

#### Race to the top

Assessing and accelerating drone readiness in the UK, the G7 and other leading nations



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#### **BT Group**

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BT Group consists of three customer-facing units: Consumer serves individuals and families in the UK; Business\* covers companies and public services in the UK and internationally; Openreach is an independently governed, wholly owned subsidiary wholesaling fixed access infrastructure services to its customers – over 650 communication providers across the UK.

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\*Business was formed on 1 January 2023 from the combination of the former Enterprise and Global units. It commenced reporting as a single unit from 1 April 2023, with pro forma reporting information to be produced ahead of BT Group's Q1 FY24 results.

## Contents

	Foreword	2
	Report scope and purpose	3
	Executive summary	5
1	Overview and industry context: why now?	9
2	Our methodology: how does it work?	13
3	Key findings and country comparisons	16
4	Recommendations for the UK	42
	Appendix	44
	Glossary	46

#### Foreword

There are few innovations that have the potential to be as transformative for the UK economy, communities and our daily lives as drones. They are helping organisations across industries from logistics, manufacturing and agriculture to do tasks faster, safer and cheaper. They are also beginning to improve public services, helping to save and protect lives, with emergency response teams, police forces and the NHS all deploying them across the UK.

BT Group has made no secret of its vision and ambitions to contribute towards the UK's drone success. Our mobile network, as the largest and most reliable in the UK, could be critical. By improving flight control, assisting with authentication and authorisation, facilitating data transmission and enabling cellular communication, 4G and 5G technology can be the backbone that helps drive the future growth of the industry.

Our networks aren't the only way in which we're investing in drones. We recently invested £5 million in Altitude Angel, a world-leading unified traffic management technology provider, to help scale the UK drone industry and supported the development of the UK's drone superhighway, a 165-mile drone corridor – set to be the world's longest of its kind – spanning airspace above Reading, Oxford, Milton Keynes, Cambridge, Coventry and Rugby. However, the drone sector cannot realise the future potential of drones alone. For drones to have the kind of impact we know they can, it requires the support of stakeholders across government, regulators, devolved administrations and local governments, working together with industry to foster an environment conducive to growth. Progress is being made. The government has recognised the potential of drones with public backing and financial support – for example, through projects funded by UK Research and Innovation and a commitment to publish a Future of Flight Plan by the end of the year.

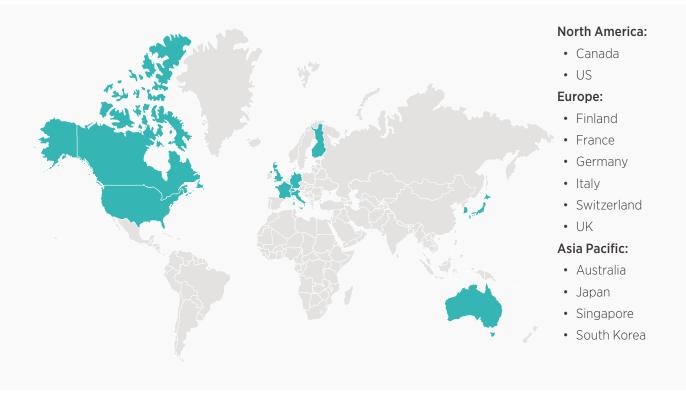
However, there is much more we must do. For this reason, we've commissioned this independent report from GSMA Intelligence, seeking to provide recommendations to policymakers and regulators, informed by best practices from around the world, to empower the UK into being a world leader in facilitating drone technology. By benchmarking the UK's drone readiness against international peers, including the G7 nations, my hope is we can identify how and what more is needed to propel the UK to the forefront of the drone revolution.

While the report demonstrates the UK has some strengths, we shouldn't settle for mediocrity. As we trail leading nations, and others are acting fast to catch up, the risk is we fall behind and miss out on the full drone dividend. This is particularly true of regulation, for which the UK has an enviable record overall but in the areas of drones has gaps in its approach. It is in all our interests to ensure these benefits are realised, and we hope this report facilitates and accelerates action so the UK can top the leaderboard for drone services and solutions in the years to come.

**Dave Pankhurst** Drones Director BT Group

# Report scope and purpose

Drones are primed to be a key asset in the development of our future economy and society. Success requires advanced communications (such as 4G/5G), technological development, commercial demand and investment – but also clear and workable regulation. The purpose of this report is to assess the UK's position on drone market readiness against a set of international peers. From this analysis, we can define best practices that can be applied domestically to help UK policymakers advance an effective regulatory system to realise commercial drone flight at scale – and unleash the economic, social and environmental benefits this entails. We have designed a methodology (see Chapter 2 for the full methodology) to benchmark the UK against a set of other leading nations (including all countries in the G7) on their readiness for a flourishing drone market. The country set was selected on the basis of ensuring broad regional coverage, in addition to picking countries that have a comparable economic make-up to the UK, a mature telecoms and ICT technology market (e.g. mobile network coverage) and known drone activity or aspirations as part of enterprise digitisation. It includes the following regions and countries:



When creating an index there is, as ever, a question of how to read individual scores in a broader context. The purpose of creating an index here is threefold:

- **Benchmarking:** By using this country list, we can assess the extent to which the UK aligns or differs with individual countries as well as scaled regulatory systems, particularly the European Union Aviation Safety Agency (EASA), which oversees EU aerospace.
- Identifying drivers: The index provides a structured way to unpick how leading countries in the drone sector compare on underlying regulatory and market factors that collectively form the conditions for a successful and flourishing drone industry.
- Learning best practice: Equally important is to derive best practice from leading countries and identify how those can be used by UK policymakers to formulate a clear regulatory system to benefit the UK government's own ambitions in the drone sector.

In this sense, the index is not meant as a definitive and comprehensive assessment of each country. Rather, it serves as a framework to evaluate and track progress, particularly on key metrics for gaps to overcome, and to provide guidance on where improvements can be made to help the drone economy thrive in a market.

## Executive summary

#### The drone economy beckons, but a regulatory system fit for the future is needed

Drones will be a key part of the growth of digital economies, offering functionality that improves productivity, safety standards and environmental outcomes. In the UK alone, it is estimated drones can boost GDP by 1.6% by 2030. Research from BT Group of UK consumers also reveals growing public support. Two thirds of people think that drones will have a positive impact on their lives, with younger people particularly optimistic. Moreover, the majority of UK consumers would be happy to see the government and regulators allow a wide range of use cases for drones, in particular missing person searches and firefighting, but also other use cases such as air-pollution monitoring and traffic management. The majority (75%) think it is important or essential that drones are used more regularly for public service delivery.

Successful and sustainable industry development is therefore firmly in the national interest. Success requires advanced communications (such as 4G/5G), technological development, commercial demand and investment – but also clear and workable regulation.

#### The UK sits mid-table

To follow an evidence-based approach, we constructed an index split into two broad parts: one on regulatory status and the other on a range of market indicators that collectively assess economic strength, telecoms sector readiness and enterprise demand (i.e. from companies and organisations most likely to use drones as part of their operations). Key highlights from the analysis are as follows:

- The UK sits in the middle of the table. It has an overall drone readiness score of 62 out of a possible 100, with both the regulatory and economic categories trailing its European peers and the G7 average of 65. Progress is moving in the right direction though, given the beyond visual line of sight (BVLOS) permissions, with clarity on implementation now needed to increase commercial flight volume.
- Switzerland scores highest on overall drone readiness, with a score of 73. This is a result of regulatory alignment with Europe's EASA framework, strong network coverage and enterprise demand. The EASA alignment allows companies in the EU and partner nations (such as Switzerland) to operate on a level playing field, improving speed to market and economies of scale.

- The other featured European countries in EASA are harmonised on the same broad drone regulations. However, their overall readiness scores differ slightly based on differences in economic and/or telecoms and ICT advancement (e.g. 4G and 5G network coverage or adoption).
- Japan is the best performer in Asia with a score of 67. Japan matches EASA countries on the regulatory front, bolstered by early action and firm government support.
- The US sits near the bottom of the table. The US came joint bottom for drone regulations, reflecting slower progress in key areas such as BVLOS and conspicuity. However, it performs much better on the other index pillars, particularly on the telecoms and ICT metrics.

The situation is fluid, however. Regulators are seeking to pass key regulations in the coming 12–24 months, meaning these scores will change over time and should not be viewed as a final marker but rather an indication of the progress still required vis-à-vis international comparators.



#### Implications for UK policymakers: act now to move up

- The UK has made progress on several fronts. The UK's flagship Future Flight Challenge has been a clear help and stimulus to private sector innovation. Meanwhile, the UK's Civil Aviation Authority (CAA) released a revised Airspace Modernisation Strategy for 2023–2040, which places integration of all airspace users at the core of the strategy. The government also released the 'HM Government Response to Sir Patrick Vallance's Pro-Innovation Regulation of Technologies Review' in March 2023. Recommendations from the review provide some confidence that the CAA will further develop a framework simplifying BVLOS operations.
- BVLOS needs to be modernised and scaled. By enabling drones to be operated out of the visual sight from their controller, BVLOS plays an important role in extending the range of commercial drone services. Within our comparator group, 75% of countries, including all countries in Europe's EASA framework, now permit BVLOS with an enacted policy. The UK has set the policy framework but with unclear guidance on how it can be used in practice and at scale, costing time and risking confusion among the raft of companies and startups testing or seeking commercial deployment of their products. Establishing a more simplified set of BVLOS implementation guidelines - alongside modernising the supporting regulatory framework that includes a UTM (unmanned traffic management system), electronic conspicuity, safety standards and training – must be a priority. This is supported by research from BT Group which shows strong public support for allowing more frequent drone flights for a range of purposes.
- **Pro-innovation regulations and a regulatory culture are needed.** Our analysis, along with survey evidence and industry conversations, points to clear regulations as a necessary pre-condition for a thriving and scaled drone industry. This is to ensure safe operations, first and foremost, but also to give certainty to market participants. This places a greater emphasis on the CAA to work with the industry to formulate workable regulations that

help promote investment in a timely manner. In comparison, for example, Japan set four tiers for drone flight in 2021, before commercial launches became available. Equally important, over time, will be looking to ensure regulations are interoperable, or harmonised, with key trading partners, such as those in Europe, so that companies have a consistent playing field to operate in.

- Act now or risk losing out. There is a 12–24 month window of opportunity, as most unmanned aerial vehicle (UAV) sector participants expect drone regulations to be in place by 2024-2025 in advanced economies. 5G-Advanced standards, which will underpin low-latency use cases in enterprise settings, along with new capabilities catering specifically for unmanned aerial systems (UAS), will also crystallise in the same time period. In anticipation of this, drone technological innovation is continuing apace in parallel with commercial trials. For the UK, this sets a reasonable marker for a modernised drone regulatory system to be in place by to ensure it can remain competitive in developing home-grown technology for domestic use and in export markets - and not risk UK talent and innovation moving to other countries.
- Learn from others. A consistent observation from leaders such as Switzerland, Italy, Finland and Japan is the need for a coalescence of public and private sector participants to co-develop regulations that reflect both safety requirements and a commercial vision that unlocks private sector investment. The Finnish FUAVE initiative is a good example, as are Korea's nine demonstration cities, which underline the value of piloting technology at pace while being able to iterate on regulations at the same time. The UK would benefit from more testing areas in this respect. More broadly, the UK has many innovative companies in the drone sector operating at the cutting edge. These voices should be heard on the front line of regulatory development just as much as for commercial partnerships.

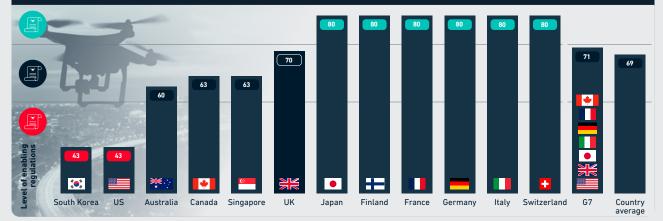
#### International drone leaderboard

For the UK to rise to the heights of the world-leading drone economies it must act fast



#### Drone regulation readiness ranking

The UK needs to modernise its regulatory and legislative regime to ensure it doesn't fall behind international competitors



#### The UK's potential to go from good to great on drones

The UK lags behind leading nations, such as Switzerland, across most indicators



# Overview and industry context: why now?

#### Drones are a key part of a digital economy

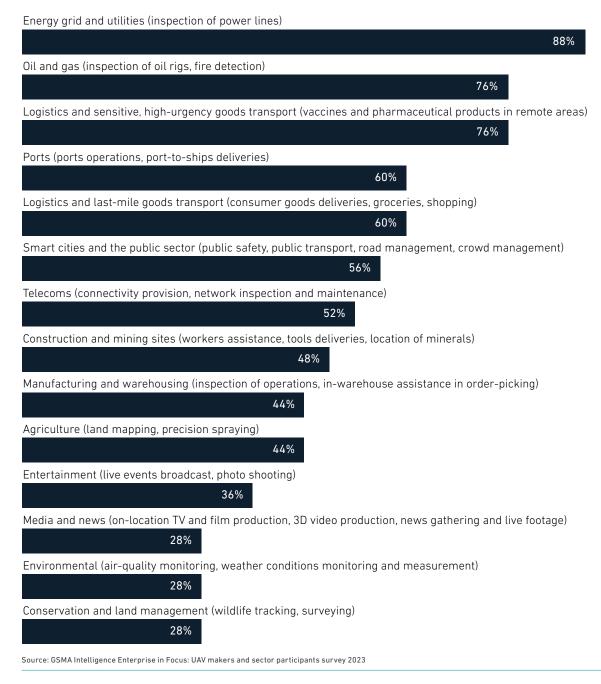
Drones will play a crucial role in the growth of digital economies, offering functionality that improves productivity, safety standards and environmental outcomes. In the UK alone, it is estimated drones can boost GDP by 1.6% by 2030. Successful and sustainable industry development is therefore firmly in the national interest.

Drone use at a commercial scale has been touted for several years, with momentum having grown in the 5G era from 2019 onwards. There are myriad reasons for this, many of them interconnected. The applicability of drones has expanded across different industries as the utility of unmanned flight, beyond the early use cases in public safety and surveillance, became apparent. For example, in a recent GSMA Intelligence survey of unmanned aerial vehicle (UAV) industry participants, seven different sectors were rated by more than half of respondents as being 'very' or 'extremely' important to drone revenues (see Figure 1). Industries with remote assets requiring diagnostics and maintenance (energy and power grids and oil and gas) continue to be the most obvious candidates, playing to the efficacy of drone surveillance and cost savings available from reducing truck rolls or manual call-outs. These sectors have been joined by a (sizeable) long tail of others, including ports, cities, manufacturing, last-mile logistics and distribution, and conservation and land/forestry management. Drone use in the public sector is also a high-potential use case, with applications in public safety and security, emergency response and health care operations in rural areas. Sector deployments play to the strengths of drones in terms of wide area surveillance, increased safety, productivity gains, cost reductions and energy savings. In some cases, however, drones are a means for generating new revenues, such as improving the quality of event broadcasts or in film production.

#### Figure 1

#### Drone interest spans a wide range of industries

How important do you see each industry in helping to drive drone revenue? (Percentage of respondents who rated a given industry as 'very' or 'extremely' important)



To a certain extent, the expanded interest in drones across different sectors has been helped by growing awareness, as deployments in one industry demonstrate applicability elsewhere. The use of a drone to monitor the conditions of a remote nickel mine can, for example, equally be used for overhead views of forests or fields used for agriculture. Similarly, the use of a drone by Amazon to deliver packages to rural areas that would otherwise require a van or courier can in turn be used for last-mile distribution of medicines to disaster zones.

Technological advancements also have a part to play. 5G connectivity has augmented the capabilities of LTE on speed and latency. On-board equipment has improved the payload capacity, and therefore range, of use cases beyond surveillance. Remote identification (ID) capabilities have emerged to permit drones to be tracked, just as aircraft are monitored through transponders. Detect-and-avoid systems have become more sophisticated, vastly minimising the risk of collision, which ties to developments on the regulatory front with regard to UTMs. The common thread here is that drones can now serve a wider range of deployment use cases with greater precision and safety mitigation measures in place. The economic benefits are sizeable, as are the positive effects related to the environment. These impacts are underscored by PwC's recent 'Skies without Limits' report, which shows that for the UK alone, drones offer:

- a £45 billion incremental annual boost to GDP by 2030 (equivalent to 1.6% of UK GDP)
- £22 billion in cost savings, primarily through reductions in road transport
- 270,000 new jobs, directly and indirectly through the supply chain
- CO<sub>2</sub> reductions totalling 2.4 million tonnes (the equivalent of removing 1.7 million cars from the road or energy needed to heat 2.8 million homes in the UK for a year).

While these figures might seem ambitious given the level of penetration today, there have been a raft of trials, deployments and funding schemes that argue the promise is very real, including:

- the Future Flight Challenge, sponsored by UK Research and Innovation
- an NHS trial for medicine delivery to the Isle of Wight<sup>1</sup>
- medical supplies delivery by Skyports to a group of 23 islands in the Scottish region of Argyll and Bute<sup>2</sup>
- services by Marshall Futureworx, powered by Sees.ai, for offshore autonomous inspection<sup>3</sup>
- the West of England Combined Authority's 5G Logistic project, which used autonomous drone flights for port surveillance and emergency response in the port of Bristol.<sup>4</sup>

#### Regulation is now the missing piece

Aside from reflecting technological gains and signalling industry demand, drone prospects have also become a political priority in many countries as a means of developing the digital economy. The UK is, for its part, squarely within this category, with the government having championed drone use as part of a broader industrial strategy. The UK government's Future Flight Challenge is a flagship investment programme designed to stimulate tech innovation from startups, scaleups, established companies or a combination of these groups. This involves a total investment envelope of £300 million over five years (2019–2024), of which £125 million will be allocated by the UK's funding agency, UK Research and Innovation, and £175 million will be invested by the private sector as part of the same initiative. Similar funding and accelerator initiatives have been set up by other countries, including the US, Switzerland and South Korea.

The principal barrier, however, has been the lack of a coherent set of regulations governing the safe operation of commercial drone flights at scale. As seen in Figure 2, UAV ecosystem participants rated regulation as the single biggest challenge to the onward success of the drone industry (80% of respondents rated it 'very' or 'extremely' challenging). This is twice as high as the next biggest factor and significantly greater than what would otherwise be common pain points for nascent technologies such as access to capital and public acceptance. The most fundamental objective from a regulatory perspective is to enable BVLOS flight. Other key objectives within the regulatory purview include UAV traffic management systems, protocols for remote ID of drones and rules on the use of spectrum frequencies for communications.

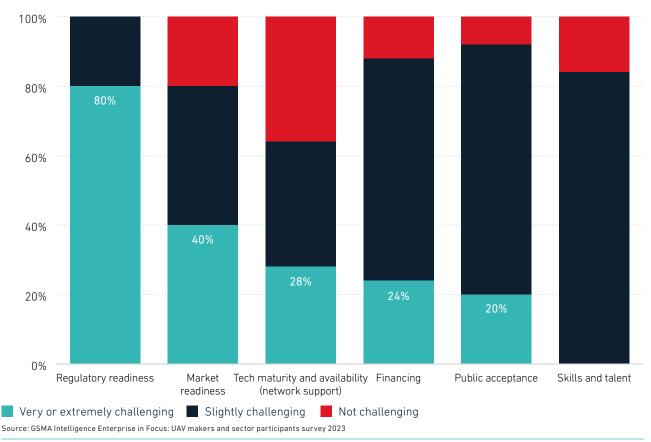
The good news is that progress is being made on the regulatory front to codify regulations on key performance and safety requirements that industry participants must follow. However, this progress is uneven, and countries that lag behind risk competitive disadvantages on multiple fronts. In particular, a lack of regulatory certainty and predictability of outcomes could lessen the UK's ability to attract drone investment and talent in an internationally competitive environment. It could also harm the UK's chances of unlocking productivity gains across its economy and public sector, as well as the consumer and citizen benefits achievable via drone-led enhancements to services across the public and private sectors.

The technology for drones is moving at pace. Having a clear and simplified regulatory system is now the main challenge; countries that are able to address this will benefit from an early mover advantage and have industrial gravitas.

#### Figure 2

#### The lack of a clear regulatory framework is viewed as the top challenge for drones success

Please rank the challenges for wide adoption of commercial use cases of UAVs in your target market (percentage of respondents)



## Our methodology: how does it work?

#### **Readiness index**

To follow an evidence-based approach, we constructed an index that is split into two broad parts: one on regulatory status and the other on a range of market indicators that collectively assess economic strength, telecoms sector readiness, and enterprise demand (i.e. from companies and organisations most likely to use drones as part of their operations). The logic of using these categories is that they are interconnected and jointly add up to a country having the most favourable conditions for a successful drone industry:

- **Regulation** sets the rules and playing field that market participants follow and therefore ties everything together. This encompasses a range of requirements and permissions such as BVLOS flight and drone ID.
- **Economic strength** measures a country's level of wealth and business investment, which underpin conditions for drone innovation and adoption.
- Telecoms sector readiness assesses the infrastructure coverage and adoption for 4G and 5G cellular technologies, both of which will play a growing role in facilitating drone communications.
- Enterprise demand assesses the propensity of different industries to use drones as a part of business operations.

Most civil aviation authorities have a long-term vision of a fully integrated airspace with crewed and non-crewed vehicles, albeit with different starting points and approaches to achieve this. Such an integrated model of airspace would maintain or improve current safety standards and digitise identification and tracking. Below we have split out the regulatory metrics included in the index, along with how they are connected (see the Appendix for a full summary of metrics, definitions and weights used in the index):

- To assist with the development of fully integrated airspace, it is important that airspace users are known and visible (**drone ID**). Most countries are approaching this with the introduction of an electronic identification or an **electronic conspicuity**.
- There is a global consensus about the importance of allowing **BVLOS** flights in order to scale dronebased services and make them commercially viable, as well as ensuring safety by avoiding the need for people to enter hazardous situations. Most countries are therefore setting up regulation related to BVLOS operations.
- Regulation on **UTM** (U-Space for EASA members) is also important for understanding how countries are approaching digitisation and full integration with traditional airspace users.
- The above regulatory metrics have an intersection with telecoms networks. The permission to use a certain set of mobile frequencies (**mobile airborne permission**) will become increasingly important for drone operators and mobile operators to provide the appropriate services. While other communications channels for drones exist, mobile connectivity offers significant benefits in terms of its pervasiveness, resilience and latency. Even in use cases where mobile is not (initially) the primary communications channel, we would expect the large majority of countries to wish to build in redundancy into drone communications such that a number of technologies connect drones in the event that any one technology faces disruption.

#### How to interpret the scores

#### Weights

- Each metric has been assigned a weighting factor, which corresponds to the relative level of importance a metric has on the overall index score; the higher the weight, the higher the importance.
- The index is weighed 50% on the regulatory metrics and 50% on market indicators (economic, telecoms and sector demand). This reflects the fact that a successful drone economy requires both components in equal measure.
- Weightings have been determined through a combination of research, data analysis and industry conversations about which indicators have the largest bearing on the drone market. There is, of course, an element of judgement here. For example, while the regulatory metrics comprise 50% of the overall index, the ability to operate BVLOS flights is weighted higher (15%) than other metrics because without BVLOS, drone flight would be fundamentally constrained to small-scale pilots, precluding any kind of scaled development across different industries.

#### **Rating scales**

- For the regulatory metrics and drone safety (part of the demand component of the index) we have scored each country on a 1–3 scale (see the Appendix for a full summary of the rating scale).
- This is done to provide a like-for-like comparison across different countries on a standardised scoring method that can be expressed quantitatively.
- This score for each country on drone regulation, however, is balanced with an explanation of the underlying drivers and implications. This is particularly important when one considers the nuances involved. For instance, having a policy in place for BVLOS or UTM is good (a score of 2); but even though two countries may be working towards enacting such policies, how far away they are from doing so may be different.

#### **Overall scores**

- The overall index scores are calculated on a bottom-up basis:
  - Each metric is populated with its raw data value for a given country (e.g. Germany has a BVLOS score of 3, a GDP per capita of \$49,430, 5G network coverage of 95% of population and so forth).
  - The raw data for each individual metric is converted, or normalised, to an indexed value between 0 and 100. The indexed score is the ratio of the raw data value divided into the maximum range value, multiplied by 100 (e.g. Germany's BVLOS score is (3/3) × 100 = 100; Germany's GDP per capita score is (\$49,430/\$94,380) × 100 = 52. The maximum range values in these examples are 3 (the top value in the 1–3 scale for each regulatory metric) and \$94,380 (the highest GDP per capita of the 12 countries, Switzerland, expressed in USD).
  - The maximum range value is either the largest value for a given metric among our country set or a higher value if the dataset is likely to change over time. For example, drone revenue as a share of national GDP is likely to rise as the industry matures. So, rather than taking the top estimated value among these countries at the current point in time, we have used a maximum value based on expected sales in 2025 – providing headroom for countries to move up on this dimension of the index.
  - After each metric has been transformed from raw values to the index, the maximum value is 100.
  - This indexed value is then multiplied by the metric weight (e.g. Germany's BVLOS score of 100 × 5% index value = 5.0).
  - The weighted scores for each metric are then summed to arrive at an index score for each of the four categories, which then combine for the overall index value.
- We provide splits by category to show the drivers for the overall index scores. These are also expanded upon in each of the country analyses in Chapter 3.

# Key findings and country comparison

To provide more detail on each of the countries featured in our analysis, we have provided a breakout of each country with its index score and commentary to illuminate influencing factors. The country breakouts can be found on the subsequent pages.

The headline results of the analysis are shown below, specifically how countries score on overall readiness (the overall score, which factors in the weighted scores on drone regulations, economic strength, telecoms sector readiness, and industry demand), with breakdowns for individual index component scores shown on subsequent country pages. This offers several insights:

- Switzerland scores highest on overall drone readiness, a result of EASA regulatory alignment, strong network coverage and enterprise demand. The EASA alignment is important because it allows companies in the EU and partner nations (such as Switzerland) to operate on a level playing field, improving speed to market and economies of scale.
- The other featured European countries in the EASA framework are harmonised on the same broad drone regulations, although their overall readiness scores differ slightly based on differences in economic or telecoms/ICT advancement (e.g. 4G and 5G network coverage or adoption).

- The UK sits in the middle of the table. It has a comparatively lower overall readiness score, with both the regulatory and economic categories trailing its European peers. Progress is moving in the right direction though, given the BVLOS permissions, with clarity on implementation now needed to increase commercial flight volume.
- Japan is the best performer in Asia, matching EASA countries on the regulatory front, bolstered by early action and firm government support.

The situation is fluid, however. Regulators are seeking to pass key regulations in the coming 12–24 months, meaning these scores will change over time and should not be viewed as a final marker but rather an indication of the progress still required vis-à-vis international comparators.





The UK sits in the middle of the table overall, behind Switzerland, other European EASA countries and Japan, but ahead of the US, Canada and others in Asia Pacific. Pre-Brexit, UK aviation regulation was under EASA with other European countries. Hence, early regulations that have been put in place are aligned with the European ones, such as the licensing and identification of the pilot, and the different categories (open, specific and certified). However, subsequent regulations have deviated from EASA. The UK has since focused more on electronic conspicuity than electronic identification, with the intent to create a solution that embraces all airspace users for full situation awareness. At the end of 2021, the CAA and Department of Transport published a joint statement about the establishment of a task force and study with three phases,<sup>5</sup> with the third phase concluding at the end of 2022. There was a possibility of allocating the 978 MHz band for unmanned aircraft systems (UAS) use, but the CAA has determined this is no longer in play.

At the time of this report's publication, the UK does not have rules for electronic drone ID or UTM. While the CAA has convened a working group on electronic conspicuity, activities have not translated into a defined framework yet. That said, discussions on electronic drone ID started at the beginning of 2023 and the CAA is evaluating the need for electronic ID and the difference compared to electronic conspicuity.

Regarding BVLOS, the rules are defined under CAP 722.<sup>6</sup> For the 'specific' category, it is mandatory to provide risk assessment, but it is an ad hoc manual process and the CAA states that it receives many requests, which is putting pressure on the industry workforce and resulting in a lengthy process. In contrast to EASA, there are also no standard scenarios and no automation in the requests. In general, compared to the European countries, the CAA is behind in providing a regulatory framework for allowing automated BVLOS operation. However, the UK's Office of Communications (Ofcom) is the first regulator to put in place a licence for UAS operators that want to use cellular bands,<sup>7</sup> which is a positive development. The government published a strategy on aerospace innovation in 2022,<sup>8</sup> which features drones. According to a policy paper by the government,<sup>9</sup> there is huge potential for drones, which PWC recently estimated could be worth £45 billion to the UK economy by 2030.<sup>10</sup> At the beginning of 2023, the CAA also released a revised Airspace Modernisation Strategy for 2023-2040,<sup>11</sup> with four strategic objectives: safety, integration, simplification and environmental sustainability. By placing integration of all airspace users at the core of the strategy, the decisions taken so far in relation to UAS start with electronic conspicuity. UTM is also included in the strategy, which will duly be one of the next items the CAA will look at. In March, the government released the 'HM Government Response to Sir Patrick Vallance's Pro-Innovation Regulation of Technologies Review',<sup>12</sup> highlighting three recommendations:

- The government should work with the CAA to establish an operating standard for drones.
- The government should empower the CAA to better regulate the use of BVLOS remotely piloted air systems (including drones and UAVs). This should include the establishment of publicly owned test sites, developed in partnership with industry and other bodies to meet specific industry needs.
- Ofcom/CAA regulation on radio communications should be amended to allow the use of UAVs/ drones/high-altitude platform station (HAPS) systems to act as radio repeaters.

These recommendations provide some confidence that the CAA will further develop a framework simplifying BVLOS operations. In 2022, the CAA also released the 'The UK National Aviation Safety Plan 2022–2024',<sup>13</sup> which identified some of the safety risks associated with drones and potential remedies. The UK is also leveraging the Air Accidents Investigation Branch (AAIB), a well-reputed organisation globally, to report all UAV incidents. Any incident can be voluntarily reported by anyone that witnesses the occurrence. The AAIB then provides regular reports of that incident.

				Index scores*		
		Raw data	Metric weight	ик	G7	Total sample average
Drone	Drone ID (network or broadcast)	1	5%	33	67	64
regulations	Electronic conspicuity	2	5%	67	38	39
	BVLOS (policy)	3	15%	100	90	89
	BVLOS (restrictions)	2	10%	67	67	67
	UTM	1	10%	33	71	67
	Mobile airborne permission	3	5%	100	57	50
	Total		50%			
Economic	Population (million)	68				
	GDP per capita (USD)	51,290	8%	54	53	60
(5)	R&D as a percentage of GDP	1.70%	2%	35	51	55
	Total		10%			
Telecoms and ICT	4G network coverage (percentage of population)	100%	5%	100	100	100
	5G network coverage (percentage of population)	63%	5%	63	88	88
	Percentage of 4G connections (share of mobile subscribers)	79%	5%	79	73	71
	Percentage of 5G connections (share of mobile subscribers)	17%	5%	17	20	23
	Total		20%			
Demand	Sector propensity to adopt (operator survey)	33%	5%	33	34	34
(enterprise sectors)	Drone revenue as a percentage of national GDP	0.028%	5%	28	34	34
$\mathbb{D}$	IoT connections per pop (cellular only)	0.36	5%	56	62	56
	Safety record	2	5%	67	67	61
	Total		20%			
Index score	Drone regulations			70	71	69
	Overall readiness (all four categories)			62	65	64



The US came joint bottom for drone regulations in the index, reflecting slow progress in key areas such as BVLOS and conspicuity. Drone operators seeking to fly BVLOS require a waiver from the Federal Aviation Administration (FAA). However, the FAA lacks a consistent set of criteria for granting waivers, thereby limiting the use of commercial drones in the US. The Increasing Competitiveness for American Drones Act of 2023 aims to simplify the approvals process for BVLOS drone flights by requiring the FAA to automatically authorise BVLOS operations under certain circumstances. The FAA is also introducing new rules on drone ID, meaning that from September 2023 most drones operating in US airspace will be required to have remote ID capability. The US performs much better on the other pillars of the drone index, particularly on the telecoms and ICT metrics. In addition to nationwide 5G coverage, the US has the highest 5G adoption rate and number of IoT connections per capita. Mobile operators are exploring the combination of 5G, mobile edge computing (MEC) and drones in several areas, including healthcare and emergency response.<sup>14</sup> Retail is another sector exploring drone applications. Walmart, for example, completed more than 6,000 drone deliveries in 2022. Current regulations mean that the retailer keeps line-of-sight for all deliveries. Its drones deliver items anywhere from 0.5 to 1.5 miles from Walmart delivery hubs; the retailer plans to offer longer-range deliveries in the future. To stimulate drone adoption, the FAA has set up seven test sites to support companies with their research and development. Initial pilots have focused on package delivery, national critical infrastructure inspections and urban air mobility (UAM).

				Index scores*		
		Raw data	Metric weight	US	G7	Total sample average
Drone	Drone ID (network or broadcast)	1	5%	33	67	64
regulations	Electronic conspicuity	1	5%	33	38	39
	BVLOS (policy)	1	15%	33	90	89
	BVLOS (restrictions)	2	10%	67	67	67
	UTM	1	10%	33	71	67
	Mobile airborne permission	2	5%	67	57	50
	Total		50%			
Economic	Population (million)	331				
	GDP per capita (USD)	78,420	8%	83	53	60
(5)	R&D as a percentage of GDP	3.50%	2%	73	51	55
	Total		10%			
Telecoms and ICT	4G network coverage (percentage of population)	99%	5%	99	100	100
	5G network coverage (percentage of population)	98%	5%	98	88	88
	Percentage of 4G connections (share of mobile subscribers)	56%	5%	56	73	71
	Percentage of 5G connections (share of mobile subscribers)	43%	5%	43	20	23
	Total		20%			
Demand	Sector propensity to adopt (operator survey)	35%	5%	35	34	34
(enterprise sectors)	Drone revenue as a percentage of national GDP	0.062%	5%	62	34	34
B	IoT connections per pop (cellular only)	0.64	5%	100	62	56
	Safety record	2	5%	67	67	61
	Total		20%			
Index score	Drone regulations			43	71	69
	Overall readiness (all four categories)			58	65	64
				l		



Canada came joint eighth for regulation. It has made progress on BVLOS and mobile airborne permission, but lacks policies covering conspicuity, drone ID and UTM. Drone operators must acquire a special flight operations certificate (SFOC) to fly their drones BVLOS. The first approval in Canada for a BVLOS drone flight came in 2020 when Iris Automation was granted permission to fly its drones, integrating detect-and-avoid technology, at a test range in Quebec. There are plans to introduce a tier of certification that would make it easier for drone operators to undertake BVLOS flights in low-risk conditions. Steps have also been taken to develop policy in other areas, as demonstrated by recent tests and trials. For example, mobile operator Telus and UTM provider AirMarket demonstrated a UTM solution at an energy site in Alberta. The solution combines data from the Telus mobile network with computer vision technology to enable drones to be operated at scale in national airspace.

In Canada, there is significant interest in using drones for deliveries to overcome the challenge of transporting goods to remote communities. However, Transport Canada does not currently allow commercial BVLOS drone operations over buildings and people. This limits the commercial use of drones for logistics. To improve drone safety, Drone Delivery Canada has signed a three-year collaboration agreement with Bell to use 5G and edge computing to support BVLOS flights, remote ID, command and control, and UTM systems. The partnership shows the growing interest from enterprise sectors in Canada in using 5G, reflecting the strong progress made on 5G rollouts and the moves by Bell and Rogers to commence 5G standalone (SA) deployments.

				Index scores*		
		Raw data	Metric weight	Canada	G7	Total sample average
Drone	Drone ID (network or broadcast)	1	5%	33	67	64
regulations	Electronic conspicuity	1	5%	33	38	39
	BVLOS (policy)	3	15%	100	90	89
	BVLOS (restrictions)	2	10%	67	67	67
	UTM	1	10%	33	71	67
	Mobile airborne permission	1	5%	67	57	50
	Total		50%			
Economic	Population (million)	38				
	GDP per capita (USD)	59,180	8%	62	53	60
(5)	R&D as a percentage of GDP	1.60%	2%	33	51	55
	Total		10%			
Telecoms and ICT	4G network coverage (percentage of population)	99%	5%	99	100	100
	5G network coverage (percentage of population)	83%	5%	83	88	88
	Percentage of 4G connections (share of mobile subscribers)	71%	5%	71	73	71
	Percentage of 5G connections (share of mobile subscribers)	23%	5%	23	20	23
	Total		20%			
Demand	Sector propensity to adopt (operator survey)	35%	5%	35	34	34
(enterprise sectors)	Drone revenue as a percentage of national GDP	0.028%	5%	28	34	34
B	loT connections per pop (cellular only)	0.18	5%	28	62	56
	Safety record	2	5%	67	67	61
	Total		20%			
Index score	Drone regulations			63	71	69
	Overall readiness (all four categories)			59	65	64



Switzerland came joint top for drone regulations, underpinned by its global leadership in areas such as BVLOS, drone ID and UTM. In 2017, Switzerland authorised the world's first BVLOS drone flight over a city and in controlled airspace. It was also the first country to implement network remote ID. Given its geographical position in the middle of Europe, the Swiss Federal Office of Civil Aviation (FOCA) has worked closely with EASA to shape drone regulations in Europe for several years. This led to Switzerland adopting EU regulation on the manufacturing and flying of drones at the start of 2023, which includes the European U-space regulation.

Switzerland also tops the rankings in overall market readiness. This is helped by nationwide 5G coverage, which is laying the foundation for new drone use cases. The agricultural sector has been the centre of early interest. Swisscom is working with Swiss startup Aero41 to deploy 5G crop-spraying drones for use in viticulture, while Sunrise is working on a similar project with Agroscope, Fenaco, Huawei and OST (Eastern Switzerland University of Applied Sciences).

Switzerland's drone sector also benefits from strong academic research output, led by the National Centre of Competence in Research (NCCR) Robotics. However, even in advanced markets such as Switzerland, challenges still exist. Five years after its first flight, Swiss Post announced it was ending its project to use drones to transport lab samples between hospitals because the current regulatory environment means it is unable to use drones widely enough to operate them at a profit. This highlights the need to make continued progress on the regulatory front, such as allowing BVLOS flights in more places.

Raw data   Metric weight   Switzerand   67   Progenetic series of the series of t					Index scores*		
Program       Electronic conspicuity       1       5%       33       38       39         Program       Electronic conspicuity       1       5%       33       38       39         BVLOS (policy)       3       15%       100       90       89         DVLOS (restrictions)       2       10%       67       67       67         UTM       3       10%       100       71       67         Mobile airborne permission       1       5%       33       57       50         Economic       Population (million)       8.6       70       67       67         Mobile airborne permission       1.0%       2%       65       51       55         Economic       GDP per capita (USD)       94,830       8%       100       100       100         Mobile airborne coverage       100%       5%       100       1			Raw data	Metric weight	Switzerland	G7	
Electronic conspicuity       1       5%       33       38       39         BVLOS (policy)       3       15%       100       90       89         BVLOS (policy)       2       10%       67       67       67         Mobile airborne permission       1       5%       33       57       50         Total       50%       33       57       50       50         Economic       Population (million)       8.6       51       55       50         Mobile airborne permission       100%       5%       100       53       60         Mobile airborne (million)       8.6       51       55       55       55         Economic       Population (million)       8.6       51       55       55         Mobile airborne coverage       100%       5%       100       100       100         Fereentage of GDP       3.10%       5%       99       88       88         Percentage of AG connections (chare of mobile subscribers)       6%       5%       68       73       71         Percentage of AG connections (chare of mobile subscribers)       13% </td <td></td> <td>Drone ID (network or broadcast)</td> <td>3</td> <td>5%</td> <td>100</td> <td>67</td> <td>64</td>		Drone ID (network or broadcast)	3	5%	100	67	64
BVLOS (restrictions)       2       10%       67       67       67         UTM       3       10%       100       71       67         Mobile airborne permission       1       5%       33       57       50         Total       50%       7       50       7         Economic       Oppler capita (USD)       94,830       8%       100       53       60         R8D as a percentage of GDP       3.0%       2%       65       51       55         Telecoms       Genetwork coverage (percentage of population)       99%       5%       99       88       88         Percentage of 5G connections (share of mobile subscribers)       68%       5%       68       73       71         Percentage of 5G connections (share of mobile subscribers)       1%       5%       21       20       23         Tendifie       Sector propensity to adopt (opercentage of 5G connections (share of mobile subscribers)       3%       5%       28       34       34         Total       20%       5%       28       34       34         Operator survey)       33%       5%       52       62	regulations	Electronic conspicuity	1	5%	33	38	39
Affinition       3       10%       100       71       67         Mobile airborne permission       1       5%       33       57       50         Economic       Population (million)       8.6		BVLOS (policy)	3	15%	100	90	89
Mobile airborne permission     1     5%     33     57     50       Total     50%     50%     50%     50%     50%       Economic     Population (million)     8.6     50%     500     53     600       GDP per capita (USD)     94,830     8%     1000     53     600       Rab as a percentage of GDP     3.10%     2%     655     51     55       Telecoms     (for centage of population)     100%     5%     99     88     88       Percentage of 4G connections (share of mobile subscribers)     68%     5%     68     73     71       Percentage of 5G connections (share of mobile subscribers)     68%     5%     21     20     23       Opercentage of 5G connections (share of mobile subscribers)     68%     5%     23     34     34       Percentage of 5G connections (share of mobile subscribers)     63%     5%     28     34     34       Opercentage of 1GC on population     0.028%     5%     28     34     34       Percentage of 5G connections (share of mobile subscribers)     68%     5%     28     34     34    1		BVLOS (restrictions)	2	10%	67	67	67
Total     50%       Economic     Population (million)     8.6       GDP per capita (USD)     94,830     8%     100     53     60       R&D as a percentage of GDP     3.0%     2%     65     51     55       Telecoms     4G network coverage (percentage of population)     90%     5%     100     100     100       SG network coverage (percentage of population)     99%     5%     99     88     88       Percentage of SC connections Schare of mobile subscribers)     68%     5%     66     73     71       Percentage of SC connections Schare of mobile subscribers)     20%     5%     21     20     23       Descriptions Centerprise of national GDP     0.028%     5%     33     34     34       Orone revenue as a percentage of national GDP     0.33     5%     28     34     34       Orone revenue as a percentage of national GDP     0.33     5%     67     67     61       Orone revenue as a percentage of national GDP     0.33     5%     67     67     61       Orone revenue as a percentage of national GDP     0.33     5%     67     67		UTM	3	10%	100	71	67
Economic     Population (million)     8.6       GDP per capita (USD)     94,830     8%     100     53     60       R&D as a percentage of GDP     3.10%     2%     65     51     55       Telecoms     (fontwork coverage (percentage of population)     10%     5%     100     100     100       Felecoms     (fontwork coverage (percentage of population)     99%     5%     99     88     88       Percentage of foc connections (share of mobile subscribers)     68%     5%     68     73     71       Percentage of foc connections (share of mobile subscribers)     21%     5%     21     20     23       Percentage of foc connections (share of mobile subscribers)     21%     5%     33     34     34       Orne revenue as a percentage     0.028%     5%     28     34     34       Intervence     20     5%     52     62     56       Intervence     20%     5%     52     62     56       Intervence     20%     5%     52     62     56       Intervence     20%     5%     67     67     61		Mobile airborne permission	1	5%	33	57	50
Index score       GDP per capita (USD)       94,830       8%       100       53       60         R8D as a percentage of GDP       3.10%       2%       65       51       55         Total       10%       5%       100       100       100         Felcoms and ICT       {Gn etwork coverage (percentage of population)       100%       5%       100       100       100         SG network coverage (percentage of fopulation)       99%       5%       99       88       88         Percentage of fopulation)       99%       5%       68       73       71         Percentage of GG connections (share of mobile subscribers)       68%       5%       68       73       71         Percentage of 5G connections (share of mobile subscribers)       21%       5%       21       20       23         Ferentage of 5G connections (share of mobile subscribers)       33%       5%       33       34       34         Intermedifier       0.028%       5%       28       34       34         Intermedifier       0.33       5%       52       62       56         Intetaritional GDP (cellular only)       20		Total		50%			
Rab as a percentage of GDP       3.10%       2%       65       51       55         Total       10%       10%       100       100       100       100         Telecoms and ICT       4G network coverage (percentage of population)       100%       5%       100       100       100         Sector propensity to adopt (percentage of mobile subscribers)       68%       5%       68       73       71         Percentage of AG connections (share of mobile subscribers)       21%       5%       21       20       23         Demand (enterprise sectors)       Sector propensity to adopt (rational GDP       33%       5%       33       34       34         I or connections per pop (cellular only)       0.33       5%       52       62       56         Safety record       2       5%       67       67       61       61         Index score       Drone regulations       20%       5%       80       71       69         Quercentage of sconnections per pop (cellular only)       0.33       5%       52       62       56         Total       20%       67       67       61       61       61<	Economic	Population (million)	8.6				
Total10%Felecons (percentage of population)100%5%100100100So network coverage (percentage of population)99%5%998888Percentage of 4G connections (share of mobile subscribers)68%5%687371Percentage of 5G connections (share of mobile subscribers)21%5%212023Percentage of 5G connections (share of mobile subscribers)21%5%333434Percentage of 5G connections (share of mobile subscribers)33%5%333434Percentage of 5G connections (share of mobile subscribers)0.028%5%283434Percentage of 5G connections (share of mobile subscribers)0.028%5%526256Percentage of 5G connections (coperator survey)0.335%526256Pono revenue as a percentage of national GDP0.335%526256Iof Connections per pop (cellular only)2.0335%526256Safety record25%67615664Index score Overall readinessPono regulations736564		GDP per capita (USD)	94,830	8%	100	53	60
Telecoms     4G network coverage (percentage of population)     100%     5%     100     100     100       5G network coverage (percentage of population)     99%     5%     99     88     88       Percentage of population)     99%     5%     68     73     71       Percentage of 5G connections (share of mobile subscribers)     68%     5%     68     73     71       Percentage of 5G connections (share of mobile subscribers)     21%     5%     21     20     23       Demand (centerprise sectors)     Sector propensity to adopt (operator survey)     33%     5%     33     34     34       Done requilation GDP of national GDP     0.028%     5%     28     34     34       IoT connections per pop of national GDP     0.33     5%     52     62     56       Safety record     2     5%     67     67     61       Index score     Drone regulations     20%     71     69       Verail readiness     90     80     71     69	(5)	R&D as a percentage of GDP	3.10%	2%	65	51	55
Telecoms and ICT(percentage of population)100%5%100100%100SG network coverage (percentage of population)99%5%998888Percentage of 4G connections (share of mobile subscribers)68%5%687371Percentage of 5G connections (share of mobile subscribers)21%5%212023Total20%Demand (enterprise sectors)Sector propensity to adopt (operator survey)33%5%333434Demand (enterprise sectors)Sector propensity to adopt (cellular only)0.335%526256Safety record25%67676161Index score Overall readinessDrone regulations807169Overall readiness		Total		10%			
SG network coverage (percentage of population)99%5%998888Percentage of population)68%5%687371Percentage of 4G connections (share of mobile subscribers)21%5%212023Percentage of 5G connections (share of mobile subscribers)21%5%212023Demand (enterprise sectors)Sector propensity to adopt (operator survey)33%5%333434Demand (enterprise of national GDP0.028%5%283434Index scoreDrone regulations25%676761Index scoreDrone regulations25%807169Overall readinessOverall readiness736564			100%	5%	100	100	100
Sector propensity to adopt (operator survey)33%5%687371Demand (enterprise sectors)Sector propensity to adopt (operator survey)33%5%333434Demand (operator survey)0.028%5%333434Demand (operator survey)0.028%5%526256Demand (operator survey)0.335%526256Demand (operator survey)0.335%5%676761Demand (operator survey)0.335%5%676761Demand (cellular only)25%807169Index score (operall readiness)Drone regulations807169Drone regulations73717171Demand (cellular only)736564			99%	5%	99	88	88
(share of mobile subscribers)21%5%212023Total20%Demand (operator survey)33%5%333434Demand (operator survey)33%5%333434Drone revenue as a percentage of national GDP0.028%5%283434IoT connections per pop (cellular only)0.335%526256Safety record25%676761Index score Overall readinessDrone regulations807169			68%	5%	68	73	71
Demand (enterprise sectors)Sector propensity to adopt (operator survey)33%5%333434Drone revenue as a percentage of national GDP0.028%5%283434Do connections per pop (cellular only)0.335%526256Safety record25%676761Total20%Index scoreDrone regulations807169Overall readiness736564			21%	5%	21	20	23
Demand (enterprise sectors)(operator survey)35%5%333434Drone revenue as a percentage of national GDP0.028%5%283434IoT connections per pop (cellular only)0.335%526256Safety record25%676761Total20%Index scoreDrone regulations Overall readiness807169Overall readiness736564		Total		20%			
sectors)Drone revenue as a percentage of national GDP0.028%5%283434IoT connections per pop (cellular only)0.335%526256Safety record25%676761Total20%Index scoreDrone regulations807169Overall readiness736564	Demand		33%	5%	33	34	34
(cellular only)0.335%526256Safety record25%676761Total20%7169Overall readiness736564	(enterprise sectors)		0.028%	5%	28	34	34
Total   20%     Index score   Drone regulations     Overall readiness   73	B		0.33	5%	52	62	56
Index score Drone regulations 80 71 69 Overall readiness 73 65 64		Safety record	2	5%	67	67	61
Overall readiness 73 65 64		Total		20%			
	Index score	Drone regulations			80	71	69
(all four categories)		Overall readiness (all four categories)			73	65	64



France is one of the 31 member countries of the EASA, so the regulation base is the same as it is for Finland, Germany, Italy and Switzerland. Each country is, however, on a different implementation timeline and has made different choices on how to implement the regulations. France was the first country to go ahead with a rule for electronic drone ID by means of broadcasting the information. The rules were changed in 2021 to follow EASA, which means that drones purchased after 2021 are subject to the EASA rules and require a CE marking.<sup>15</sup> The U-space (UTM) came into entry in January 2023 in France,<sup>16</sup> with the required four services mandated by EU 2021/664,17 EU 2021/66518 and EU 2021/666:<sup>19</sup> the network identification service; the geo-awareness service; the UAS flight authorisation service; and the traffic information service.

For the common information services (CIS), France seems to have opted for a single service provider in a U-space area, which may be designated by the state. This type of service provider is called a single common information service provider (CISP) and it must also have a European certificate. However, like most of the EASA members there is no actual implementation of the CISP or the U-space. Implementation may happen in 2023, although it is difficult to say in which countries this will occur. France scores lower on the economic indicator and sits in the middle of the table for telecoms and ICT, with very high coverage of 5G but a lower uptake compared to, for example, the UK. France also has a history in aviation with companies such as Airbus and Thales, which are embarking in this sector either from the manufacturing side or as a USSP/UTM provider. France is probably the second-largest EU country in terms of commercial UAS market size and has a healthy number of UAV manufacturers, notably Parrot, Delta Drone and Delair. Parrot released ANAFI AI, which has been one of the first commercial drones with 4G-embedded connectivity.

Applications such as precision farming, plot mapping and public safety appear to be the most popular use cases. For example, Drone Volt<sup>20</sup> specialises in spraying, an up-and-coming application, particularly in viticulture.

Regarding the safety indicator, EASA member states report all aviation incidents, including for UAVs, through the same system, called ECCAIRS 2.<sup>21</sup> In addition, EASA publishes a regular safety review,<sup>22</sup> which shows a drop in accidents since the introduction of the first rules.

				Index scores*		
		Raw data	Metric weight	France	G7	Total sample average
Drone	Drone ID (network or broadcast)	3	5%	100	67	64
regulations	Electronic conspicuity	1	5%	33	38	39
	BVLOS (policy)	3	15%	100	90	89
	BVLOS (restrictions)	2	10%	67	67	67
	UTM	3	10%	100	71	67
	Mobile airborne permission	1	5%	33	57	50
	Total		50%			
Economic	Population (million)	65				
	GDP per capita (USD)	42,650	8%	45	53	60
(5)	R&D as a percentage of GDP	2.30%	2%	48	51	55
	Total		10%			
Telecoms and ICT	4G network coverage (percentage of population)	100%	5%	100	100	100
	5G network coverage (percentage of population)	88%	5%	88	88	88
	Percentage of 4G connections (share of mobile subscribers)	76%	5%	76	73	71
	Percentage of 5G connections (share of mobile subscribers)	8%	5%	8	20	23
	Total		20%			
Demand	Sector propensity to adopt (operator survey)	33%	5%	33	34	34
(enterprise sectors)	Drone revenue as a percentage of national GDP	0.028%	5%	28	34	34
B	IoT connections per pop (cellular only)	0.42	5%	66	62	56
	Safety record	2	5%	67	67	61
	Total		20%			
Index score	Drone regulations			80	71	69
	Overall readiness (all four categories)			68	65	64

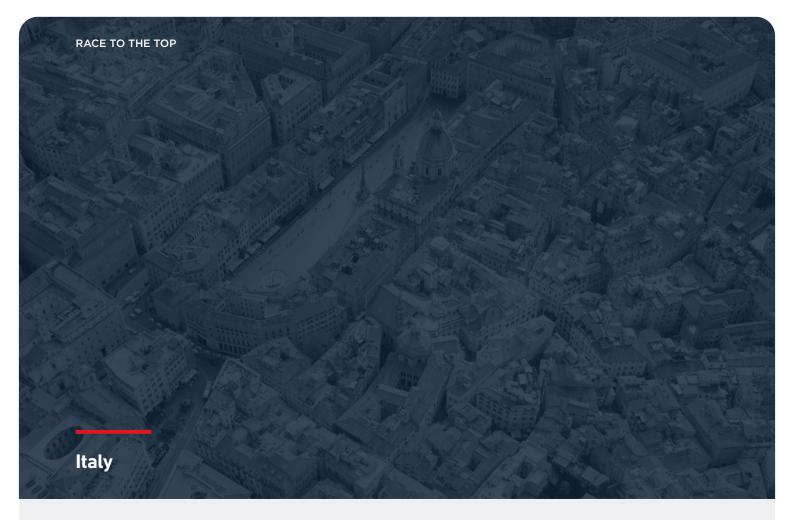


Germany is a member of EASA. In 2019, a joint venture was formed between the German air navigation service provider (DFS) and Deutsche Telekom to yield Dronig, which provides the traffic management component of U-space. Droniq is unique in the industry, combining experience in aviation and telecoms, and it was among the first in Europe to release an LTE-based transponder. Unlike other countries, Germany has taken the decision that some of the functions mandated for U-space are provided by a single national entity. Dronig has recently applied to be a certified USSP, but in Germany there is no entity assigned for the certification and hence the process may take a long time before having U-space implemented. Some of the most common applications are in the area of inspections (both vertical and linear, such as construction, towers, power lines and gas pipelines) and for public safety.<sup>23</sup>

Germany is considered the biggest EU country in terms of commercial drone market size. This is made evident by the number of companies in the drone ecosystem, even if the majority of those are startups, as highlighted in the federal government's Unmanned Aircraft Systems and Innovative Aviation Strategies.<sup>24</sup> Innovation is also driven by national research establishments such as the German Aerospace Center (DLR). Germany has also allocated funding of up to €50 million for UAS and UAM projects from 2020 to 2023.

From the economic and telecoms and ICT indicators, Germany is performing reasonably well, similar to Finland and Japan. Overall, Germany comes joint third in market readiness.

Raw data   Metric weight   Germany   67   Paralessing     Drone ID (network or broadcast)   3   5%   100   67   64     Image: Interpretention of the Interpre					Index scores*		
Program       Electronic conspicuity       1       5%       33       38       39         Program       Electronic conspicuity       1       5%       100       90       89         BVLOS (policy)       3       15%       100       90       89         DVLOS (restrictions)       2       10%       667       67       67         UTM       3       10%       100       71       67         Mobile airborne permission       1       5%       33       57       50         Feconomic       Population (million)       84			Raw data	Metric weight	Germany	G7	
Flectronic conspicuity   1   5%   33   38   39     BVLOS (policy)   3   15%   100   90   89     BVLOS (restrictions)   2   10%   67   67   67     UM   3   10%   100   71   67     Mobile airborne permission   1   5%   33   57   50     Total   50%     Economic   Population (million)   84   52   53   60     Rab as a percentage of GDP   3.10%   2%   65   51   55     Total   10%   5%   100   100   100     Ferentage of GDP   3.10%   5%   95   88   88     Ferentage of population   100%   5%   100   100   100     Ferentage of SG connections   7%   5%   78   73   71     Ferentage of SG connections   7%   5%   133   34   34     Ferentage of SG connections   7%   5%   17   20   23     Ferentage of SG connections   7%   5%   13   34   34     Formare remeue as a percenta		Drone ID (network or broadcast)	3	5%	100	67	64
BVLOS (restrictions)       2       10%       67       67       67         UTM       3       10%       100       71       67         Mobile airborne permission       1       5%       33       57       50         Total       50%       7       50       7         Economic       Opp per capita (USD)       49,430       8%       52       53       60         R8D as a percentage of GDP       3.0%       2%       65       51       55         Telecoms       Genetwork coverage (percentage of population)       100%       5%       100       100       100         SG network coverage (percentage of foconnections share of mobile subscribers)       7%       5%       78       73       71         Percentage of 5G connections schare of mobile subscribers)       7%       5%       17       20       23         Demander (enterprise sector)       Sector propensity to adopt       33%       5%       78       34       34         Drone revenue as a percentage       0.028%       5%       28       34       34         Drone revenue as a percentage       0.028%       5%       <	regulations	Electronic conspicuity	1	5%	33	38	39
Affinition       3       10%       100       71       67         Mobile airborne permission       1       50%       33       57       50         Economic       Population (million)       84		BVLOS (policy)	3	15%	100	90	89
Mobile airborne permission     1     5%     33     57     50       Total     50%     50%     50%     50%     50%       Economic     Population (million)     84     50%     50     600       GDP per capita (USD)     49,430     8%     52     53     60       RaD as a percentage of GDP     3.10%     2%     65     51     55       Telecoms     (for centage of population)     100%     5%     95     88     88       Percentage of 4G connections (chare of mobile subscribers)     7%     5%     95     88     88       Percentage of 5G connections (chare of mobile subscribers)     7%     5%     77     20     23       Opercentage of 5G connections (chare of mobile subscribers)     7%     5%     73     34     34       Percentage of 5G connections (chare of mobile subscribers)     7%     5%     33     34     34       Percentage of 5G connections (chare of mobile subscribers)     7%     5%     33     34     34       Percentage of 5G connections (chare of mobile subscribers)     5%     33     34     34     34       <		BVLOS (restrictions)	2	10%	67	67	67
Total     50%       Economic     Population (million)     84       GDP per capita (USD)     49,430     8%     52     53     60       R&D as a percentage of GDP     3.10%     2%     65     51     55       Telecoms     4G network coverage (percentage of population)     100%     5%     100     100     100       SG network coverage (percentage of population)     95%     5%     95     88     88       Percentage of SC connections Schare of mobile subscribers)     7%     5%     17     20     23       Percentage of SC connections Schare of mobile subscribers)     33%     5%     33     34     34       Describer of mobile subscribers)     17%     5%     17     20     23       Describer of mobile subscribers)     33%     5%     33     34     34       Opener of survey)     0.26     5%     41     62     66       Iceliar only     20%     5%     67     67     61       Describer of survey     2.5%     67     67     61       Describer of survey     2.6%     5%     67		UTM	3	10%	100	71	67
Feconomic     Population (million)     84       GDP per capita (USD)     49,430     8%     52     53     60       R&D as a percentage of GDP     3.10%     2%     65     51     55       Total     10%     10%     100     100     100       Felecoms     (percentage of population)     95%     5%     95     88     88       Percentage of population     95%     5%     95     88     88       Percentage of foc connections     17%     5%     17     20     23       Percentage of foc connections     17%     5%     17     20     23       Percentage of foc connections     17%     5%     33     34     34       Operator survey     33%     5%     28     34     34       Operator survey     0.26     5%     41     62     56       Io Connections per pop (cellular only     2     5%     67     67     61       Io Connections per pop (cellular only     2     5%     67     61     65     64		Mobile airborne permission	1	5%	33	57	50
Image: control of CP per capita (USD)       49,430       8%       52       53       60         R8D as a percentage of GDP       3.10%       2%       65       51       55         Total       10%       2%       65       51       55         Fercentage of population)       100%       5%       100       100       100         SG network coverage of population)       95%       5%       95       88       88         Percentage of population)       95%       5%       95       88       88         Percentage of 5G connections       78%       5%       78       73       71         Percentage of 5G connections       17%       5%       17       20       23         Fercentage of 5G connections       17%       5%       13       34       34         Oper cator survey)       33%       5%       33       34       34         Intermedication GDP       0.26       5%       41       62       56         Intermedication GDP       0.26       5%       67       67       61         Intermedication GDP       2       5%		Total		50%			
R&D as a percentage of GDP     3.10%     2%     65     51     55       Telecoms     KB d active coverage (percentage of population)     100%     5%     100     100     100       Sector propensity to adopt of national GDP     7%     5%     95     88     88       Percentage of population)     95%     5%     95     88     88       Percentage of population)     95%     5%     78     73     71       Dercentage of 5G connections (percentage of mobile subscribers)     78%     5%     17     20     23       Dercentage of 5G connections (percentage of mobile subscribers)     77%     5%     17     20     23       Dercentage of 5G connections (percentage of mobile subscribers)     77%     5%     33     34     34       Dercentage of 5G connections (percentage of mobile subscribers)     33%     5%     33     34     34       Dercentage of SG connections (percentage of mobile subscribers)     0.028     5%     41     62     56       Dercentage of population     0.26     5%     61     62     61     61       Dercentage of population     0.26     5%     <	Economic	Population (million)	84				
Total10%Felecons (percentage of population)100%5%100100100So network coverage (percentage of population)95%5%958888Percentage of 4G connections (share of mobile subscribers)7%5%787371Percentage of 5G connections (share of mobile subscribers)17%5%172023Percentage of 5G connections (share of mobile subscribers)17%5%172023Percentage of 5G connections (share of mobile subscribers)17%5%133434Percentage of 5G connections (coreator survey)0.028%5%146256Pono revenue as a percentage (cellular only)0.265%416256Prove regulations25%687169Proverli readinessPono regulations696564		GDP per capita (USD)	49,430	8%	52	53	60
Telecoms     4G network coverage (percentage of population)     100%     5%     100     100     100       5G network coverage (percentage of population)     95%     5%     95     88     88       Percentage of population)     95%     5%     78     73     71       Percentage of 5G connections (share of mobile subscribers)     17%     5%     17     20     23       Demand (centerprise sectors)     Sector propensity to adopt (operator survey)     33%     5%     33     34     34       Demand (cellular only)     0.028%     5%     61     62     56       Iot connections per pop of national GDP     0.26     5%     41     62     56       Iot connections per pop of national GDP     0.26     5%     61     61     61       Total     20%     67     67     61     61       Iot connections per pop of national GDP     0.26     5%     41     62     56       Iot connections per pop of national GDP     20%     67     67     61       Index score     Drone regulations     80     71     69       Overall readiness     6	(5)	R&D as a percentage of GDP	3.10%	2%	65	51	55
Telecoms and ICT(percentage of population)100%5%100100100SG network coverage (percentage of population)95%5%958888Percentage of 4G connections (share of mobile subscribers)78%5%787371Percentage of 5G connections (share of mobile subscribers)17%5%172023Total20%Operator survey)33%5%333434Demand (enterprise sectors)Sector propensity to adopt (operator survey)33%5%3333434Demand (enterprise sectors)Sector propensity to adopt (cellular only)0.265%4116256Index score Overall readinessDrone regulations20%5%686564		Total		10%			
SG network coverage (percentage of population)95%5%958888Percentage of population)78%5%787371Percentage of 4G connections (share of mobile subscribers)78%5%172023Percentage of 5G connections (share of mobile subscribers)17%5%172023Total20%Operator survey)33%5%333434Demand (enterprise sectors)Sector propensity to adopt (operator survey)33%5%283434Demand (enterprise of national GDP0.028%5%416256Drone revenue as a percentage of national GDP0.265%416256Safety record25%676761Total20%Index scoreDrone regulations807169Overall readiness686564			100%	5%	100	100	100
Kare of mobile subscribers)78%5%787371Percentage of 5G connections (share of mobile subscribers)17%5%172023Total20%172023Demand (operator survey)33%5%333434Demand (operator survey)33%5%333434Demand (operator survey)0.028%5%283434Demand (operator survey)0.265%416256Dorone revenue as a percentage of national GDP0.265%416256IoT connections per pop (cellular only)20%676761Index scoreDrone regulations20%5%807169Overall readiness686564			95%	5%	95	88	88
Image: Sector propensity to adopt (operator survey)17%5%172023Demand (operator survey)Sector propensity to adopt (operator survey)33%5%333434Demand (operator survey)Once revenue as a percentage of national GDP0.028%5%283434Dot connections per pop (cellular only)0.265%416256Safety record25%676761Index score Overall readinessDrone regulations807169			78%	5%	78	73	71
Demand (enterprise sectors)Sector propensity to adopt (operator survey)33%5%333434Drone revenue as a percentage of national GDP0.028%5%283434Do connections per pop (cellular only)0.265%416256Safety record25%676761Total20%Index score Overall readinessDrone regulations807169			17%	5%	17	20	23
Demand (enterprise sectors)(operator survey)35%5%333434Drone revenue as a percentage of national GDP0.028%5%283434IoT connections per pop (cellular only)0.265%416256Safety record25%676761Total20%Index scoreDrone regulations807169Overall readiness686564		Total		20%			
sectors)Drone revenue as a percentage of national GDP0.028%5%283434IoT connections per pop (cellular only)0.265%416256Safety record25%676761Total20%Index scoreDrone regulations807169Overall readiness686564	Demand		33%	5%	33	34	34
(cellular only)0.265%416256Safety record25%676761Total20%807169Overall readiness686564	sectors)		0.028%	5%	28	34	34
Total   20%     Index score   Drone regulations     Overall readiness   68	$\mathbb{D}$		0.26	5%	41	62	56
Index score Drone regulations 80 71 69 Overall readiness 68 65 64		Safety record	2	5%	67	67	61
Overall readiness		Total		20%			
	Index score	Drone regulations			80	71	69
		Overall readiness (all four categories)			68	65	64



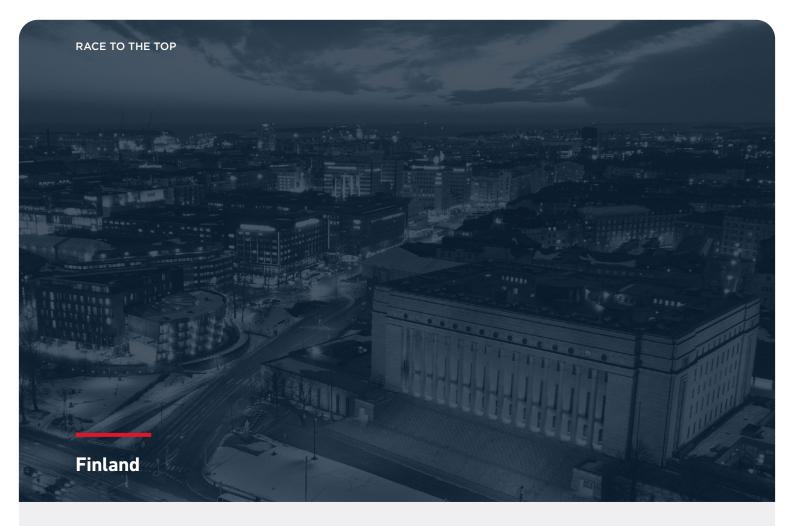
Italy is an EASA member state, with its drone regulations (and index scores) aligned with Switzerland, France, Germany and Finland. Italy scores the lowest in the economic index, equal to France, but quite high in terms of telecoms and ICT and demandside factors, bringing Italy to an overall second position for market readiness.

All implemented rules from the European Commission are reported by the Italian Civil Aviation Authority (ENAV).<sup>25</sup> From 2020, ENAV decided to create a company through a public tender to act as the only registration point for UAVs. The company, D-Flight, is owned by ENAV group but was set up by Leonardo and Telespazio. Italy already has 90,000 operators with 80,000 registered drones. Services supported are geoawareness, registration, identification through QR code (not remote ID) and the drone operation plan. Specific operating risk assessment and drone detection services are also provided, and they serve both the 'open' and 'specific' categories. D-Flight decided to provide subscription-based pricing for customers. Most of the BVLOS operations are now directly coordinated and approved by ENAV and are therefore not managed through D-Flight. D-Flight also wants to request the USSP certification once the national authorities have defined the process and the responsible entities for U-space implementation. Similar to France, the expectation is that the local air navigation service provider will take the responsibility of the CISP.

Italy mandates that UAS manufacturers, operators and pilots report any safety events/incidents instead of a on a voluntary basis (see Art. 25<sup>26</sup>).

Applications of drones in Italy are in public safety (such as search and rescue in the Alps<sup>27</sup> or RigiTech's medical supplies delivery trial<sup>28</sup>), surveys and inspections. There are also experimental areas dedicated to UAS innovation, in collaboration with universities; one example is DoraLAB,<sup>29</sup> a cooperation between ENAV, TIM and the Torino Polytechnic. Recently, the Aerospace Technology District of Puglia, the Bari Polytechnic and the Universities of Bari and Salento started work to build the Grottaglie airport testbed, a research infrastructure aiming to help the development of UAS and for traffic management for UAS.

				Index scores*		
		Raw data	Metric weight	Italy	G7	Total sample average
Drone	Drone ID (network or broadcast)	3	5%	100	67	64
regulations	Electronic conspicuity	1	5%	33	38	39
	BVLOS (policy)	3	15%	100	90	89
	BVLOS (restrictions)	2	10%	67	67	67
	UTM	3	10%	100	71	67
	Mobile airborne permission	1	5%	33	57	50
	Total		50%			
Economic	Population (million)	60				
	GDP per capita (USD)	33,660	8%	35	53	60
(5)	R&D as a percentage of GDP	1.50%	2%	31	51	55
	Total		10%			
Telecoms and ICT	4G network coverage (percentage of population)	100%	5%	100	100	100
	5G network coverage (percentage of population)	97%	5%	97	88	88
	Percentage of 4G connections (share of mobile subscribers)	78%	5%	78	73	71
	Percentage of 5G connections (share of mobile subscribers)	8%	5%	8	20	23
	Total		20%			
Demand	Sector propensity to adopt (operator survey)	33%	5%	33	34	34
(enterprise sectors)	Drone revenue as a percentage of national GDP	0.028%	5%	28	34	34
$\mathbb{D}$	IoT connections per pop (cellular only)	0.52	5%	80	62	56
	Safety record	3	5%	100	67	61
	Total		20%			
Index score	Drone regulations			80	71	69
	Overall readiness (all four categories)			70	65	64

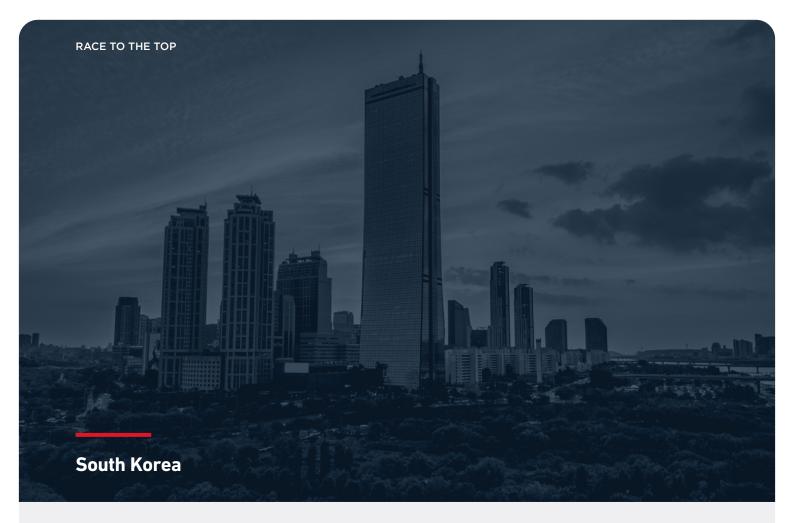


As an EASA member state, Finland has a set of drone regulations aligned with other EU states, including France, Germany and Italy. Finland has a regulatory score of 80, above the G7 and overall average, as it benefits from BVLOS flights, drone ID systems and a UTM policy (although not yet enacted, which is why it has a slightly lower score compared to the aforementioned EU countries, which have implemented this step). The country completed a successful initiative in 2022, called FUAVE (the Finnish UAV Ecosystem), designed to connect companies, startups and academic institutions – 85 organisations in total – to lay out and roadmap strategic priorities for commercial drone flight.

One of the by-products of this ecosystem collaboration is that Finland now has six designated areas for drone test flights and innovation. Deployments are targeting applications in agriculture and forestry management, among others. In addition to would-be vertical sector use cases, the testing areas also mean companies can optimise drone flights in harsh weather conditions (in Oulu, for example, flights are in arctic conditions) and using advanced lidar sensing capabilities. That FUAVE also involved the Finnish transport and communications regulator, Traficom, is testament to the need for bringing regulators into the discussion in line with technology developments, rather than playing catch-up and otherwise stalling progress.

The market indicators in Finland are a bit below average but by and large strong. LTE cellular network coverage is ubiquitous and 5G coverage is over 80%. The main challenge now is expanding into lower-density geographical areas, particularly in the northerly Arctic regions, where drones have clear use in marine, defence and goods distribution for inaccessible communities.

				Index scores*		
		Raw data	Metric weight	Finland	G7	Total sample average
Drone	Drone ID (network or broadcast)	3	5%	100	67	64
regulations	Electronic conspicuity	1	5%	33	38	39
	BVLOS (policy)	3	15%	100	90	89
	BVLOS (restrictions)	2	10%	67	67	67
	UTM	3	10%	100	71	67
	Mobile airborne permission	1	5%	33	57	50
	Total		50%			
Economic	Population (million)	5.5				
	GDP per capita (USD)	51,180	8%	54	53	60
(5)	R&D as a percentage of GDP	2.90%	2%	60	51	55
	Total		10%			
Telecoms and ICT	4G network coverage (percentage of population)	100%	5%	100	100	100
	5G network coverage (percentage of population)	83%	5%	83	88	88
	Percentage of 4G connections (share of mobile subscribers)	76%	5%	76	73	71
	Percentage of 5G connections (share of mobile subscribers)	18%	5%	18	20	23
	Total		20%			
Demand	Sector propensity to adopt (operator survey)	33%	5%	33	34	34
(enterprise sectors)	Drone revenue as a percentage of national GDP	0.028%	5%	28	34	34
$\square$	loT connections per pop (cellular only)	0.33	5%	52	62	56
	Safety record	2	5%	67	67	61
	Total		20%			
Index score	Drone regulations			80	71	69
	Overall readiness (all four categories)			68	65	64
				1		



South Korea ranks joint bottom on drone regulations (tied with the US), as well as on overall market readiness. This should not, however, be construed as a sign of failing interest or policy. The South Korean government has prioritised drones as a part of its national industrial strategy, first outlining objectives and a regulatory roadmap in 2019. This includes the allowance of BVLOS flights (not permitted as of now) and a UTM. The current situation can be characterised as 'in development', with a bevy of initiatives leading up to a regulatory framework being in place by 2023 and commercial flights at scale in 2025. For example, the government has designated nine local authorities as 'drone demonstration cities', with a range of companies invited to participate in trials and sandbox development in these jurisdictions and a dedicated test centre (called UV Land), which is roughly the size of two football pitches. Use cases in South Korea have covered goods delivery, public safety and surveillance, agricultural surveying, and ports and coastal monitoring. R&D investment is also near the top of the table, reflecting the country's preeminent science and technology pedigree.

South Korea scores more favourably on the ICT and telecoms indicator. The country has always been a digital native, and its 5G coverage is world-leading at 98% of the population, with take-up also being particularly high. 5G enterprise trials and deployments continue to gain momentum in factories, hospitals and transit hubs, with drones seen as a viable instrument to conduct higher-productivity operations in these settings.

This is therefore a country in motion, and we would expect these scores to increase in the coming 12 months as regulations are promulgated and come into force.

Raw data   Metric weight   South Korea   6.7   Pairlessing     Drone ID (network or broadcast)   1   5%   3.3   6.7   6.4     Electronic complicity   1   5%   3.3   3.8   3.9     BNDS (policy)   1   15%   3.3   9.0   9.9     EVDS (policy)   1   10%   3.3   9.0   9.9     Multic airborne permission   2   10%   6.7   6.7   6.7     Mobile airborne permission   2   5%   6.7   5.0   6.0     Economic   Population (million)   51   -   -   5.0     Mobile airborne permission   2.4   7.0   8.0   7.0   5.0     Mobile airborne permission   5.1   -   -   -   -     Mobile airborne permission   5.1   5.0   5.0   6.0   -   -     Mobile airborne permission   5.1   -   -   -   -   -     Mobile airborne permission   5.1   -   -   -   -   -     Mobile airborne permission   5.1   -   -   -   -   -   -     Mobile airborne permission   5.3%   5.5%   5.3% <th></th> <th></th> <th></th> <th></th> <th>Index scores*</th> <th></th> <th></th>					Index scores*		
Brone Figurations       Electronic conspicuity       1       5%       33       38       39         Figurations       Electronic conspicuity       1       5%       33       90       89         BVLOS (policy)       1       15%       33       90       89         BVLOS (restrictions)       2       10%       67       67       67         UTM       1       10%       33       71       67         Mobile airborne permission       2       5%       67       50         Feconomic       Population (million)       51       50       50         Mobile airborne permission       34,770       8%       37       53       60         SDP per capita (USD)       34,770       8%       100       51       55         Teleons       {Genetwork coverage} (percentage of population)       98%       5%       98       88       88         Ball       Gonetwork coverage (percentage of population)       98%       5%       33       73       71         Percentage of SG connections (share of mobile subscribers)       53%       5%       33       34       34			Raw data	Metric weight	South Korea	G7	
Flectronic conspicuity   1   5%   33   38   39     BVLOS (policy)   1   15%   33   90   89     BVLOS (restrictions)   2   10%   67   67   67     UTM   1   10%   33   71   67     Mobile airborne permission   2   5%   67   57   50     Total   50%   57   50     Fecononic     Population (million)   51   55     GDP per capita (USD)   34,770   8%   37   53   60     Fecononic     Mabile airborne permission   51   55   55   55     GDP per capita (USD)   34,770   8%   30   100   100     Statistic coverage (percentage of GDP   4.80%   2%   100   100   100     Genetwork coverage (percentage of population)   98%   5%   98   88   88     Bernard (percentage of populations   5%   5%   30   31   31     Percentage of 4G connections (share of mobile subscribers)   5%   5%   33   34   34     Sectors if   0.039%   5%   33   34   34 <t< td=""><td></td><td>Drone ID (network or broadcast)</td><td>1</td><td>5%</td><td>33</td><td>67</td><td>64</td></t<>		Drone ID (network or broadcast)	1	5%	33	67	64
Image: sector	regulations	Electronic conspicuity	1	5%	33	38	39
Image: sector of the		BVLOS (policy)	1	15%	33	90	89
Mobile airborne permission25%6750Total50%EconomicPopulation (million)51		BVLOS (restrictions)	2	10%	67	67	67
Total     50%       Economic     Population (million)     51       GDP per capita (USD)     34,770     8%     37     53     60       R&D as a percentage of GDP     4.80%     2%     1000     51     55       Telecoms     4G network coverage (percentage of population)     100%     5%     1000     100     100       SG network coverage (percentage of population)     98%     5%     98     88     88       Percentage of SG connections Schare of mobile subscribers)     53%     5%     53     73     71       Percentage of SG connections Schare of mobile subscribers)     34%     5%     34     20     23       Demand Genetry ise ectors)     Sector propensity to adopt of national GDP     34%     5%     34     34     34     34       Orone revenue as a percentage of national GDP     0.25     5%     40     62     66       Total     20%     33     67     61     5%     61     61     61       Demand Genetry ise of national GDP     0.25     5%     34     34     34     34     34     34     34     34		UTM	1	10%	33	71	67
Economic     Population (million)     51       GDP per capita (USD)     34,770     8%     37     53     60       R&D as a percentage of GDP     4.80%     2%     100     51     55       Telecoms     (Gnetwork coverage (percentage of population)     10%     5%     100     100     100       Felecoms     (Gnetwork coverage (percentage of population)     98%     5%     98     88     88       Percentage of foc connections (share of mobile subscribers)     53%     5%     53     73     71       Percentage of 5G connections (share of mobile subscribers)     43%     5%     43     20     23       Demand (share of mobile subscribers)     34%     5%     34     34     34       Orone revenue as a percentage     0.039%     5%     39     34     34       Orone revenue as a percentage     0.25     5%     40     62     56       Io Connections per pop (cellular only)     0.25     5%     30     67     61       Io Connections per pop (cellular only)     1     5%     33     67     61       Io Connections per pop (cellular only)		Mobile airborne permission	2	5%	67	57	50
Teleconomic       Sector propensity to adopt (operator survey)       34,770       8%       37       53       60         R&D as a percentage of GDP       4.80%       2%       100       51       55         Total       10%       5%       100       100       100       100         Sector propensity to adopt (operator survey)       34%       5%       34 <td></td> <td>Total</td> <td></td> <td>50%</td> <td></td> <td></td> <td></td>		Total		50%			
Rab as a percentage of GDP       4.80%       2%       100       51       55         Telecoms and ICT       KB network coverage (percentage of population)       100%       5%       100       100       100         SG network coverage (percentage of population)       98%       5%       98       88       88         Percentage of AG connections (share of mobile subscribers)       53%       5%       43       20       23         Demand (enterprise sectors)       Sector propensity to adopt (rational GDP       34%       5%       34       34       34         Demand (enterprise sectors)       Sector propensity to adopt (rational GDP       0.039%       5%       39       34       34         ICT connections per pop (cellular only)       0.25       5%       400       62       56         Safety record       1       5%       33       67       61         Index score       Drone regulations       20%       43       71       69         Overall readiness       0       20%       39       34       34       34         Index score       Drone regulations       20%       20%       65       64   <	Economic	Population (million)	51				
Total10%Felecons (percentage of population)100%5%100100100SG network coverage (percentage of population)98%5%988888Percentage of 4G connections (share of mobile subscribers)53%5%537371Percentage of 5G connections (share of mobile subscribers)43%5%432023Demand (enterprise)Sector propensity to adopt (operator survey)34%5%343434Done revenue as a percentage of national GDP0.255%406256Iof connections per pop (cellular only)0.255%406256Safety record15%336761Index score Overall readinessPono regulations437169Overall readinessOverall readiness646564		GDP per capita (USD)	34,770	8%	37	53	60
Telecoms     4G network coverage (percentage of population)     100%     5%     100     100     100       5G network coverage (percentage of population)     98%     5%     98     88     88       Percentage of population)     98%     5%     53     73     71       Percentage of 5G connections (share of mobile subscribers)     43%     5%     43     20     23       Demand (enterprise sectors)     Sector propensity to adopt (operator survey)     34%     5%     34     34     34       Demand (cellular only)     Sector propensity to adopt (operator survey)     0.039%     5%     39     34     34       Done revenue as a percentage of national GDP     0.25     5%     40     62     56       Iof connections per pop of national GDP     0.25     5%     40     62     56       Safety record     1     5%     33     67     61       Total     20%     43     71     69       Material Constraines     1     5%     43     67     61       Total     20%     43     71     69       Material Constraines     49 </td <td>(5)</td> <td>R&amp;D as a percentage of GDP</td> <td>4.80%</td> <td>2%</td> <td>100</td> <td>51</td> <td>55</td>	(5)	R&D as a percentage of GDP	4.80%	2%	100	51	55
Telecoms and ICT(percentage of population)100%5%100100%100SG network coverage (percentage of population)98%5%988888Percentage of 4G connections (share of mobile subscribers)53%5%537371Percentage of 5G connections (share of mobile subscribers)43%5%432023Demand (enterprise sectors)Sector propensity to adopt (operator survey)34%5%343434Drone revenue as a percentage of national GDP0.039%5%393434IoT connections per pop (cellular only)0.255%406256Safety record15%336761Index score Overall readinessDrone regulations437169Overall readiness406564		Total		10%			
SG network coverage (percentage of population)98%5%988888Percentage of population)53%5%537371Percentage of 4G connections (share of mobile subscribers)43%5%432023Percentage of 5G connections (share of mobile subscribers)43%5%432023Total20%Demand (operator survey)34%5%343434Demand (enterprise sectors)Sector propensity to adopt (operator survey)34%5%343434Dorne revenue as a percentage of national GDP0.039%5%393434Dorne revenue as a percentage of national GDP0.255%406256Safety record15%336761Total20%Index scoreDrone regulations437169Overall readiness435%435%6564			100%	5%	100	100	100
Safe of mobile subscribers)53%5%537371Percentage of 5G connections (share of mobile subscribers)43%5%432023Demand (enterprise sectors)Sector propensity to adopt (operator survey)34%5%343434Demand (operator survey)Sector propensity to adopt (operator survey)34%5%343434Demand (operator survey)O.039%5%393434Demand (operator survey)0.255%406256Dorone revenue as a percentage of national GDP0.255%406256IoT connections per pop (cellular only)0.255%406256Safety record15%336761Index score Overall readinessDrone regulations437169Overall readiness437169			98%	5%	98	88	88
(share of mobile subscribers)43%5%432023(share of mobile subscribers)Total20%Demand (operator survey)34%5%343434Demand (operator survey)34%5%343434Done revenue as a percentage of national GDP0.039%5%393434Done revenue as a percentage of national GDP0.255%406256IoT connections per pop (cellular only)0.255%406256Safety record15%336761Index score Overall readinessDrone regulations437169			53%	5%	53	73	71
Demand (enterprise sectors)Sector propensity to adopt (operator survey)34%5%343434Drone revenue as a percentage of national GDP0.039%5%393434Dorone revenue as a percentage of national GDP0.255%406256IoT connections per pop (cellular only)0.255%406256Safety record15%336761Total20%437169Overall readiness496564			43%	5%	43	20	23
Demand (enterprise sectors)(operator survey)34%5%34343434Drone revenue as a percentage of national GDP0.039%5%393434IoT connections per pop (cellular only)0.255%406256Safety record15%336761Total20%Index scoreDrone regulations437169Overall readiness496564		Total		20%			
sectors)Drone revenue as a percentage of national GDP0.039%5%393434IoT connections per pop (cellular only)0.255%406256Safety record15%336761Total20%Index scoreDrone regulations437169Overall readiness496564	Demand		34%	5%	34	34	34
Image: Control (cellular only)Image: Control (cellular only)Im	sectors)		0.039%	5%	39	34	34
Total   20%     Index score   Drone regulations     Overall readiness   43     71   69     49   65	$\mathbb{D}$		0.25	5%	40	62	56
Index score Drone regulations 43 71 69 Overall readiness 65 64		Safety record	1	5%	33	67	61
Overall readiness 49 65 64		Total		20%			
	Index score	Drone regulations			43	71	69
		Overall readiness (all four categories)			49	65	64



Like South Korea, Japan has high aspirations for drones. In contrast though, Japan has a more developed drone regulatory system, scoring joint highest on the regulatory index, in line with EASA member states. Japan has a hierarchy of four drone tiers, set in 2021, to define the thresholds for moving from manual to automated drone flight, and within versus without the line of sight. Level one permits manually operated drone flights within the line of sight (such as for field inspection), while level four allows automated flights out of the line of sight over residential areas. The big change came late in 2022, when the Japanese government lifted the ban on BVLOS flights over urban and residential areas, paving the way for level four flights across the commercial drone sector. In parallel, a UTM has been designed to coordinate traffic among multiple simultaneous flights. This is seen as particularly important in Japan because of its high population concentration in major cities and, in some cases, lack of labour capacity in the logistics industries, implying the need for alternative solutions for product delivery.

Japanese mobile operators continue to be at the forefront of digital technology and service development, with drones being no different. NTT, the parent of NTT Docomo, has incorporated drones as part of its enterprise business, targeting industries such as construction, agriculture and transportation. SoftBank is already deploying drones to act as aerial base stations in areas of poor or no mobile coverage - much as HAPS or satellites would do at higher altitudes. KDDI has partnered with Aeronext, a drone startup, through its open innovation fund to jointly develop IP to facilitate drone delivery of goods (medicines and essential supplies), particularly for people in rural and hard-to-reach areas. Japan's relatively low 5G take-up reflects an ageing and somewhat frugal population, although its 5G network coverage is near ubiquitous, which helps expand the range that commercial drone flight can operate within.

				Index scores*		
		Raw data	Metric weight	Japan	G7	Total sample average
Drone	Drone ID (network or broadcast)	2	5%	67	67	64
regulations	Electronic conspicuity	1	5%	33	38	39
	BVLOS (policy)	3	15%	100	90	89
	BVLOS (restrictions)	2	10%	67	67	67
	UTM	3	10%	100	71	67
	Mobile airborne permission	2	5%	67	57	50
	Total		50%			
Economic	Population (million)	126				
	GDP per capita (USD)	35,030	8%	37	53	60
(S)	R&D as a percentage of GDP	3.30%	2%	69	51	55
	Total		10%			
Telecoms and ICT	4G network coverage (percentage of population)	100%	5%	100	100	100
	5G network coverage (percentage of population)	91%	5%	91	88	88
	Percentage of 4G connections (share of mobile subscribers)	71%	5%	71	73	71
	Percentage of 5G connections (share of mobile subscribers)	27%	5%	27	20	23
	Total		20%			
Demand	Sector propensity to adopt (operator survey)	34%	5%	34	34	34
(enterprise sectors)	Drone revenue as a percentage of national GDP	0.039%	5%	39	34	34
	loT connections per pop (cellular only)	0.42	5%	66	62	56
	Safety record	1	5%	33	67	61
	Total		20%			
Index score	Drone regulations			80	71	69
	Overall readiness (all four categories)			67	65	64
				1		

# Singapore

The Civil Aviation Authority of Singapore (CAAS) is responsible for drone regulation in Singapore. It has made strong progress in developing BVLOS and conspicuity policies but lags behind other countries regarding drone ID and UTM rules. Singapore therefore ranks joint eighth overall for drone regulation. The limited and congested airspace in Singapore creates challenges for deploying drones. As a result, recent work has focused on developing automated solutions to support large-scale drone deployments. In March 2021, Singapore concluded a three-year trial of an automated UTM system, which tested flight authorisation, conformance monitoring and remote ID capabilities. A tender for UTM consultancy services was subsequently launched in March 2022. Singapore performs well on several of the economic and telecoms and ICT indicators. Drones are seen as an important 5G use case, with UAM operations forming one of the key pillars of the Infocomm Media Development Authority's (IDMA) 5G innovation programme.<sup>30</sup> Given Singapore's status as a major maritime shipping hub, early activity has centred on the use of drones to transform maritime operations. In April 2021, the Maritime and Port Authority of Singapore (MPA) launched Singapore's first maritime drone estate (MDE) to provide a testbed for drone technologies with maritime applications, including shore-to-ship deliveries and remote ship inspections. Trials are supported by the availability of 5G SA networks. For example, mobile operator M1 partnered with Airbus and IDMA to test 5G SA connected drones at the MDE. The testbed has also been used for trialling drone applications by shipping company Wilhelmsen, online food and grocery delivery platform Foodpanda and local drone operator F-drones.

Raw data   Metric weight   Singapore   6.7   Problements     Prongulation   1   5%   3.3   6.7   6.4     All Conciscingituty   2   5%   6.7   3.8   3.9     All Conciscingituty   3   10.8   0.00   0.9   0.9     All Conciscingituty   2   10%   6.7   6.7   6.7     All Conciscingituty   2   10%   6.7   7.0   6.7     All Conciscingituty   1   10%   6.7   7.0   6.7     Metric weight   5.9   7.0   7.0   7.0   7.0     Metric weight   7.0   7.0   7.0   7.0   7.0     Metric weight   7.0   7.0   7.0   7.0   7.0     Metric weight   7.6   7.0   7.0   7.0   7.0     Metric weight   7.6   7.0   7.0   7.0   7.0					Index scores*		
Brone Figurations       Electronic conspicuity       2       5%       67       38       39         Figurations       Electronic conspicuity       2       5%       67       38       39         BVLOS (policy)       3       15%       100       90       89         BVLOS (restrictions)       2       10%       67       67       67         UTM       1       10%       67       71       67         Mobile airborne permission       1       5%       33       57       50         Economic       Opp per capita (USD)       84,500       8%       89       53       60         Mobile airborne permission       100%       5%       46       51       55         Economic       GDP per capita (USD)       84,500       8%       89       53       60         Mobile airborne germentage of GDP       2.2%       2%       46       51       55         Feecomic       (Genetwork coverage (percentage of population)       77%       5%       77       88       88         Percentage of AG connections (share of mobile subscribers)       5%       5%			Raw data	Metric weight	Singapore	G7	
Flectronic conspicuity   2   5%   67   38   39     BVLOS (policy)   3   15%   100   90   89     BVLOS (restrictions)   2   10%   67   67   67     UTM   1   10%   67   71   67     Mobile airborne permission   1   5%   33   57   50     Total   50%   50     Economic   Population (million)   5.9   55   60     R8D as a percentage of GDP   2.2%   2%   46   51   55     Total   10%   5%   100   100   100     Ferentage of GDP   2.2%   2%   46   51   55     Control   10%   5%   100   100   100     Ferentage of GDP   2.5%   5%   77   88   88     Ferentage of a connections   7%   5%   75   73   71     Ferentage of GC connections   16%   5%   16   20   23     Ferentage of GC connections   15%   5%   75   73   71     Ferentage of GC connections   15%   <		Drone ID (network or broadcast)	1	5%	33	67	64
Image: sector	regulations	Electronic conspicuity	2	5%	67	38	39
ITM       1       10%       67       71       67         Mobile airborne permission       1       5%       33       57       50         Economic       Population (million)       5.9 $$		BVLOS (policy)	3	15%	100	90	89
Mobile airborne permission     1     5%     33     57     50       Total     50%     50%     50%     50%     50%       Economic     Population (million)     5.9     50%     88     89     53     60       GDP per capita (USD)     84,500     8%     89     53     60       RaD as a percentage of GDP     2.2%     2%     46     51     55       Telecoms     (for entwork coverage (percentage of population)     100%     5%     100     100     100       So network coverage (percentage of fopulation)     17%     5%     77     88     89     34     34     34     34     34     34     34     34     34     34		BVLOS (restrictions)	2	10%	67	67	67
Total     50%       Economic     Population (million)     5.9       GDP per capita (USD)     84,500     8%     89     53     60       R&D as a percentage of GDP     2.2%     2%     46     51     55       Telecoms     (Gnetwork coverage (percentage of population)     100%     5%     100     100     100       SG network coverage (percentage of population)     77%     5%     77     88     88       Percentage of SG connections Schare of mobile subscribers)     16%     5%     16     20     23       Descriptions (percentage of SG connections Schare of mobile subscribers)     16%     5%     34     34     34       Descriptions (percentage of SG connections Schare of mobile subscribers)     34%     5%     34     34     34       Descriptions (percentage of SG connections Schare of mobile subscribers)     34%     5%     34     34     34       Descriptions (percentage of SG connections Schare of mobile subscribers)     16%     5%     34     34     34       Descriptions (percentage of SG connections Schare of mobile subscriptions     16%     5%     33     67     61       Descriptio		UTM	1	10%	67	71	67
Economic     Population (million)     5.9       GDP per capita (USD)     84,500     8%     89     53     60       R&D as a percentage of GDP     2.2%     2%     46     51     55       Telecoms     (Gnetwork coverage (percentage of population)     10%     5%     100     100     100       Felecoms     (Gnetwork coverage (percentage of population)     77%     5%     77     88     88       Percentage of fo connections (share of mobile subscribers)     75%     5%     75     73     71       Percentage of 5G connections (share of mobile subscribers)     16%     5%     16     20     23       Percentage of propensity to adopt (share of mobile subscribers)     16%     5%     34     34     34       Orone revenue as a percentage     0.039%     5%     39     34     34       Int Connections (GDP     0.17     5%     36     62     56       Int Connections per pop (cellular only)     0.17     5%     36     62     56       Int Connections per pop (cellular only)     1     5%     33     67     61       Int Connectupitations		Mobile airborne permission	1	5%	33	57	50
Exonution       GDP per capita (USD)       84,500       8%       89       53       60         R&D as a percentage of GDP       2.2%       2%       46       51       55         Total       10%       -       -       -       -         Feecons and ICT       6G network coverage (percentage of population)       100%       5%       100       100       100         SG network coverage (percentage of population)       77%       5%       77       88       88         Percentage of Aconnections (share of mobile subscribers)       75%       5%       75       73       71         Percentage of SG connections (share of mobile subscribers)       16%       5%       16       20       23         Ferentage of SG connections (share of mobile subscribers)       34%       5%       34       34       34         Operational GDP (operator survey)       34%       5%       34       34       34         Iot Connections per pop (cellular only)       0.17       5%       26       62       56         Iot Connections per pop (cellular only)       0.17       5%       33       67       61         Iot Connection		Total		50%			
Rab as a percentage of GDP       2.2%       2%       46       51       55         Telecoms and ICT       KB network coverage (percentage of population)       100%       5%       100       100       100         SG network coverage (percentage of population)       100%       5%       77       88       88         Percentage of AG connections (share of mobile subscribers)       75%       5%       75       73       71         Percentage of AG connections (share of mobile subscribers)       16%       5%       16       20       23         Demand (enterprise sectors)       Sector propensity to adopt (rational GDP       34%       5%       34       34       34         IOT connections per pop (cellular only)       0.17       5%       26       62       56         Iot connections per pop (cellular only)       0.17       5%       33       67       61       61         Iot connections per pop (cellular only)       0.17       5%       34       34       34       34         Iot connections per pop (cellular only)       0.17       5%       33       67       61         Iot conne regulations       Pone regulations       Cor	Economic	Population (million)	5.9				
Total10%Felecons (percentage of population)100%5%100100100SG network coverage (percentage of population)77%5%778888Percentage of 4G connections (share of mobile subscribers)75%5%757371Percentage of 5G connections (share of mobile subscribers)16%5%162023Demand (enterprise)Sector propensity to adopt (operator survey)34%5%343434Done revenue as a percentage of national GDP0.039%5%333434Iof connections per pop (cellular only)0.175%266256Safety record15%336761Index score Overall readinessPono regulations105%555564		GDP per capita (USD)	84,500	8%	89	53	60
Telecoms     4G network coverage (percentage of population)     100%     5%     100     100     100       5G network coverage (percentage of population)     77%     5%     77     88     88       Percentage of population)     77%     5%     75     73     71       Percentage of 5G connections (share of mobile subscribers)     16%     5%     16     20     23       Demand (enterprise sectors)     Sector propensity to adopt (operator survey)     34%     5%     34     34     34       Demand (cellular only)     10     5%     39     34     34     34       Iof connections per pop of national GDP     0.17     5%     26     22     56       Iof connections per pop     0.17     5%     33     67     61       Iof connections per pop     0.17     5%     33     67     61       Iof connections per pop     0.17     5%     33     67     61       Iof connections per pop     0.17     5%     63     71     69       Index score     Drone regulations     60     65     64	(5)	R&D as a percentage of GDP	2.2%	2%	46	51	55
Telecoms and ICT(percentage of population)100%5%100100%100SG network coverage (percentage of population)77%5%778888Percentage of 4G connections (share of mobile subscribers)75%5%757371Percentage of 5G connections (share of mobile subscribers)16%5%162023Demand (enterprise sectors)Sector propensity to adopt (operator survey)34%5%343434Drone revenue as a percentage of national GDP0.039%5%393434IoT connections per pop (cellular only)0.175%266256Safety record15%336761Index score Overall readinessDrone regulations637169Overall readiness606564		Total		10%			
SG network coverage (percentage of population)77%5%778888Percentage of population)75%5%757371Percentage of 4G connections (share of mobile subscribers)16%5%162023Percentage of 5G connections (share of mobile subscribers)16%5%162023Total20%Operations (operator survey)34%5%343434Demand (enterprise sectors)Sector propensity to adopt (operator survey)34%5%343434Demand (enterprise of national GDP0.039%5%393434Diff connections per pop (cellular only)0.175%266256Safety record15%336761Total20%			100%	5%	100	100	100
Sector propensity to adopt (operator survey)34%5%757371Demand (enterprise sectors)Sector propensity to adopt (operator survey)34%5%343434Demand (operator survey)Sector propensity to adopt (operator survey)34%5%343434Demand (operator survey)Sector propensity to adopt (operator survey)34%5%343434Demand (operator survey)0.039%5%393434Demand (operator survey)0.175%266256Index scoreDrone regulations120%637169Index scoreDrone regulations637169Overall readiness606564			77%	5%	77	88	88
Ide2023Ide2023Ide2023Ide2023Ide2023Ide2023Ide2023Ide2023Ide2023Ide2023Ide2023Ide2023Ide20%3434Ide20%3334Ide20%3334Ide20%3334Ide20%3334Ide20%3434Ide20%3334Ide20%3434Ide20%3336Ide20%3434Ide20%3434Ide3434Ide3434Ide3434Ide3434IdeIde <td></td> <td></td> <td>75%</td> <td>5%</td> <td>75</td> <td>73</td> <td>71</td>			75%	5%	75	73	71
Demand (enterprise sectors)Sector propensity to adopt (operator survey)34%5%343434Drone revenue as a percentage of national GDP0.039%5%393434IoT connections per pop (cellular only)0.175%266256Safety record15%336761Total20%Index score Overall readinessDrone regulations637169		-	16%	5%	16	20	23
Demand (enterprise sectors)(operator survey)34%5%34343434Drone revenue as a percentage of national GDP0.039%5%393434IoT connections per pop (cellular only)0.175%266256Safety record15%336761Total20%Index scoreDrone regulations637169Overall readiness606564		Total		20%			
sectors)Drone revenue as a percentage of national GDP0.039%5%393434IoT connections per pop (cellular only)0.175%266256Safety record15%336761Total20%Index scoreDrone regulations637169Overall readiness606564	Demand		34%	5%	34	34	34
(cellular only)0.175%266256Safety record15%336761Total20%637169Overall readiness606564	sectors)		0.039%	5%	39	34	34
Total   20%     Index score   Drone regulations     Overall readiness   60	B		0.17	5%	26	62	56
Index score Drone regulations 63 71 69 Overall readiness 60 65 64		Safety record	1	5%	33	67	61
Overall readiness 60 65 64		Total		20%			
	Index score	Drone regulations			63	71	69
		Overall readiness (all four categories)			60	65	64





Australia has made significant advances in the drone space, with permissive regulation in BVLOS accompanying market activity. Its overall regulation index score is below average but, as with South Korea, this somewhat masks underlying activity to build on the BVLOS permissions that now exist. Australia's Civil Aviation Safety Authority (CASA) has laid clear guidelines for commercial drone operation, smoothing the registration process and ensuring operators have knowledge of flight, noise and safety parameters. As with other Asia Pacific countries such as Japan and South Korea, the Australian government has actively put drones up the industrial agenda as a strategic asset for economic growth and diversification. It estimates drones will provide an uplift of AUD14.5 billion (approximately 0.6% of GDP), with the priority sectors being transport and logistics (goods deliveries), agriculture and forestry, marine and coastal protection, and construction - even detailing a breakdown on a dedicated government website for drone information. The development of a UTM remains in process, along with drone ID and conspicuity; the plan is for these to materialise in the coming two years, a key underpinning for commercial scale.

The overall market readiness score comes in at around the average of the 12 countries analysed. The country's economic and telecoms and ICT position is solid overall. The 5G network coverage score is slightly below average, but this largely reflects the vast population distribution across a wide landmass. Commercial use of IoT devices is evident in heavy industry (mining and oil and gas), logistics and buildings, all of which have clear drone applications. As one example, Telstra, the largest telecoms operator in the country, is active in multiple sectors and has also used drones to assist in surveying land to inform the most optimal areas for reforestation. Smaller companies can also benefit from the Emerging Aviation Technology Partnership Program, a government accelerator scheme designed to facilitate partnerships with established companies that has ringfenced AUD32 million over two years to 2024.

				Index scores*		
		Raw data	Metric weight	Australia	G7	Total sample average
Drone	Drone ID (network or broadcast)	1	5%	33	67	64
regulations	Electronic conspicuity	1	5%	33	38	39
	BVLOS (policy)	3	15%	100	90	89
	BVLOS (restrictions)	2	10%	67	67	67
	UTM	1	10%	33	71	67
	Mobile airborne permission	1	5%	33	57	50
	Total		50%			
Economic	Population (million)	25				
	GDP per capita (USD)	68,020	8%	72	53	60
(5)	R&D as a percentage of GDP	1.80%	2%	38	51	55
	Total		10%			
Telecoms and ICT	4G network coverage (percentage of population)	100%	5%	100	100	100
	5G network coverage (percentage of population)	81%	5%	81	88	88
	Percentage of 4G connections (share of mobile subscribers)	73%	5%	73	73	71
	Percentage of 5G connections (share of mobile subscribers)	30%	5%	30	20	23
	Total		20%			
Demand	Sector propensity to adopt (operator survey)	34%	5%	34	34	34
(enterprise sectors)	Drone revenue as a percentage of national GDP	0.039%	5%	39	34	34
B	loT connections per pop (cellular only)	0.42	5%	66	62	56
	Safety record	2	5%	67	67	61
	Total		20%			
Index score	Drone regulations			60	71	69
	Overall readiness (all four categories)			61	65	64
				l		

# Recommendations for the UK

How should we think about the future of drone regulations and market activity in the UK? What can be garnered from other countries in terms of effective strategies? How does this play out over time? And what is the optimal dynamic between government and industry participants?

As well as a strong ecosystem of startups and larger companies developing the technology and business case for drones, the UK has many positives as a country that can help the drone industry flourish. The key gaps for the UK compared to other leading nations – principally Switzerland, the European EASA markets and Japan – are in the regulatory domain, in particular not yet having a joined-up system that underpins BVLOS flight at scale. The window of opportunity to act is closing given that investment will go to countries or economic areas with the largest purchasing power, demand base and permissive regulation. In this context, we have laid out the following recommendations for the UK government, the CAA and other relevant agencies to consider:

- BVLOS needs to be modernised and scaled. The ability to fly BVLOS underpins a successful drone industry and its applications. The absence of BVLOS constrains drone flights to small geographic areas and precludes many of the use cases that would take place over larger expanses such as goods distribution, emergency response and site surveying. Within our comparator group, 75% of countries, including all countries in Europe's EASA framework, now permit BVLOS with an enacted policy. The UK has set the policy framework but with unclear guidance on how it can be used in practice and at scale, costing time and risking confusion among the raft of companies and startups testing or seeking commercial deployment of their products. Establishing a more simplified set of BVLOS implementation guidelines - alongside modernising the supporting regulatory framework that includes a UTM, electronic conspicuity, safety standards and training - must be a priority.
- Pro-innovation regulations and a regulatory culture are needed. Our analysis, along with survey evidence and industry conversations, points to clear regulations as a necessary pre-condition for a thriving and scaled drone industry. This is to ensure safe operations, first and foremost, but also to give certainty to market participants. There is a risk that regulations for drones fall behind the pace of technology innovation and international regulatory trends, as has arguably happened in the case of regulation of digital markets and of cloud. This places a greater emphasis on the CAA to work with the industry to formulate workable regulations that help promote investment in a timely manner. In comparison, for example, Japan set four tiers for drone flight in 2021, before commercial launches became available. Equally important, over time, will be looking to ensure regulations are interoperable, or harmonised, with key trading partners, such as those in Europe, so that companies have a consistent playing field to operate in.
- Act now or risk losing out. There is a 12–24 month window of opportunity, as most UAV sector participants in our survey expect drone regulations to be in place by 2024–2025 in advanced economies. 5G-Advanced standards, which will underpin low-latency use cases in enterprise settings, along with new capabilities catering specifically for UAS, will also crystallise in the same time period. In anticipation of this, drone technological innovation is continuing apace in parallel with commercial trials. For the UK, this sets a reasonable marker for a modernised drone regulatory system to be in place by to ensure it can remain competitive in developing home-grown technology for domestic use and in export markets - and not risk UK talent and innovation moving to other countries.
- Learn from others. A consistent observation from leaders such as Switzerland, Italy, Finland and Japan is the need for a coalescence of public and private sector participants to co-develop regulations that reflect both safety requirements and a commercial vision that unlocks private sector investment. The Finnish FUAVE initiative is a good example, as are Korea's nine demonstration cities, which underline the value of piloting technology at pace while being able to iterate on regulations at the same time. The UK would benefit from more testing areas in this respect. More broadly, the UK has many innovative companies in the drone sector operating at the cutting edge. These voices should be heard on the front line of regulatory development just as much as for commercial partnerships. The flagship Future Flight Challenge has been a clear help and stimulus to private sector innovation and so this, or a related scheme, should be extended.

# Appendix

#### Figure A1

# A summary of the metrics, definitions and weights used in the index

	Category	Metric	Source	Definition	Metric weight
Regulatory	Drone regulations	Drone ID (network or broadcast)		Regulation requiring an electronic identification to be transmitted during flight (most regulations require the identification to be transmitted via broadcast mechanism and/or through a communication network)	5%
		Electronic conspicuity		Regulation requiring electronic conspicuity for the UAV to provide situational awareness	5%
		BVLOS (policy)	Degulators	Regulation permitting the ability to fly BVLOS	15%
		BVLOS (restrictions)	Regulators	If BVLOS is permitted, the extent to which any restrictions are attached for each flight	10%
		UTM		Unmanned air traffic management system. This is a means of coordinating safe drone flight within set parameters, and is separate from traditional air traffic control for civil aviation	10%
		Mobile airborne permission		Regulatory permission and condition for using mobile spectrum bands for airborne services	5%
				Total	50%
	 Economic	Population*	GSMA Intelligence	Total population in a given country	
		GDP per capita (USD)	IMF	Average GDP (or income) per head of population	8%
		R&D as a percentage of GDP	OECD	Ratio of R&D investment as a share of national GDP	2%
				Total	10%
	Telecoms and ICT	4G network coverage (percentage of population)	GSMA Intelligence	Share of population living in range of a 4G cellular signal	5%
		5G network coverage (percentage of population)		Share of population living in range of a 5G cellular signal	5%
		Percentage of 4G connections (share of mobile subscribers)		Share of mobile subscribers on a 4G tariff in a given country	5%
Market		Percentage of 5G connections (share of mobile subscribers)		Share of mobile subscribers on a 5G tariff in a given country	5%
_				Total	20%
	Demand	Sector propensity to adopt	GSMA Intelligence**	Telecoms operator sentiment on drones as part of an enterprise sector sales strategy	5%
	(enterprise sectors)	Drone revenue as a percentage of national GDP	Statista, GSMA Intelligence	Estimated total drone revenue as a share of national GDP	5%
		IoT connections per pop	GSMA Intelligence	Total IoT connections expressed per head of population. This includes consumer and enterprise use cases	5%
		Safety record	Regulators	System for reporting incidents or malfunctions that impact safety both on other airspace users or humans and property on the ground	5%
				Total	20%
	Index score	Drone regulations		Sum of index scores for the regulatory metrics	
	muex score	Overall readiness (all four categories)		Total index score combining regulatory and market metrics	

\* Population is not formally included in the index. Data is shown in the country tables for context purposes \*\* Drawn from a GSMA Intelligence survey of telecoms operators worldwide (2022)

#### Figure A2

# A summary of the rating scale for regulatory metrics and drone safety

		Score	
	1	2	3
Drone ID (network or broadcast)	No policy in place (neither BRID nor NRID rule is provided)	Policy in place, but not enacted (either BRID or NRID or both are defined but not fully implemented)	Policy in place and enacted (both BRID and NRID implemented)
Electronic conspicuity	No policy in place	Policy in place, but not enacted	Policy in place and enacted
BVLOS (policy)	No policy in place	Policy in place, but not enacted	Policy in place and enacted
BVLOS (restrictions)	Allowed only in defined test areas	Allowed beyond test areas but with limitations (this could be either by means of standard scenarios or through exemptions and SORA)	Allowed anywhere
UTM	No policy in place	Policy in place, but not enacted	Policy in place and enacted
Mobile airborne permission	Mobile airborne use not permitted	Mobile airborne permitted with no required license	Mobile airborne permitted with mandatory license
Safety record*	No clear system for reporting safety incidents	System of voluntary reporting for safety incidents	System of mandatory reporting for safety incidents

\* This is part of the demand section of the index but follows the same rating scale as the regulatory metrics

# Glossary

BRID	Broadcast Remote ID. This is based on the transmission of radio signals directly from an airborne UAS to ground receivers in the UAS's vicinity.
BVLOS	Beyond the visual line of sight flight for drones. This refers to a situation when drones can be operated out of the visual sight from their controller, such as in cities, forests or remote areas.
САА	The UK Civil Aviation Authority.
Drone ID	Regulation requiring an electronic identification to be transmitted during flight. Most regulations require the identification to be transmitted via broadcast mechanism and/or through a communication network.
EASA	European Union Aviation Safety Agency. The supervisory body for aviation safety for countries in the EU as well as some non-member states.
Electronic conspicuity	Regulation requiring electronic conspicuity (visibility) for the UAV to provide situational awareness.
NRID	Network Remote ID. This is based on communication via the internet from a remote ID service provider that interfaces with the UAS, or with other sources in the case of non-equipped network participants. The drone is communicating with something that provides remote identification information to the internet.
U-space	U-space is a set of new services relying on a high level of digitalisation and automation of functions and specific procedures designed to support safe, efficient and secure access to airspace for large numbers of drones. U-space is an enabling framework designed to facilitate any kind of routine mission, in all classes of airspace and all types of environment – even the most congested – while addressing an appropriate interface with manned aviation and air traffic control.
UAM	Urban air mobility. UAM envisions a safe and efficient aviation transportation system that will use highly automated aircraft and operate and transport passengers or cargo at lower altitudes within urban and suburban areas.
UAS	Unmanned aerial system. The term refers to the combination of the vehicle or aircraft, the controller and the link(s) that connects them.
UAV	Unmanned aerial vehicle. This term refers to the platform, airframe or body of the aircraft. The term can be used interchangeably with drone and unmanned aircraft (UA).
UTM	Unmanned air traffic management system. This is a means of coordinating safe drone flight within set parameters and is separate from traditional air traffic control for civil aviation.

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