to effectively understand and respond to inquiries.

In the U.S., the FAA's response for this need of enhanced awareness came in the form of Remote Identification. Remote ID is crucial to integration efforts, commonly called the "digital license plate" for drones. Remote ID is the ability of a drone in flight to provide identification and location information that other approved parties can receive.

**Remote ID, by design, will enhance accountability among drone pilots and provide reassurance to the public of privacy and security concerns. It also provides a security foundation for safely unlocking more advanced use cases in the future.**

### ● State & Local Government

To best serve their communities, local agencies need awareness of where flights are actually happening, both in real time and historically. The collection of data can allow communities to respond to active incidents and begin to analyze trends and insights for unique community considerations.

### ● UAS Operator

Local Remote ID capabilities lay the foundation for safe and secure UAS operations. Future capabilities can be combined with Remote ID to support advanced operations such as flying over people, moving traffic, or beyond visual line of site through waivers or new rules and regulations.

## Public Operations

While Remote ID is one aspect of the safe management and integration of drones, activation and awareness of internal operations for government entities also becomes increasingly critical at Level 2.

From local law enforcement to image data collection or infrastructure inspection, the number of government operations executed daily across the globe is rapidly increasing. As those activations expand in parallel with private and commercial drone operations, the need for systems to increase awareness and coordination rises dramatically.



### PUBLIC SAFETY

Drones are already helping to mitigate danger in some aspects of public safety.

Tools specific to first responders can be found in the Public Safety and Law Enforcement Toolkit from the FAA in the U.S.

Public safety teams will also have to prepare for situations involving the misuse of drones, where UAS Detection and Remote ID can equip them with additional information to respond effectively.



### PARKS & RECREATION

While flying in National Parks is currently prohibited in the U.S., local departments can encourage compliant drone use in communities.

FAA-recognized Community Based Organizations are eligible to request the establishment of a FRIA - Federally Recognized Identification Area- to provide safe areas for residents to fly without requiring Remote ID.



### INFRASTRUCTURE INSPECTION



In the U.S. there is a nationwide backlog for critical infrastructure inspections.

The House of Representatives passed the Drone Infrastructure Inspection Grant Act, designed to support the use of drones to increase efficiency, reduce costs, improve worker safety and reduce carbon emissions when carrying out inspections.



### IMAGERY COLLECTION

National, state and local agencies are relying more on drone imagery to optimize their workflows and conduct comprehensive research.

While different departments of government may be using drones to support different use cases, the need to coordinate those operations internally and externally is universal.

Community-focused tools designed to support communication and coordination are vital for driving harmony among all operations.

# Level 3 Planning & Analysis

Unlike traditional aviation typically operating within airport environments, UAS can operate, take off, and land throughout local communities, requiring additional coordination between federal, state, and local governments. Aligning federal, statewide and local approaches ensures a seamless and unifying approach that expedites coordination and simplifies the complexity of the operators' landscape.

Federal programs have been launched extensively over the past few years in the U.S. to support advanced planning through research and analysis, including the [UAS Integration Pilot Program \(IPP\)](#) and the continuation of that work through the [BEYOND Program](#). These programs are designed to drive meaningful dialogue on the balance between stakeholders, including national and local interests related to drone integration, and provide actionable information on the expanded and universal integration of drones into the National Airspace System.



Photo Source: FAA.gov

There are currently [seven UAS test sites](#) to support the FAA in integrating UAS into the National Airspace System, each playing a critical role in planning, analysis and advancement efforts. In parallel, through obtained waivers and other certifications, operations are proliferating significantly beyond these sites.

## State & Local Considerations

State & Local Governments will need to be informed of federal efforts, and in certain cases, participate in and influence these workstreams. In addition, state and local agencies have begun their own planning and analysis projects to prepare for the rapidly evolving industry while simultaneously creating an attractive environment for investment from UAS Operators.

## Infrastructure Investments

Infrastructure investments have historically focused on highly tangible items like roads and bridges. Currently, the infrastructure enabling safer and scalable drone operations isn't clearly defined even as drone operations and regulations advance. As such state and local agencies are analyzing and investing in enabling solutions for safer operations today and tomorrow, reducing operator barriers to entry within their geographies.



**Advanced UAS Infrastructure Corridor Planning** - Many agencies are investing in corridor planning as a first step in infrastructure investment. UAS corridors provide full service infrastructure for UAS operations along these infrastructure service areas. These initiatives can help increase community acceptance, remove the need for advanced waivers and one-off approvals within the service area, and begin to implement infrastructure for testing before a widescale rollout.



**Feasibility Studies & Modeling** - In parallel to traditional transportation and infrastructure planning, taking a comprehensive approach to UAS integration planning will support longer term roadmap viability and ensure drones are successfully integrated with the community and all modes of transportation.

## Policy Development

Designing infrastructure and regulations to foster growth in the industry will require close collaboration between private industry and all levels of government. The [BVLOS ARC](#) (Beyond Visual Line of Sight Advanced Rule Making Committee) for example brought together, public and private stakeholders to collaborate on the report. Drones flying beyond an operator's visual line of sight present unique challenges to the FAA's existing regulatory framework and require additional consideration.



BLVOS ARC FINAL REPORT  
May 2022

These are challenges the entire UAS community must confront together, because they have implications not only to safety, but also security and society at large.

Regional organizations have a role to play as well. For example, Metropolitan Planning Organizations (MPOs) are experts in guiding alignment on complex emerging topics like UAS integration, and can ensure regions are preparing in harmony to promote interoperability and avoid fragmented approaches and siloed systems. Local communities are closest to their constituents and can help bridge the gap in alignment across interested parties.

## Level 4 Validate

When implementing emerging technology, validation of proposed infrastructure, systems and regulations is required to test new concepts before they can be responsibly replicated and scaled. The FAA has demonstrated the first step of this process during their UTM (Unmanned Traffic Management) Field Testing. These field-tests are designed to prove out new capabilities and proposed standards that support small UAS operations in the real world. The test outcomes help to support policy development and help the industry update standards to support routine BVLOS Operations.

In partnership with the FAA, the same rigor in validation testing is happening at the state and local levels to continue to move from planning and analyzing to implementing infrastructure and policy. UAS Operators are essential in exercising and validating that infrastructure while advising on what will best support industry growth and consumer benefits.

### Shared Infrastructure



Network



C2



Authorization



Surveillance



Ground Risk



Air Risk

### Bring Your Own Infrastructure

Drone policies have been rooted in traditional aviation principles, but drone infrastructure development has not followed suit. Traditional airlines are not expected to commission and maintain their own navigation aids or maintain individual airports. Requiring drone operators to bring their own infrastructure is inefficient and expensive, leading to a lack of standardization, coordination, and ultimately industry stagnation.

On the regulatory side, individual approvals and validation of private infrastructure systems are inefficient and unscalable.

**Public or shared-use infrastructure is required to successfully scale and realize the full potential benefits that drones can offer.**

# Level 5 Replicate

Validated systems, data, processes and supported UAS use cases can be replicated into new markets to safely expand the infrastructure service area. Precedent-based approvals or pre-approved standards and systems significantly expedite processes and reduce the burdens on both the commercial and regulatory stakeholders.

Many UAS Operators are currently providing their own private infrastructure and have received waivers for specific aircraft certification and use case approval, operating in limited geographic areas at very complex levels.

To replicate these successes at scale, stakeholders will need to move from one-off waiver-based approvals to integrated, coordinated efforts, leveraging standardized infrastructure, systems, and supporting tools.

## Shared Infrastructure



### Market Expansion

For traditional airports, infrastructure replication is relatively standard. Expanding drone infrastructure into new geographies is complex, given the unique attributes of each location, the broad areas of operation, and the importance of ground risk and localized information.

Applying the knowledge of these unique attributes to the implementation strategy at a new location is an important step in the process.

### Use Case Expansion

Proliferation into new use cases is particularly complex for drones, given that the rules, regulations, and requirements can depend on the market geography, drone type and the certifications or standards that the drone hardware meets.

When introducing new use cases to the infrastructure service area, care should be taken to ensure the use case characteristics are supported by the infrastructure capabilities.

# Level 6 Scale

The long-promised vision of drones advancing economic, environmental, and societal objectives can only be fully realized when operations are comprehensively scaled. The infrastructure and regulations needed to enable ubiquitous drone operations will require a commitment from all stakeholders.

Aligning all stakeholders on this unified approach to integration will simplify and expedite the execution of a shared vision of safe operations at scale and supporting the realization of the full potential of UAS for all communities.

## Economic Impacts

The size of the commercial drone market— the fastest growing segment—is expected to reach **\$16 billion** by 2025 and **\$29 billion** by 2030.<sup>1</sup> The U.S. economy could save up to **\$920 million** annually using drones to inspect energy utility infrastructure alone.<sup>2</sup>

One study of UAS local delivery programs found that local participating retailers could each experience more than **\$200,000** a year in increased business opportunity, and local restaurants could generate up to **\$284,000** in additional sales, by expanding the footprint of serviceable customers.<sup>3</sup>



## Social Equity Opportunities

Supporting the UAS industry provides a unique opportunity to advance equity and ensure expanded access for underserved or remote communities. Drones have the potential to play a key role in delivering essential goods and medical supplies to vulnerable populations that are **mobility challenged** or lack access to a vehicle<sup>6</sup> and **difficult-to-reach populations**.<sup>7</sup>

## Environmental Benefits

Existing commercial drone deployments have already demonstrated a net positive impact on the environment—including reductions in overall noise levels and CO2 greenhouse gas emissions. The Virginia Tech Drone Delivery Study indicated that enabling drone delivery in a single U.S. metropolitan area could avoid up to **294 million miles per year in road use** and up to **580 car crashes per year**; which is equivalent to taking **25,000 cars off the road**, and which reduces carbon emissions by up to **113,900 tons per year**. of planting **46,000 acres per year of new forest**.

While everyone can benefit from the integration of drones at scale, communities that create favorable regulatory and business environments for the industry will likely siphon benefits, like job creation, from those who do not.



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