THE GLOBAL DRONE REGULATION LANDSCAPE

HOW LAWS AND REGULATIONS ARE SHAPING THE DEVELOPMENT OF THE DRONE INDUSTRY AROUND THE WORLD

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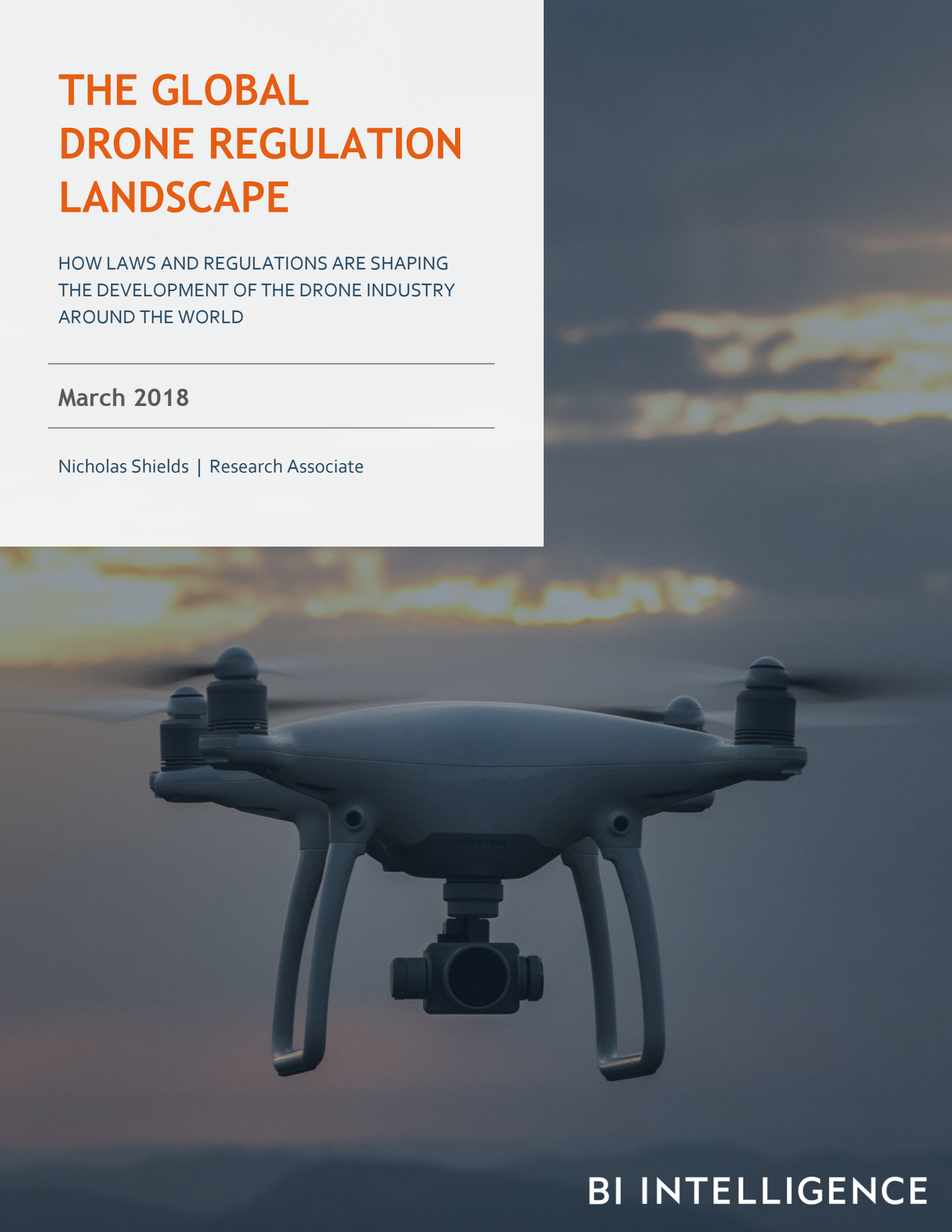

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KEY POINTS

- **Despite technological advancements that have made drones, or unmanned aircraft, viable for a number of use cases, the industry remains a nascent space when it comes to regulation.** Governments globally maintain restrictions on the use of the aircraft, limiting or outright prohibiting large-scale drone fleets for last-mile deliveries, construction site inspections, agricultural monitoring, and other use cases.

- **These regulations are largely hindering drones from reaching full commercial viability, even in the world's largest drone markets: the US, Europe, and China.**

    - In the US, the Federal Aviation Administration's (FAA) line-of-sight requirement and ban on flying over humans have kept the market from reaching its full potential.

    - Meanwhile, in Europe, a lack of EU-wide regulations has led to a patchwork of national regulations that can be confusing for businesses.

    - In China, the military maintains tight control over the country's airspace, making it difficult, particularly for foreign companies, to operate drones there.

- **However, Business Insider Intelligence expects drone regulations in these geographies to loosen in the next several years.** Regulators in the US, EU, and China are all in the process of crafting new commercial drone rules that we expect will open up more opportunities for businesses to fly drones. This will be critical to pushing drones into the mainstream in the form of large-scale commercial projects.

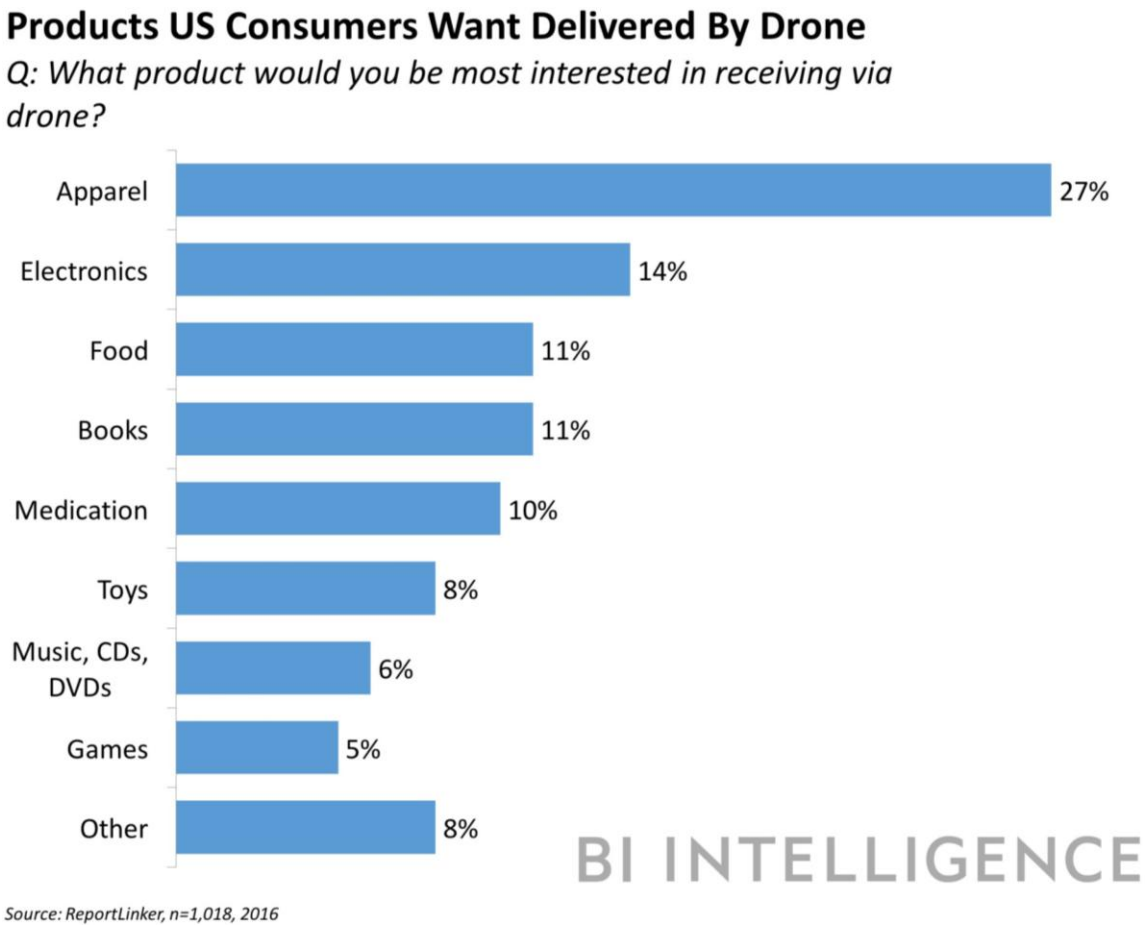
- **Additionally, while no market will come close to the US, Europe, or China in the near term, several have regulatory approaches that are promising for the emergence of drone industries in the future.** These include Australia, Japan, India, and a smattering of smaller countries like Rwanda.

Download the charts and associated data in Excel »

INTRODUCTION

Drone technologies continue to improve at a rapid pace and are slowly pushing the unmanned aircraft toward the mainstream. However, the drone industry remains a nascent space when it comes to regulation, and governments globally maintain restrictions on the use of the aircraft, limiting or outright prohibiting large-scale drone fleets for last-mile deliveries, construction site inspections, agricultural monitoring, and other use cases.

These restrictions are the top determining factor in the development of the global drone industry. Lawmakers and agencies regulate drones to prevent possible collisions with planes, helicopters, and other aircraft. However, such regulations haven't kept up with the advancement of the technology, which is now safe enough for a variety of use cases, with proper precautionary measures. Further complicating matters, technology for tracking the aircraft to allow law enforcement officials to make sure consumers and businesses are within legal limits is immature. These issues are largely hindering drones from reaching full commercial viability. In response, governments are now looking to find ways to create more regulatory clarity for businesses and operators, which will help open up new use cases and business opportunities for companies in the next several years.



In this report, Business Insider Intelligence takes an in-depth look at how national, trans-national, regional, and local regulations are shaping the development of drone industries in the world's three largest commercial drone markets: the US, Europe, and China. We explain how individual laws and mandates — or a lack of them — in these geographies have affected commercial drone adoption so far, and classify the different approaches these jurisdictions have taken to regulating commercial drones. In addition, we offer a glimpse of what lies ahead for drone regulations in these markets, and give an overview of developments in other select geographies.

THE UNITED STATES

The Federal Aviation Administration (FAA) holds all regulatory authority over unmanned aircraft in the US. The agency governs commercial and recreational drones through Public Law 112-95, Section 336, “Special Rules for Model Aircraft” and Title 14 of the Code of Federal Regulation, Part 107. The FAA deployed its current slate of regulations in 2016, providing greater clarity to drone operators. This helped spur growth in the US enterprise drone market — drone technology provider PrecisonHawk, for instance, saw its pipeline of inbound leads increase about 300% in the month after the regulations became effective, the company's CEO, Michael Chasen, told Business Insider Intelligence. However, several restrictions, including the FAA’s line-of-sight requirement and its ban on drones flying over humans, have limited the market from reaching its full potential.

The FAA grants businesses exemptions to these rules under Section 333, and had issued 1,100 waivers in total as of November 2017. The FAA hasn't granted permission for any companies to operate a full-scale last-mile drone delivery service, but it has granted a sizeable number of exemptions for construction, energy, and agricultural firms for inspection and photo-gathering purposes. Additionally, Chasen said he expects the FAA to become more willing to grant exemptions for drone use in a variety of settings, even if regulations aren't officially softened or revised.

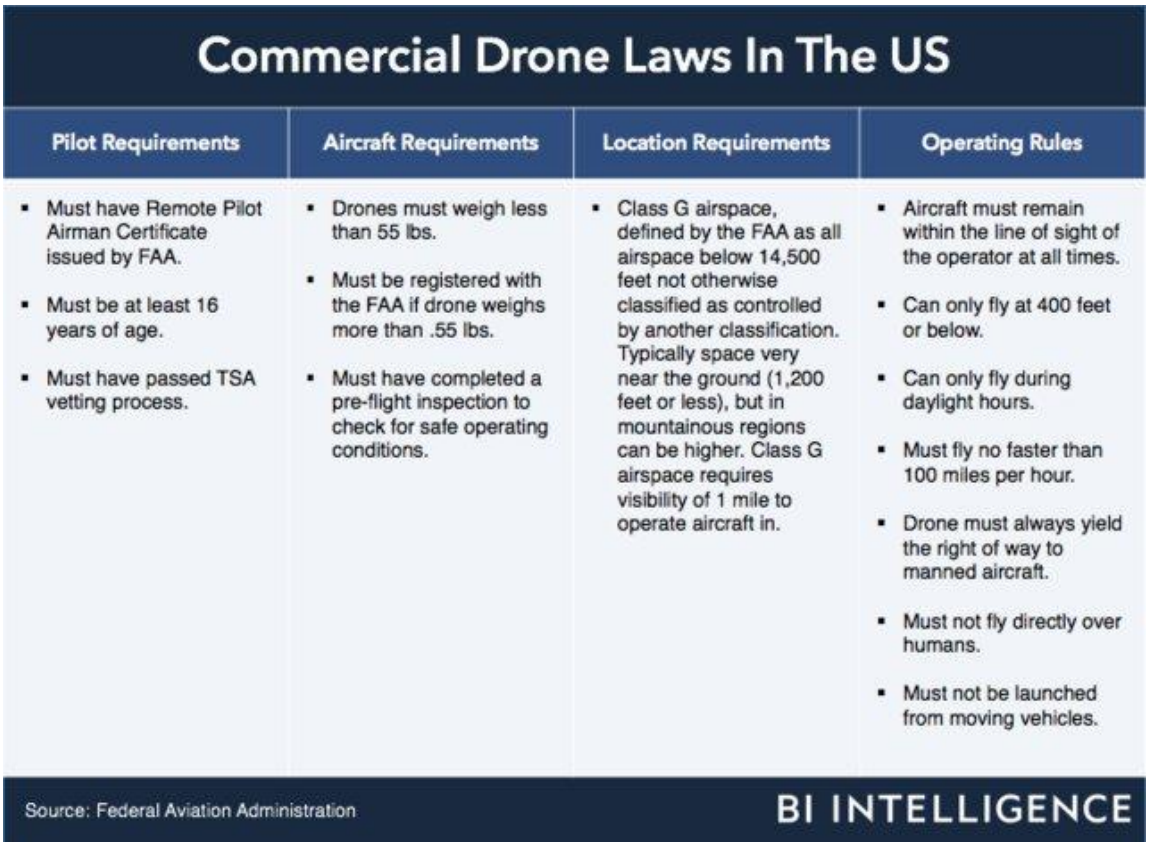
Top Regulatory Issues

1. The FAA's line-of-sight requirement. This mandate says that commercial drones must operate only within the sight limits of the drones' pilots, severely limiting long-distance drone deliveries. As a result, it has prompted companies to move their initial drone delivery tests overseas. Amazon is testing its Prime Air drone delivery program in the UK countryside and Australia, for example, and Alphabet's drone delivery arm Project Wing followed the e-commerce titan to Australia last October.

Companies are exploring ways to circumvent this requirement — notably, Workhorse Group, an electric truck manufacturer, partnered with UPS to trial last-mile drone deliveries using specially modified Workhorse trucks. The drones launch from the roof of the trucks, after drivers load parcels onto the aircraft and confirm their flight paths. This method is picking up steam — German auto giant Daimler AG showed off a van similar to Workhorse's last year at the Consumer Electronics Show (CES). If the requirement remains in place in the coming years, we'll likely see other logistics firms explore this approach as well.

2. The ban on drones flying over humans. This requirement limits a variety of use cases including drone deliveries, as well as aerial inspections of construction sites or agricultural fields. The FAA likely hopes this rule prevents the aircraft from falling out of the sky and hurting anyone on the ground, or potentially spying on bystanders. That said, the agency has granted several exemptions to this rule. CNN, for instance, secured permission to fly drones over large crowds from the FAA last October, a first for any company. And other organizations, including The New York Times and NFL, have received exemptions since then.

Drone use in populous areas is also limited by a lack of specific regulations or legal precedents related to privacy. The federal government doesn't have any concrete regulations around drone privacy, and neither do many state or local governments. In fact, the Electronic Privacy Information Center (EPIC) sued the FAA last year for not doing enough to provide clear guidance on this topic. And, while the National Telecommunications and Information Administration (NTIA) released guidelines around drones and privacy in 2017, they are completely voluntary and unenforceable. Meanwhile, a Munich Re survey of enterprise risk managers from last August found that a whopping 61% of respondents were concerned about the potential for invasion of privacy when commercial drones fly over homes or businesses. Unfortunately, because there's very little precedent to help courts decide privacy cases involving drones, or what fines may be levied for violations, this will likely remain a thorny issue until clearer regulation emerges.



3. A patchwork of state-level drone laws. The FAA doesn't bar states from crafting their own drone regulations, and several states — as well as local governments — have done so. However, state and local regulations can conflict with federal laws, creating legal confusion for businesses and drone operators. For instance, the Massachusetts town of Newton, an affluent suburb of Boston, was recently involved in a year-long legal battle over an ordinance that made it illegal to fly a drone over private properties at less than 400 feet in the air. In the end, a federal appeals court ruled the law was illegal because it conflicted with the FAA's requirement that businesses using drones fly them only under 400 feet. However, various drone industry experts and insiders expressed great confidence to Business Insider Intelligence that federal, state, and local regulatory landscapes will all become more favorable to businesses and drone operators in the next few years.

4. Ban on autonomous drones. Autonomous drones flying pre-programmed delivery or inspection routes would largely eliminate the need for human operators altogether, vastly reducing the costs of operating drones for such purposes. However, we expect the ban on such aircraft will be one of the last major drone regulations to be relaxed or eliminated because of concerns around a hacker taking control of an autonomous drone. Moreover, some fleets would likely be programmed to fly together, presenting an even greater danger if they're taken control of. In addition, autonomous flying software and technologies require further development and testing to prove they can safely avoid any obstacles, including birds, tall buildings, or other aircraft.

What Comes Next

The Trump Administration recently began a program designed to iron out how state, local, and federal governments should divide regulatory responsibilities for drones. In particular, the initiative will grant approval for operations beyond current regulatory limits that involve drones flying at night, over people, and beyond operators' lines of sight. The tests aim to determine how various agencies can best cooperate on regulating commercial drones. They should also help the FAA gather considerably more information before it considers revising regulations around the line-of-sight rules and autonomous drones.

Meanwhile, the National Aeronautics and Space Administration (NASA) is engaged in a long-term research project to try and develop an air traffic management system for drones. Such a system would potentially be able to identify and track individual drones, allowing law enforcement officials to determine when drones might present a danger because of a malfunction or hack. NASA is planning to release this system by 2019 at the latest, and is allowing private companies to submit proposals for parts or all of such a setup. The agency completed the last round of tests of its own prototype for this system last June. Law enforcement officials likely view such a system as a necessity before loosening the line-of-sight requirement or ban on flying over people. That means the FAA may not change these rules until after the system's release in 2019, which would delay widespread commercial drone use in populated areas until then.

EUROPE

There currently aren't any regulations that cover drone use across the entire European Union (EU). Instead, a patchwork of national regulations govern the use of unmanned aircraft across all the member states, somewhat resembling the state-level regulations in the US. The majority of large countries in the region with digitally savvy populations have some legal framework controlling drones. Meanwhile, in other nations, where there are no formal drone laws yet, use of the aircraft is largely regulated through existing aviation laws.

Many European countries have a similar regulatory landscape to the US, but they are generally more lenient in practice. For instance, the US, UK, and Germany all have requirements that commercial drone operators keep their aircraft within the line of sight of the operator at all times, and each has designated airspace where commercial drones can operate. However, regulatory agencies in Europe are often laxer in enforcing and granting exemptions to these laws. Notably, the UK's Civil Aviation Authority (CAA) granted Amazon an exemption to its line-of-sight rule in late 2016, enabling the e-commerce titan to test Prime Air in the country. Additionally, the German government has proved to be fairly lenient in granting exemptions to its drone laws. Since 2014, it has allowed logistics giant DHL to deliver parcels via drone to customers in a remote, mountainous area of the country, marking one of the earliest commercial drone delivery pilots in the world. In France, meanwhile, the postal service was granted permission by the country's aviation regulatory body, the General Directorate for Civil Aviation, to use drones to deliver mail to consumers in a remote, nine-mile area in the south.

However, Switzerland stands out for its lack of extensive drone laws, which has led several companies to test their aircraft in the mountainous country. Notably, Matternet, a California-based drone startup, began testing the delivery of blood and other medical samples to a remote area of Switzerland, in partnership with a local hospital, last fall. To do so, Matternet needed wide-ranging permission from the Swiss government to operate a "drone logistics network," which it was granted that March.

Commercial Drone Laws In Europe

Country	Pilot Requirements	Aircraft Requirements	Operating Rules	Line of Sight Requirement?
 France	• Pilots must have a level of knowledge and training that depends on the type of scenario for which the drone is to be used, with some situations requiring a full pilot's license.	• Can't weigh more than 150 kilograms.	• Must be granted permission for all flights by French DGAC. • Can't fly over people. • Must remain below 150 meters in the air. • Must "respect other people's privacy."	Yes
 Germany	• Cannot wear glasses and must be granted license by Luftfahrt-Bundesamt.	• Must weigh less than 25 kilograms. • Must be registered with Luftfahrt-Bundesamt.	• Cannot fly within 1.5 kilometers of an airport. • Must fly 100 meters from the ground. • Can't fly at night. • Cannot fly above highways, government property, power plants, residential properties.	Yes
 UK	• Operators must be granted a license by the CAA saying operator is "sufficiently competent" to fly a drone.	• Must weigh less than 29 kilograms.	• Must remain below 400 feet in the air. • Must remain within 500 meters of the operator. • Must stay 50 meters away from people or buildings.	Yes
 Switzerland	• Pilot must be issued license by the Federal Office of Civil Aviation.	• Must weigh over 30 kilograms.	• Can't fly within 100 meters of a group of people. • Must follow all military and privacy laws.	Yes

Source: Directorate General for Civil Aviation, Federal Office of Civil Aviation, UK Civil Aviation Authority, Telegraph, Luftfahrt-Bundesamt Law Library of Congress

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Top Regulatory Issues

1. The lack of EU-wide drone regulations. Drone regulations in many countries across Europe — especially the ones outlined above — are quite similar. Other countries, including Greece and Hungary, have limitations on how high the aircraft can fly, while Norway and Sweden boast the very common line-of-sight rule. However, the lack of baseline, EU-wide regulations prevents drone companies from creating sales forces, marketing teams, and other arms dedicated to serving the entire EU as a bloc, meaning these units have to navigate different regulatory environments throughout Europe, which can be time-consuming and confusing. Additionally, these issues plague businesses that want to use drones in multiple European countries, as they need to spend time and energy sorting through the different regulatory landscapes. A unified set of EU-wide regulations will be critical to the development of the drone industry in Europe.

2. Unfavorable regulatory environments in many underdeveloped regions. Many former Soviet-bloc countries in Eastern Europe either have incredibly strict drone regulations or ban the aircraft outright. This includes Slovakia, which effectively bans the commercial or civilian use of drones and doesn't issue many exemptions, as well as Lithuania, which has no drone regulations whatsoever. This has effectively limited the whole European market to reach only a fraction of its current potential, as construction companies, agricultural conglomerates, and other businesses can't integrate the aircraft into their operations in these geographies.

What Comes Next

The European Commission, the chief executive body of the EU, hopes to have formal drone laws that apply across all member states in place by 2019. And, while it's still unknown exactly what these laws will look like, early proposals are encouraging for drone operators and businesses. An initial proposal from this past November included a measure to create a common airspace up to 150 meters in the air, dubbed the "U-space," for enterprise drones. The U-space would be controlled by an air traffic control system similar to existing ones for traditional aircraft, and likely include automated tools for things like geofencing, e-identification, and automatic registrations for aircraft and operators, helping streamline compliance for businesses.

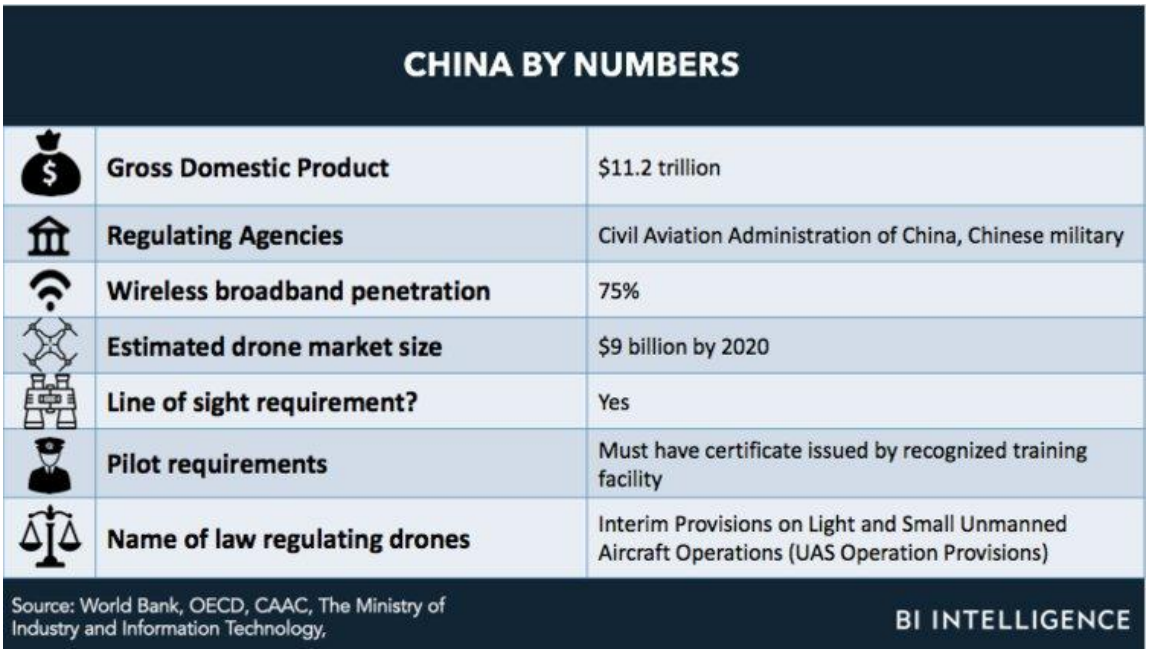
The European Aviation Safety Administration (EASA) is currently working with the national governments of all member states to ensure these laws are as all-encompassing as possible and allow a variety of different drone use cases. The European Commission also plans to finance the integration of drones into the existing aviation systems across the continent, helping companies and drone service providers make this transition. Additionally, the executive body wants to create a panel of industry experts that will consistently observe the space and propose potential future policy recommendations. When the EU eventually adopts drone regulations applicable throughout the union, it will not prevent individual countries from crafting their own drone laws, as long as they aren't in conflict with the broader regulations.

Meanwhile, look for countries that don't currently have any drone laws to craft them in the next few years, and for countries with strict drone laws to loosen them after the EU-wide regulations go into effect. About 85% of EU member states have at least some formal laws or regulations governing the use of unmanned aircraft, by Business Insider Intelligence's estimates. Once the EU adopts regulations that are applicable to all member states, they will encourage more activity in the countries that have thus far prohibited much drone use. Moreover, even countries that don't initially revise their national regulations will likely change their stance to remain economically competitive as commercial drone activity increases in neighboring EU countries.

CHINA

China is the world's largest potential market for commercial drone use, due to its massive, increasingly digitally savvy population and booming economy. But the country has some of the world's most stringent laws governing the use of unmanned aircraft. This is largely due to the fact that the Chinese military controls nearly all of the airspace in the country, creating a myriad of issues for businesses and commercial drone operators. In addition, the Civil Aviation Administration of China (CAAC), the top aviation regulatory body in the country, maintains its own drone laws in the same way that the FAA does in the US.

The country, notably, is home to the world's preeminent consumer and enterprise drone manufacturer, DJI, which controls about 70% of the global consumer and enterprise drone hardware market, according to 2016 estimates from Goldman Sachs and Oppenheimer. Partly as a result, as well as due to its long history of fostering the adoption of new technologies, the country's government has granted permits for 120,000 commercial drones, which amounts to approximately 11,500 people per commercial drone. This is significantly fewer drones per person, however, than are registered in the US. The FAA has granted permits for 77,000 enterprise drones, or one for about every 4,200 people. In addition, the Chinese government has played an active role in trying to train drone pilots, recognizing about 200 private training facilities that have issued a total of 14,000 certificates, which are mandatory to be a commercial drone operator in the country.



Additionally, the CAAC has granted exemptions to its rules to a handful of businesses for substantial commercial operations, mostly to fly the aircraft over people. JD.com, the country's second-largest e-commerce provider, is already using drones to perform deliveries in the suburbs of Beijing and several other rural provinces, for example. To conduct these operations, the company needed to secure permission from the CAAC to fly the aircraft over humans and demonstrate how it could safely do so. Additionally, JD.com was granted an exemption to fly the aircraft beyond the line of sight of its operators, albeit only for a few select delivery routes.

Top Regulatory Issues

1. Unlike in most western countries, the Chinese military controls the vast majority of the country's airspace. Last year, China Daily, a state-run newspaper, estimated that less than 30% of the country's airspace was available for use by nonmilitary personnel, such as commercial airlines or drones. In the US, on the other hand, nearly 80% of the airspace is available for civilian use. For commercial drone use, this means there's far less space for the aircraft to operate than there is in other markets, even when accounting for the difference in size between China and other nations.

2. Western drone companies, often young, under-capitalized startups, usually struggle to form joint ventures to operate in the country. Due to Chinese economic policy, most foreign companies that want to operate in the country need to form these sorts of partnerships with domestic companies. General Motors (GM), for instance, has a joint venture with SAIC Group, one of the country's largest automakers. While this isn't a major issue for behemoths like GM, it can be difficult for drone startups with limited resources that are often less than a decade old. As a result, while many western drone service providers, including PrecisionHawk, Airmap, and others, have explored the region, none have built a very strong presence in the country.

What Comes Next

Industry experts told Business Insider Intelligence that they expect the Chinese government to grow more lenient in granting exemptions to its drone laws, even if the country's official regulations don't change. That will likely push China to become the largest market in the world for commercial drone use. The Chinese government is known for not wanting to be behind the adoption curve of new, disruptive technologies, and is even willing to spend billions to ensure it stays ahead of other highly developed countries. Notably, it recently announced a massive new initiative to build AI solutions that are more advanced than those privately built in the US.

That means as the US, EU, and other technologically advanced markets begin to create more favorable drone laws in the next few years, China could potentially follow suit and either revise its drone laws to become more favorable to commercial use or grant more exemptions to its laws than it currently does, causing the market to take off. In fact, the country's Ministry of Industry and Information Technology estimated late last year that the country's commercial drone market will be worth $9 billion by 2020, up significantly from a 2016 iResearch report that sized the Chinese drone market at only around 75 million yuan ($11.9 million).

Additionally, the Chinese government will create standards for four categories of commercial drone use in the not-too-distant future. The CAAC and the government are currently working together with city and local governments to curb incidents where drones interfere with other aircraft, an effort that somewhat mirrors a similar initiative the Trump Administration is taking up in the US. Eventually, the CAAC will group commercial drone initiatives into one of four categories: agriculture, aerial surveillance, aviation photography, and license training. This, interestingly, doesn't include last-mile deliveries, although it's possible new rules governing this use case will be developed later on after further testing.

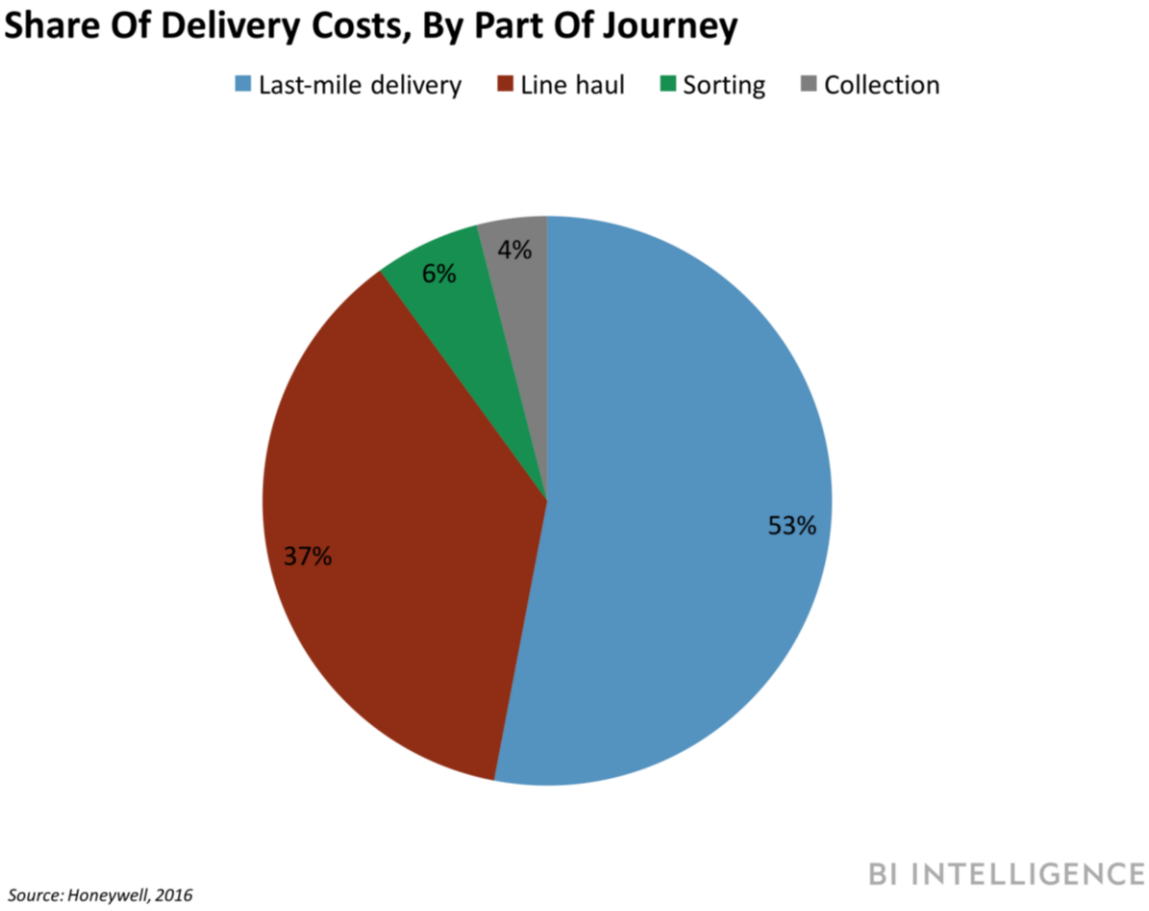
OTHER NOTABLE GEOGRAPHIES

Although no market will come close to the US, Europe, or China near term, several have regulatory approaches that are promising for the emergence of drone industries in the future. Below are some highlights:

- **Australia.** The country has a relatively lax regulatory environment for commercial drone use that has attracted some of the industry's biggest names to test their aircraft in the country, including Amazon and Alphabet, as mentioned. Both companies chose to test in Australia largely because of its lack of a ban on drones flying over humans. Meanwhile, PrecisionHawk's Chasen told Business Insider Intelligence that he sees Australia as having one of the most favorable regulatory environments for enterprise drone use in the world.

- **Japan.** Japan is one of only a handful of countries that doesn't require businesses and consumers to register their drones before use. Instead, operators and businesses simply need a license, which the government grants to everyone that applies on its website. The country has a line-of-sight requirement like most others, and the government maintains an up-to-date map of all the areas where it's illegal to operate the aircraft, such as over airports and military bases. Japan plans to legalize last-mile drone deliveries around 2020, which is in line with the time frames of many other developed countries.

- **India.** The Directorate General of Civil Aviation (DGCA), India's top aviation regulatory agency, released rules governing enterprise and consumer drone use that became official on January 1 of this year. The new rules divide the aircraft into four categories based on their size, mandate that businesses and consumers register all drones they use, prohibit drone use within 5 kilometers of airports or 50 kilometers of the country's borders, and require that all pilots be over the age of 18. The DGCA also requires that operators keep their drones within their line of sight. Additionally, the agency plans to grant companies special exemptions to these rules. India has a booming e-commerce sector that could look to take advantage of drones for last-mile deliveries, especially in rural areas of the country that are inaccessible by roads. Honeywell estimates that last-mile deliveries make up 53% of total delivery costs, and that figure is likely even higher in these remote areas of India that are hard to access via traditional roads. Flipkart, an online marketplace based in the country, has actually been lobbying the Indian government to permit commercial drone deliveries since 2015.



Commercial drone use is generally sparse elsewhere in the world, but there are some exceptions. Rwanda, for instance, allows California-based startup Zipline to deliver medical supplies to remote, isolated areas of the country, many of which aren't accessible via roads. While the country has some concrete drone laws in place, Zipline needed to get wide-ranging permission from the Rwandan government for the deliveries, even though it doesn't have a line-of-sight requirement. Zipline is planning to bring the service to Tanzania, which is much larger, later this year, and it will likely need similar permission.

THE BOTTOM LINE

- Governments globally maintain restrictions on the use of the aircraft, limiting or outright prohibiting large-scale drone fleets for last-mile deliveries, construction site inspections, agricultural monitoring, and other use cases.

- These regulations are largely hindering drones from reaching full commercial viability, even in the world's largest drone markets: the US, Europe, and China.

- However, regulators in the US, EU, and China are all in the process of crafting new commercial drone rules that we expect will open up more opportunities for businesses to fly drones. This will be critical to pushing drones into the mainstream in the form of large-scale commercial projects.

- Several other jurisdictions, including Australia, Japan, India, and a smattering of smaller countries like Rwanda, also have regulatory approaches that are promising for the emergence of drone industries, though no market will match the US, Europe, or China in the near term.

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