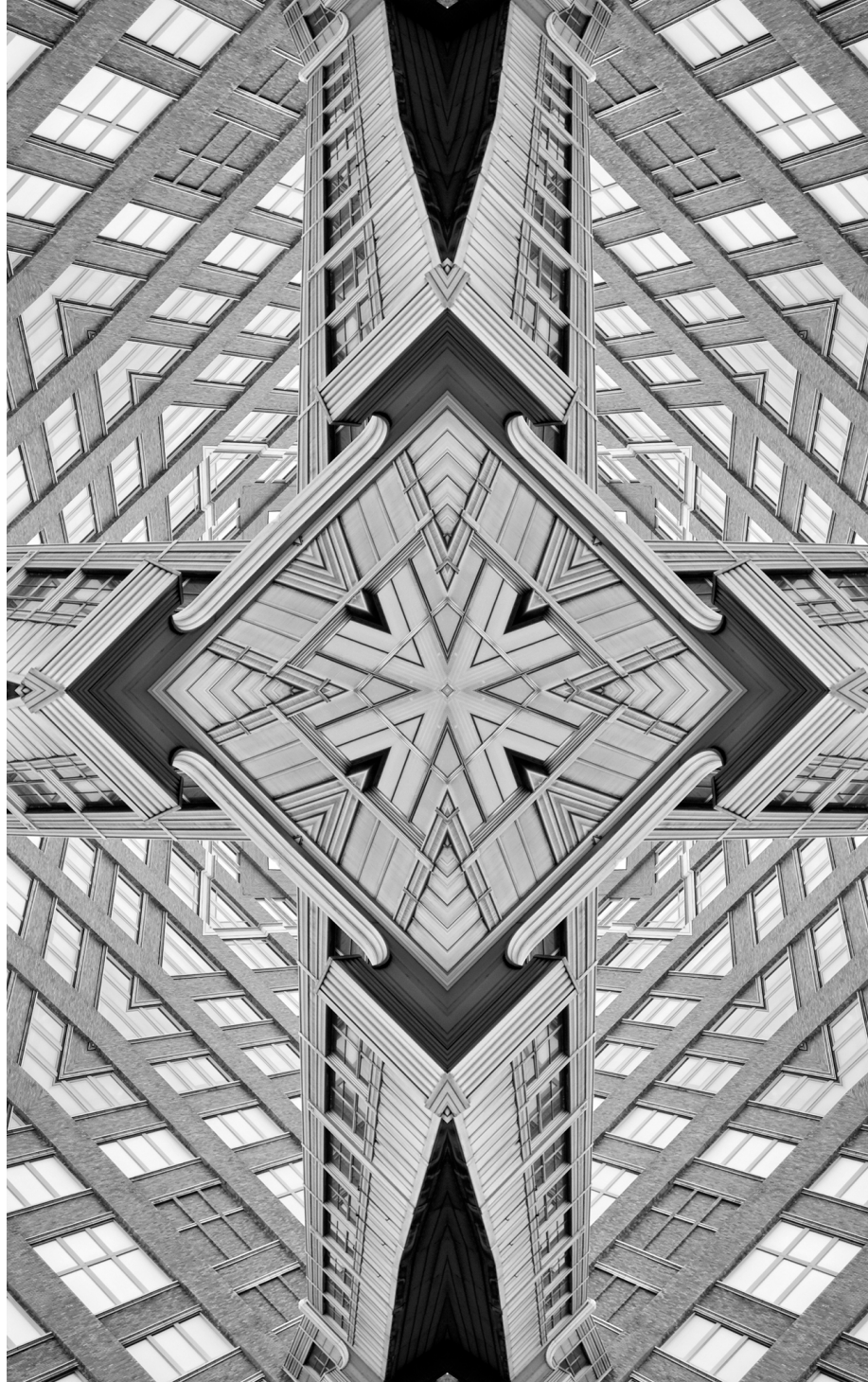ORF
OBSERVER
RESEARCH
FOUNDATION

Issue

Brief

ISSUE NO. 565
JULY 2022

Fast-Tracking the Flight of India's Drone Industry

Antara Vats

Abstract

India is keen to leverage its nascent civilian drone (or unmanned aerial vehicle) industry to become a global hub. Since 2021, it has built a conducive policy ecosystem to support the domestic drone industry. In what this brief collectively calls the 'Drone Regulations 3.0', it includes the liberalised Drone Rules 2021, a production linked incentive scheme, the unmanned aerial vehicle traffic management policy, the certification scheme for unmanned aircraft systems, the drone import policy, and the Drone (Amendment) Rules, 2022. This brief traces the evolution of the regulatory environment for the domestic drone industry since 2014 and recommends actions to address the remaining gaps to transform India into a global drone hub.

Introduction

The Drone Rules (New Rules) 2021 defines drones as "an aircraft that can operate autonomously or can be operated remotely without a pilot on board."[1] Drones, also known as unmanned aircraft systems (UAS) or unmanned aerial vehicles (UAVs), were previously primarily used to carry lethal weapons.[2] However, with technological advancements, their use for civilian purposes has evolved in recent years. Drones provide productivity and efficiency at low costs for a variety of activities. In India, for instance, drones were used to ward off locust attacks[3] and deliver COVID-19 vaccines,[4] and central and state ministries and industry players have scaled-up experiments since 2020 on drone usage for land surveys,[5] disaster management,[6] law enforcement,[7] aerial surveillance,[8] and agricultural activities[9] across the country (see Table 1). Improvements in access and quality of geospatial data due to the National Geospatial Policy, 2021[10] have also facilitated the use of drones across sectors. However, risks to infrastructure and citizen safety in urban environments due to a collision with another unmanned or manned vehicle remain in low altitude uses. Moreover, most drones have modern built-in cameras that can easily violate citizens' spatial and informational privacy.

Table 1:
Dominant drone use cases across India

Use Case	Examples
Payload deliveries	• Medicine from the Sky project: COVID-19 vaccines, medicines, and units of blood in Mizoram, Arunachal Pradesh, and Gujarat[11] • Drone Response and Outreach in Northeast (i-Drone) project: COVID-19 vaccines, antenatal care medicines, syringes, gloves, and multivitamins in Manipur, Nagaland, and Andaman and Nicobar Islands[12] • Food and grocery in Maharashtra, Delhi, Mumbai, Hyderabad, Karnataka, Tamil Nadu, Rajasthan, and Punjab[13,14]
Agricultural activities	• Hara Bahara project: Reforestation by Telangana government[15] • Pesticide, insecticide, and nutrient sprays across multiple states[16] • Crop assessment in several states[17]

Use Case	Examples
Aerial surveillance	• Compliance with COVID-19 lockdown guidelines in Delhi, Telangana, Kerala, Maharashtra, and Punjab[18] • Emergency/disaster situations in Uttarakhand and Kerala[19] • High Power Police Technology Mission: Law enforcement by most Indian states like Delhi, Uttar Pradesh, Telangana, Chennai, Tamil Nadu, and Karnataka[20] • Forest governance and prevention of illegal activities like deforestation, poaching and encroachment and forest fires in Maharashtra, Haryana, and Tamil Nadu[21]
Geospatial mapping	• Survey of inhabited areas and mapping with improvised technology in village areas in all Indian states except Delhi[22]
Project monitoring	• Mining by Coal India[23] and Central Mine Planning and Design Institute[24] • Road infrastructure by the National Highways Authority of India[25] • Railways by Central Railways[26] • Watershed management in Maharashtra[27]

Introduction

With the aim of becoming a global drone hub by 2030,[28] India has adopted an enabling policy ecosystem for drones since August 2021. In what this brief collectively calls the 'Drone Regulations 3.0', it includes the Drone Rules (New Rules) in August 2021, a production linked incentive (PLI) scheme in September,[29] National Unmanned Aircraft System Traffic Management Policy Framework (UTM 2.0) in October,[30] the certification scheme for unmanned aircraft systems (CSUAS) in January 2022,[31] the drone import policy[32] and Drone (Amendment) Rules in February 2022.[33] Additionally, the Insurance Regulatory and Development Authority of India (IRDAI) released a set of guidelines for drone insurance in February 2021,[34] the Ministry of Agriculture released standard operating protocols (SOPs) to streamline the use of drones for spraying soil nutrients and pesticides in December,[35] and the Indian Council of Medical Research (ICMR) released a guidance document for using drones in healthcare in June 2022.[36]

Introduction

With the Drone Regulations 3.0, the government appears to be attempting to balance the growth of the domestic drone industry and the need to regulate risks alongside industry requirements by proactively involving industry actors in the policymaking process. This co-regulatory approach was largely missing in previous drone-related policy documents, with the government keen to independently understand the technology and pre-emptively address risks. The government's role as the largest deployer of drones produced by private sector enterprises may have also contributed to adopting this approach.

As drone usage increases in India, it is imperative to assess developments in the domestic regulatory environment for drones since 2014 in the backdrop of the global regulatory approach. Moreover, drones are categorised as remotely piloted aircraft systems, model remotely piloted aircraft systems, and autonomous unmanned aircraft systems. Autonomous unmanned aircraft systems use artificial intelligence (AI) technologies like computer vision[37] to detect and avoid obstacles. Drone Regulations 3.0 could perhaps guide the approach for legislative interventions to regulate high-risk use cases of AI. This brief also recommends measures to address the remaining gaps and inconsistencies in Drone Regulations 3.0 to make India a global drone hub. For instance, the regulatory regime for civilian drones must provide pathways to ensure air space management to avoid collisions, standards for security, informational and spatial privacy of citizens, and so on. These standards must be consistent as they determine the drone structure, components, and technology used within them. The scope of this brief is limited to civilian drones as the government views the issues of military drones[a] as separate from civilian drones.

---

a   In 2019, the Ministry of Civil Aviation released the National Counter Rogue Drone Guidelines and is working on a comprehensive counter-drone policy to keep pace with rapid technological advancements. Additionally, in January 2022, it passed guidelines for anti-drone guns to neutralise rogue drones by security forces in border areas.

Global Regulatory Landscape

Although drones are being deployed for various uses (most of the use cases identified in Table 1 are not unique to India), regulators across the globe continue to scramble to address concerns about balancing public safety with rapid innovation. Organisations like the International Civil Aviation Organization[38] and International Organization for Standardization[39] (ISO) have released operational procedures for commercial UAVs. These documents expand on international best practices and serve as an advisory standard for manufacturers and operators while providing recommendations for the safe and secure inclusion of UAVs in the airspace. ISO continues to refine and produce standards on drone personnel training, classification, and maintenance, among other considerations. The European Union Aviation Safety Agency[40] also attempts to simplify the certification process and align countries in the union to a single regulatory process.

Regulations at a national level can be classified into the following groups:[41]

a) Outright bans

b) Effective bans where the formal process of licensing has outlined requirements that are impossible to meet

c) Operations within visual line of sight (VLOS)

d) Operations extended beyond VLOS with certain restrictions and requirements

e) Restrictions are applicable

f) Unrestricted drone flights

g) No drone-related legislation

Most countries ahead of the drone adoption curve—such as China, the US, Australia, the UK, and Canada[42]—have implemented operations within VLOS or operations that extend beyond VLOS with certain restrictions and requirements in the form of regulations. For instance, in Australia, standardised national drone safety signage provides consumers information on the authorised

region for drone flights, and the Australian Civil Aviation Safety Authority plans to adopt a digital mechanism to grant flight permits automatically.[43] In China, drones are permitted to be used for heavy payload deliveries.[44] In the UK, the Civil Aviation Authority has assigned a virtual space for enterprises to test their technology and has set up a regulatory sandbox to test and develop a concept of operations for the integration of UAVs into low-level air space, among other considerations.[45] In Africa, Malawi launched the first drone corridor to provide an opportunity for domestic and global enterprises to test their solutions,[46] and Rwanda offers international and domestic enterprises airspace contingent on them meeting safety requirements and standards provided by the government on a mission-specific basis.[47]

At the same time, countries like Morocco, Uzbekistan, Madagascar, Iran, and Iraq have banned drone operations to some extent due to public safety concerns.

Nevertheless, global regulators appear to have a common understanding that as the use cases of drones evolve, so should the regulatory framework and security arrangements, in sync with industry needs to ensure widespread adoption and innovation. This notion has found its way into India's regulatory approach to civilian drones.

Global Regulatory Landscape

"Drones are increasingly being deployed for various uses, but regulators across the globe are scrambling to address concerns about balancing public safety with rapid innovation."

Domestic Regulatory Environment for Drones

Since 2014, India's drone regulatory landscape has undergone a substantial evolution, clearly divisible into three phases (see Table 2). In the first phase (October 2014 to September 2018 and termed the Drone Regulations 1.0), the Ministry of Civil Aviation (MoCA) enacted an outright ban on the use of drones. The Drone Regulations 2.0 (September 2018 to March 2021) comprised regulations that sought to pre-emptively address the risks associated with the use of UAVs and the formal process of adoption and licensing was intractable. The Drone Regulations 3.0 (August 2021 to June 2022) emerged from a co-regulatory approach and aimed to bolster the domestic drone industry to make India a global hub. Although the civil aviation minister declared regulations released in 2018 as Drone Regulation 1.0, the author believes that banning drones was a regulatory choice that preceded other approaches in India and must be accounted for while discussing the evolution of the domestic regulatory landscape.

Table 2: Overview of domestic drone regulations (October 2014 to June 2022)

Drone Regulations 1.0 (October 2014 to November 2018)	• Outright ban
Drone Regulations 2.0 (December 2018 to March 2021)	• Civil Aviation Requirement for Remotely Piloted Aircraft Systems, 2018 • Drone Ecosystem Policy Roadmap, 2019 • National Unmanned Aircraft System Traffic Management Policy • Unmanned Aircraft System Rules, 2021
Drone Regulations 3.0 (August 2021 to June 2022)	• Drone Rules, 2021 • National Unmanned Aircraft System Traffic Management Policy 2.0 • Certification Scheme for Unmanned Aircraft Systems, 2022 • Drone Import Policy, 2022 • Drone (Amendment) Rules, 2022

Domestic Regulatory Environment for Drones

Drone Regulations 1.0 (October 2014 to November 2018)

In 2014, the Directorate General of Civil Aviation (DGCA) under the MoCA banned the use of drones in India until it formulated proper rules and regulations to govern their usage.[48] At that time, enterprises like Amazon were in the process of testing drone deliveries but had to halt their plans.[49] In 2016 and 2017, the DGCA released two versions of the National Drone Policy[50] for public comment. However, the ban was only lifted in September 2018 with the release of the Civil Aviation Requirement (CAR) for RPAS.[51] The MoCA stated that the delay stemmed from the rapid evolution of drone technology, the absence of clear international civil aviation standards and replicable drone regulations from other countries.[52] Notably, despite the ban, UAVs still flew without quality, certification, or safety standards.

Drone Regulations 2.0 (December 2018 to March 2021)

In 2018, the DGCA released the CAR for RPAS and RPAS Guidance Manual.[53] The ministries of defence and home affairs, the Airports Authority of India, and security agencies played a central role in drafting these rules. With CAR, the DGCA laid the groundwork for a paperless process for registering licenses, drones, owners, and pilots and obtaining all permissions for drone operations using the DigitalSky platform.[b] All RPAS, except nano drones and those owned by the central intelligence agencies, were required to have a unique identification number (UIN) and unmanned aircraft operator permit. The platform was envisioned to be used to implement 'no permission no take-off' (NPNT).[c] In addition, the rules enabled VLOS flights during the daytime and divided the airspace into the red (no-fly area), yellow (area requiring flight approvals), and green zones (unrestricted areas for flight) for drones.

To assist in the drafting of CAR 2.0, the MoCA released the Drone Ecosystem Policy Roadmap[54] in January 2019. Some pivotal recommendations were proposed, such as setting up a drone directorate within the DGCA, developing favourable infrastructure for beyond visual line of sight (BVLOS) operations

---

b   DigitalSky is India's unmanned traffic management system that assists the DGCA in conducting various drone-related activities, such as processing drone license applications.

c   NPNT mandates making hardware and software upgrades to the drone to enable the flight only after receiving the permission artefact, and prevent unauthorised drones from flying or derailing from approved flight paths.

Domestic Regulatory Environment for Drones

like unmanned aircraft system traffic management (UTM), drone corridors and ports. This was followed by the MoCA releasing the discussion draft of UTM 1.0 and setting up a dedicated drone directorate in 2020.[55] To address concerns over air space management due to the increased number of UAS and manned aircraft, the UTM 1.0 document[56] urged using the DigitalSky platform to ensure real-time situational awareness by all stakeholders, simplifying drone operations and evaluating and mitigating risks for low-level UTM.

The MoCA released the draft Unmanned Aircraft System Rules[57] in March 2021. The rules instructed startups, authorised manufacturers, and educational institutions to carry out research and development (R&D) only after obtaining authorisations from the DGCA and made it mandatory to procure a certificate of airworthiness, which determines that specified safety requirements are met for a manufactured or imported UAS. The stakeholders involved in the entire life cycle of drone development and deployment had to seek about 25 types of permissions and approvals, with 72 different types of fees (ranging from INR 500 to INR 25,000). The UAS Rules, like CAR, continued to prohibit foreign entities from registering as authorised persons to operate or own drones. However, it permitted product delivery using medium and large UAS.

While the use of drones was legalised, regulation severely restricted the development and operations of drones,[58] especially for enterprises and individuals using drones for recreational purposes.[59] Clearances were required at every stage, including an import licence from the Directorate General of Foreign Trade (DGFT), an import clearance from DGCA, and equipment type approval by the Department of Technology's Wireless Planning and Coordination Wing, before applying for a UIN on the DigitalSky platform under CAR.

While CAR did not allow for drone deliveries, stymieing experimental BVLOS operations planned by industry players and impacting foreign investment, the UAS Rules allowed BVLOS operations. However, the provision of detailed procedure for conducting experimental operations (including security clearances and compliance requirements) were delayed as the DGCA and MoCA did not set timelines for processing permissions. The time lost in understanding the complex set of rules, applying for permissions and then receiving them meant opportunities and money were lost by the domestic industry. Moreover, failure to meet any of the requirements could translate into heavy penalties for operators and manufacturers.

Domestic Regulatory Environment for Drones

Furthermore, all the permissions were intended to be facilitated by DigitalSky platform but it suffered from serious technical limitations,[60] including bugs in the application programming interfaces and a non-functional drone airspace map that divided the airspace into zones. The UAS Rules, while providing clarity in some aspects of CAR, tangled the regime in others,[61] to the detriment of consumers and industry. Importantly, prescriptive models of regulation that brood over strict certification standards do not often act in the interest of dynamic technologies that evolve rapidly.[62]

Drone Regulations 3.0 (August 2021 to June 2022)

Through continuous discussions with industry, legal experts, and public and government stakeholders, India's drone regulatory landscape has, since August 2021, begun to give room to the industry to experiment and contribute meaningfully to the policy ecosystem. The number of permissions needed has been drastically reduced from 25 to five, and the types of fees from 72 to four. The MoCA has also removed the restrictions on foreign ownership of domestic drone companies and the requirement of import clearances from DGCA. It has allowed the development of drone corridors for cargo deliveries and increased the permissible payload to 500 kgs. The revamped drone airspace map released in September 2021 has classified up to 90 percent of Indian airspace as the green zone for flying drones up to 400 feet. Furthermore, a revamped DigitalSky platform was launched in January 2022, with digitalised forms, permissions, and updated information.

International actors previously on the fence about investing in India were quick to respond[63] once the government took steps to support the domestic industry in September 2021. For instance, Japan, which is looking for alternatives to DJI drones based in China due to data security concerns, has now partnered with an Indian firm (Aerodyne) to manufacture drones.[64] To promote 'Atmanirbhar Bharat' and Make in India, the MoCA has earmarked INR 120 crore under the PLI scheme to incentivise the development of drones and drone components over the next three years. Fourteen entities[65] were shortlisted from the first set of PLI applications.[66] Additionally, the agricultural ministry announced a monetary grant programme, Sub-Mission on Agricultural Mechanisation (SMAM),[67] in January 2022 to facilitate the purchase of agricultural drones. Mission 'Drone Shakti' was announced as part of the 2022 Union Budget to promote drone-as-a-service and support drone startups.

Domestic Regulatory Environment for Drones

In January 2022, the DGFT notified the certification scheme for unmanned aircraft systems (CSUAS) to streamline the process and timeline of receiving the drone type certificate. CSUAS aims to ensure a minimum airworthiness standard and account for the safety and quality of indigenous drones by outlining an evaluation criterion for obtaining the certificate. The MoCA also announced the Drone (Amendment) Rules 2022 to remove the requirement of a remote pilot license. In February, the government also notified the drone import policy, which bans the import of foreign drones except those required for defence, security, and R&D purposes with permission from the DGFT, while also simplifying the import process of drone components by eliminating permission requirements. The MoCA is also working on a drone export policy.

Drone Regulations 3.0 have three distinct features when compared to previous iterations:

First, the New Rules have proposed to create a drone promotion council with stakeholders from government, academia, and startups instead of only the key stakeholders from the government. The council is an encouraging step for the industry as it can assist the government in identifying implementable security standards that are cost-effective and ensure public safety. The agriculture ministry's SOPs on the use of drones in agriculture and ICMR's June 2022 guidelines on using drones for vaccine deliveries were also prepared in consultation with industry, academia, and government stakeholders. UTM 2.0 has also increased possibilities for the industry to innovate by allowing third-party service providers to deploy algorithm-driven software services to manage drone traffic and supplementary services for navigation and weather tracking.[68] Moreover, in addition to the Quality Council of India,[c] a multi-stakeholder steering committee with representatives from relevant government departments, regulatory bodies, and technical and academic experts will oversee the implementation of CSUAS.

---

d   Within the Drone Rules 2021, the Quality Council of India has been onboarded as a certification entity to issue the certificate of airworthiness for drones.

Domestic Regulatory Environment for Drones

Second, documents within Drone Regulations 3.0 are intended to respond to the technological advancements, regulatory changes, and developments in air traffic management systems. The provisions allow the MoCA to keep up with the technology and its risks before pre-emptively regulating it, especially for BVLOS deliveries.[69] The government is in the process of conducting several experimental trials to identify the regulatory requirements. For instance, the ICMR guidance document was based on field experiments conducted in 2021. UTM 2.0 has laid the groundwork for experimental trials to dynamically address the challenges of rapid adoption and expansion of civilian drone usage across sectors in India while balancing global safety norms. Although UTM 2.0 does not address the development of drone corridors, updated versions of the document are expected to do so.

Third, Drone Regulations 3.0 are bolstered by budgetary allocations to enhance the supply and demand of drones. With an outlay of INR 120 crore, the PLI scheme for drones and drone components is the first large-scale investment by the government in the industry to increase the supply of drones. The MoCA has also been investing in enhancing demand through SMAM. It incentivises farm science centres (Krishi Vigyan Kendras), the Indian Agricultural Research Institute, farm machinery training and testing institutes, and state agriculture universities to organise large-scale demonstrations of drones on agricultural fields by granting up to 100 percent of the cost of such drones or INR 10 lakh, whichever is less.[70] Farmer producer organisations are also eligible to receive grants of up to 75 percent of the cost of agriculture drones or hire them from drone manufacturers, startups, custom hiring centres, and Hi-tech hubs.[71]

> "Since August 2021, India's drone regulatory landscape has begun to give room to the industry to experiment and contribute meaningfully to the policy ecosystem."

Strengthening India's Drone Industry: Recommendations

The MoCA's aim with Drone Regulations 3.0 is to build a conducive policy ecosystem that fast-tracks the flight of India's drone industry by attempting to balance industry needs with concerns around public safety. Nevertheless, some pertinent gaps remain within the new framework that must be addressed for India to realise its goal of becoming a global drone hub.

Focus on skill development for drone manufacturers, assemblers, developers, and pilots

To ensure a steady supply chain of drones, the government must enhance the scope of its vocational skilling programmes under Skill India for drone pilots, assemblers, software developers, drone data analysts, flight planners, technicians, geographic information system engineers, and hardware manufacturers. India's drone industry is expected to generate around five lakh job opportunities, 15,000 of which are in manufacturing.[72] The DGCA has authorised only 23 remote pilot training organisations (RPTO) or flight training organisations.[73] Considering the enormous employment opportunity, the government must facilitate the establishment of drone schools that focus on the entire life cycle and not just on flying drones. The Aerospace and Aviation Sector Skill Council (AASSC),[74] set up under the Skill India initiative, could become an RPTO and conduct regular short-term skill-based programmes. AASSC can prepare the course curriculum, examinations, and trainers for these courses along with academic institutions like the National Institute of Technology, Andhra Pradesh, which currently offers minor courses on drone technology and pilot training.[75] Moreover, AASSC has recently signed a deal with ClearSkies Aviation OPC Pvt Ltd and Throttle Aerospace Systems to assist in enhancing skills for drone development, repair, and operation.[76]

Focus on research and development capabilities

One of the key impediments to the growth of the domestic drone industry is disruptions in global supply chains and gaps in domestic R&D capabilities.[77] Since most domestic startups are currently just assembling imported drone components, the drone promotion council could be utilised to promote

Strengthening India's Drone
Industry: Recommendations

domestic software and component development. Furthermore, through the PLI scheme and the establishment of centres of excellence to promote R&D and conduct skills training (such as those established in IIT-Hyderabad[78] and IIT-Guwahati[79]), the government can assist industry players in finding ways to build cost-effective assembly lines as alternatives to international suppliers.

Augment consistency in manufacturing standards for software and hardware

While Drone Regulation 3.0 has refrained from mandating NPNT, the SOPs by the Ministry of Agriculture released in December 2021 mandate that drones comply with NPNT software and hardware (Page 6 (ii)). As states like Uttar Pradesh[80] gear towards becoming a drone manufacturing hub and developing their manuals for the commercial use of drones, the Bureau of Indian Standards subcommittee on UAV standardisation[81] can assist in developing consistent standards across states for the process of manufacturing, maintaining, testing, training, data sharing, and traffic management. Inconsistent standards severely impact industry obligations, often at the cost of innovation.[82]

Re-evaluate broad exemptions on drone research

Drone Regulations 3.0 exempts educational institutions, startups, drone manufacturers, and research entities from requiring UINs, certificates of airworthiness, remote pilot licences, and prior permission for using drones for research purposes. The previous versions of drone regulations required R&D organisations to apply for several permissions, increasing compliance and deterring innovation. Nonetheless, not assigning any identification criteria to drones under R&D in a densely populated country appears to be a ticking timebomb. The New Rules mention certain conditions that need to be met for R&D exemption to take effect, such as operations within the premises of the R&D entity in the green zone or an open area in the green zone under the person's control. However, the risk of accident is more when the research is underway as the drone might not be equipped with high precision and safety requirements. Strong R&D-centric countries like Australia[83] and the US[84] have mandated the registration of drones for R&D. The prototype drones under R&D must at least be assigned a UIN to identify the operator and purpose of flying in case someone suffers an injury.

Enable clarity on drone insurance

The New Rules require all drones, except nano drones, to operate with third-party insurance. Presently, only a few companies provide drone insurance in India.[85] The IRDAI's structure for drone insurance includes indemnity for the insured against the legal liability to pay damages in case of bodily harm to an individual, physical damage to the body of the drone, personal accident cover for the operator, and optional coverages. A significant optional coverage includes cover for the invasion of privacy, but like other categories of optional coverages, invasion of privacy has not been defined well within the existing regulations. During their flights, drones collect and process large amounts of personal and other data. Under the data communication, security, and privacy section, UTM 1.0 stated that data privacy will be protected under the Personal Data Protection Bill, 2019.[86] However, the absence of a data protection law in India significantly impairs the recourse mechanisms of citizens. Moreover, UTM 1.0 did not raise apprehensions about the blanket exemptions to government bodies and law enforcement agencies for collecting and processing personal data. UTM 2.0 has relegated the task of outlining data privacy standards post-UTM experiments. UTM 2.0 also states that the public may use UAS Traffic Management Service Provider to report if the drone breaches an individual's privacy. The absence of clarity on whether spatial privacy in private and public spaces is included[87] and the process adopted by public and private enterprises to collect and store data from drones makes it difficult for the public to defend their rights[88] and for an insurance provider to provide a cover for it. Standards for important considerations like privacy, security, and safety demand urgent attention and clarity. The MoCA must prioritise UTM experiments on outlining data privacy standards along with other optional coverages.

India's growing drone industry provides substantial economic opportunities to generate employment and increase the export of drones. While the Drone Regulations 1.0 and 2.0 were decent attempts, they were both over- and under-inclusive in their approach to defining and addressing the risks.[89] Despite their attempt at providing clear directions, they missed out on important aspects and were burdened by inconsequential details.[90] India still does not have answers to all the emerging risks, pathways for processes to ensure streamlined inclusion of drones in the airspace management systems, or mechanisms to control autonomous objects that are easy to produce and can generate considerable damage. Nevertheless, it has made a noteworthy attempt with Drone Regulations 3.0. The government has realised drones' strategic and economic benefits, and has provided the necessary impetus to harness the technology's potential. Like in many other countries, the focus of Drone Regulations 3.0 is to provide an agile framework and make concerted efforts for stakeholder consultations and experiments under UTM 2.0 instead of acting in haste. In the new era of domestic drone regulations, the regulator has become a facilitator for the industry while attempting to balance public safety needs. In the years to come, the essence of this regulatory approach should reflect in other emerging technology domains. ORF

Conclusion

Antara Vats *is Junior Fellow at ORF's Centre for Security, Strategy and Technology.*

Endnotes

1   Ministry of Civil Aviation, Government of India, *The Drone Rules 2021* https://www.civilaviation.gov.in/sites/default/files/Draft_Drones_Rules_14_Jul_2021.pdf

2   National Drones, "RPAS, Drone, UAV or UAS?" https://nationaldrones.com.au/rpas-drone-uav-or-uas/

3   Ministry of Civil Aviation, Government of India, https://www.civilaviation.gov.in/sites/default/files/MoCA_Order_Conditional_Exemption_for_anti_locust_operations_21_May_2020.pdf

4   Syed Mohammed, "Telangana launches 'Medicine from the Sky' project to drone-deliver vaccines, medicines to remote areas", *The Hindu*, September 11, 2021, https://www.thehindu.com/news/national/telangana/telangana-launches-medicine-from-the-sky-project-to-drone-deliver-vaccines-medicines-to-remote-areas/article36401406.ece

5   Ministry of Panchayat Raj, Government of India, https://svamitva.nic.in/svamitva/about.html?OWASP_CSRFTOKEN=69FI-XINX-5DHV-6HZA-EGYG-HALK-X3B2-JIDZ

6   Lalit Gupta and Nandita Pegu, "Drones to the rescue", *The Hindu*, May 5, 2020, https://www.thehindubusinessline.com/opinion/drones-to-the-rescue/article31500737.ece

7   "Drones-enabled SMART Policing", *Financial Express*, February 11, 2022, https://www.financialexpress.com/infrastructure/airlines-aviation/drones-enabled-smart-policing/2431371/

8   Gupta and Pegu, "Drones to the rescue"

9   Bharat Sharma, "5 Ways India is Boosting Its Drone Industry and Why It's Good For Everyone", *India Times*, September 18, 2021, https://www.indiatimes.com/technology/news/5-ways-india-is-boosting-its-drone-industry-and-why-its-good-for-everyone-549715.html

10   Department of Science and Technology, Government of India, *National Geospatial Policy, 2021*, https://www.surveyofindia.gov.in/webroot/UserFiles/files/NGP_11_07_Draft.pdf

11   Mohammed, "Telangana launches 'Medicine from the Sky' project to drone-deliver vaccines, medicines to remote areas"

12   Sayantani Biswas, "Drones in healthcare: ICMR's guidebook released at Bharat Mahotsav 2022", *Mint,* June 2, 2022, https://www.livemint.com/news/india/drones-in-healthcare-icmr-s-guidebook-released-at-bharat-drone-mahotsav-2022-read-here-11654159070747.html

13   Laxitha Mundhra, "Govt Bans Drone Import To Promote Indian Industry; Exempts R&D, Defence Purposes", *Inc42*, February 10, 2022, https://inc42.com/buzz/govt-bans-drone-import-to-promote-indian-industry-exempts-rd-defence-purposes/

14   "Swiggy, ANRA run drone trials", *Mint*, December 16, 2021, https://www.livemint.com/companies/news/swiggy-anra-run-drone-trials-11639596227621.html; Stephen Gershom; "Drone Delivery in India – Zypp Electric To Start Drone Delivery in Five Indian Cities," *DriveSpark*, January 8, 2022, https://www.drivespark.com/off-beat/drone-delivery-in-india-zypp-electric-drone-delivery-in-bangalore-delhi-mumbai-hyderabad-pune-035249.html

15   Sharma, "5 Ways India is Boosting Its Drone Industry and Why It's Good For Everyone"

16   The Hindu Bureau, "Union Budget 2022 | Drone services to be promoted through startups, skilling at ITIs", *The Hindu*, February 1, 2022, https://www.thehindu.com/business/budget/union-budget-2022-drone-services-to-be-promoted-through-startups-skilling-at-itis/article38360683.ece

17   "Union Budget 2022 | Drone services to be promoted through startups, skilling at ITIs"

18   Soumyarendra Barik, "Govt Agencies Can Now Legally Deploy Drones For COVID-19 Surveillance", *Medianama*, May 6, 2021, https://www.medianama.com/2020/05/223-govt-can-deploy-coronavirus-drone-surveillance/

19   "How drones boost disaster response, search and rescue", *Idea Forge*, November 19, 2021, https://www.ideaforge.co.in/blog/drones-disaster-response/

20   ET Government, "PM Modi backs tech driven High-Power Police Technology Mission", November 22, 2021, https://government.economictimes.indiatimes.com/news/technology/pm-modi-backs-tech-driven-high-power-police-technology-mission/87841341

21   "Drones for Security and Surveillance", *Idea Forge*, January 7, 2022, https://www.ideaforge.co.in/blog/drones-for-security-and-surveillance/

22   Ministry of Panchayat Raj, Government of India, https://svamitva.nic.in/svamitva/about.html?OWASP_CSRFTOKEN=69FI-XINX-5DHV-6HZA-EGYG-HALK-X3B2-JIDZ

23   PSU Watch Bureau, "Coal India to use drones for volumetric measurements", *PSU Watch*, January 25, 2021, https://psuwatch.com/coal-india-to-use-drones-volumetric-measurements/

24   Express News Service, "Drones to map underground fires in coal mines", *The New Indian Express*, February 6, 2020, https://www.newindianexpress.com/nation/2020/feb/06/drones-to-map-underground-fires-in-coal-mines-2099699.html

25   "NHAI makes drone usage mandatory for recording status of new highway projects" *Mint*, June 16, 2021, https://www.livemint.com/news/india/nhai-makes-drone-usage-mandatory-for-recording-national-highways-work-11623837758237.html

26   PTI, "Indian Railways procures Ninja drones for security surveillance and passenger safety", *The Economic Times*, August 22, 2020, https://economictimes.indiatimes.com/industry/transportation/railways/indian-railways-introduces-drone-based-surveillance-system-for-rail-security/articleshow/77621214.cms?from=mdr

27   IANS, "Maharashtra using drones for smart water management", *The New Indian Express*, May 9, 2019, https://www.newindianexpress.com/nation/2019/may/09/maharashtra-using-drones-for-smart-water-management-1974704.html

28   "Vision is for India to be the Drone Hub of the world; Drones shall play a key role in future armed conflicts: Amber Dubey, JS, MoCA". *FICCI*, February 3, 2021, https://ficci.in/pressrelease-page.asp?nid=4062; Gunja Sharan, "India Can Become A Global Drone Hub By 2030: Jyotiraditya Scindia", *Inc42*, May 11, 2022, https://inc42.com/buzz/india-can-become-a-global-drone-hub-by-2030-jyotiraditya-scindia/

29   Ministry of Civil Aviation, Government of India, *Production Linked Incentive (PLI) scheme for drones and drone components in India*, https://egazette.nic.in/WriteReadData/2021/230076.pdf

30   Ministry of Civil Aviation, Government of India, *National Unmanned Aircraft System Traffic Management (UTM) Policy Framework*, https://www.civilaviation.gov.in/sites/default/files/National-UTM-Policy-Framework-2021_24_Oct_2021.pdf

31   Ministry of Civil Aviation, Government of India, *Certification Scheme for Unmanned Aircraft Systems*, https://qcin.org/public/uploads/ck-docs/1643271921.Certification%20Scheme%20for%20Unmanned%20Aircraft%20Systems,%20MoCA%20notification%2026th%20Jan%202022.pdf

32   Directorate General of Foreign Trade, *Indian Trade Classification (Harmonised System) 2022 [ITC(HS)2022]*, https://www.teamleaseregtech.com/updates/article/16206/dgft-issues-notification-of-indian-trade-classification-harmonised-sys/

33   Ministry of Civil Aviation, Government of India, *Drone (Amendment) Rules, 2022*, https://egazette.nic.in/WriteReadData/2022/233331.pdf

34   Insurance Regulatory and Development Authority of India, *Product Structure for Insurance of Remotely Piloted Aircraft System (RPAS) / Drones,* https://www.irdai.gov.in/ADMINCMS/cms/whatsNew_Layout.aspx?page=PageNo4375&flag=1.

35   Ministry of Agriculture and Farmers Welfare, *Standard Operating Procedure (SOP) for use of Drone Application*, https://agricoop.nic.in/sites/default/files/SOP%20for%20Drone_2.pdf

36   Indian Council of Medical Research, *Guidance Document: Use of Drones in Healthcare*, https://www.icmr.gov.in/idrone/pdf_book/Guidance_use_drones_healthcare/mobile/index.html

37   Vikram Singh Bisen, "How AI Based Drone Works: Artificial Intelligence Drone Use Cases", *Medium*, February 5, 2020, https://medium.com/vsinghbisen/how-ai-based-drone-works-artificial-intelligence-drone-use-cases-7f3d44b8abe3

38   International Civil Aviation Organisation, *ICAO Cir 328, Unmanned Aircraft Systems (UAS)*, https://www.icao.int/meetings/uas/documents/circular%20328_en.pdf

39   International Organization for Standardization, *ISO 21384-3:2019 - Unmanned aircraft systems — Part 3: Operational procedures*, https://www.iso.org/standard/70853.html; Huzefa Tavawalla et al, *The Global Drone Regulation*: *Aerial Transport, Agritech, Commerce & Allied Opportunities*, Nishith Desai Associates, 2021, https://www.nishithdesai.com/fileadmin/user_upload/pdfs/Research_Papers/The_Global_Drone_Revolution.pdf

40   "Global Regulation of Drones", *Clyde&Co*, March 23, 2022, https://www.clydeco.com/en/insights/2022/03/global-regulation-of-drones

41   Miriam McNabb, "Drone Privacy Laws Around the World", *Drone Life* https://dronelife.com/2020/12/01/drone-privacy-laws-around-the-world-surfshark-maps-it-out/; Anish Michael, *Giving wings to a drone-powered India: Mapping enablers and opportunities*, Ola Mobility Institute, 2021, https://olawebcdn.com/ola-institute/drone-powered-india.pdf

Endnotes

42   *Leading countries in the global drone market in 2022, by revenue*, Statista, https://www.statista.com/forecasts/1302524/revenue-of-the-drone-market-worldwide

43   Australian Government, Civil Aviation Authority, Drones, https://www.casa.gov.au/drones

44   Civil Aviation Administration of China, http://www.caac.gov.cn/en/SY/

45   United Kingdom, Civil Aviation Authority, https://register-drones.caa.co.uk

46   Unicef Malawi, "Humanitarian drone corridor launched in Malawi", *UNICEF*, August 23, 2017, https://www.unicef.org/stories/humanitarian-drone-corridor-launched-malawi

47   Amanda Russo and Harrison Wolf, "What the world can learn from Rwanda's approach to drones", *World Economic Forum*, January, 16, 2019, https://www.weforum.org/agenda/2019/01/what-the-world-can-learn-from-rwandas-approach-to-drones/

48   "Civilian drones banned in India: Report", *India Today*, October 13, 2014, https://www.indiatoday.in/technology/news/story/civilian-drones-banned-in-india-report-222975-2014-10-13

49   Yatti Soni, "Amazon To Start Drone Deliveries In Chosen Countries Soon", *Inc42*, June 6, 2019, https://inc42.com/buzz/amazon-drone-delivery/; IANS, "Mumbai pizza delivery drone crashes into security hurdle", *Business Today*, May 23, 2014, https://www.businesstoday.in/lifestyle/off-track/story/mumbai-pizza-delivery-drones-raise-security-buzz-46064-2014-05-23

50   Nishika Tyagi, "India: The Drone Policy 2018", *Mondaq*, September 24, 2018, https://www.mondaq.com/india/aviation/738854/the-drone-policy-2018#_ftn1

51   Ministry of Civil Aviation, Government of India, https://pib.gov.in/newsite/PrintRelease.aspx?relid=183093

52   Ministry of Civil Aviation, Government of India, https://pib.gov.in/newsite/printrelease.aspx?relid=183093

53   Ministry of Civil Aviation, Government of India, *DGCA RPAS Guidance Manual*, https://public-prd-dgca.s3.ap-south-1.amazonaws.com/InventoryList/headerblock/drones/DGCA%20RPAS%20Guidance%20Manual.pdf

54   Ministry of Civil Aviation, Government of India, *Drone Ecosystem Policy Roadmap*, https://www.documentcloud.org/documents/5685215-Indian-Government-Drone-Ecosystem-Policy-Roadmap.

55   Soumyarendra Barik, "India Now Has A Dedicated Drones Directorate To Focus Exclusively On Drones" *Medianama*, November 16, 2020, https://www.medianama.com/2020/11/223-drones-directorate-india/

56   Ministry of Civil Aviation, Government of India, *National Unmanned Aircraft System (UAS) Traffic Management Policy*, https://www.civilaviation.gov.in/sites/default/files/National-UTM-Policy-Discussion-Draft-30-Nov-2020-updated.pdf

57   Ministry of Civil Aviation, Government of India, *Unmanned Aircraft System Rules, 2021*, https://www.dgca.gov.in/digigov-portal/Upload?flag=iframeAttachView&attachId=150337918

58   Mukesh Yadav, "India's new drone policy is shortsighted. Here's why", *Quartz India*, February 7, 2019, https://qz.com/india/1543681/indias-new-drone-policy-is-shortsighted-heres-why/

59   Rajeswari Pillai Rajagopalan and Rahul Krishna. *Drones: Guidelines, Regulations, and Policy Gaps in India*, Observer Research Foundation, March 2018, https://www.orfonline.org/wp-content/uploads/2018/03/ORF_OccasionalPaper_145_Drones.pdf

60   Antara Vats, "The road ahead for drone regulations in India", *Observer Research Foundation*, August 14, 2021, https://www.orfonline.org/expert-speak/the-road-ahead-for-drone-regulations-in-india/

61   Varsha Rajesh et al, "India: The Unmanned Aircraft System Rules, 2021: Key Highlights And Summary" *Mondaq*, March 24, 2021, https://www.mondaq.com/india/aviation/1050342/the-unmanned-aircraft-system-rules-2021-key-highlights-and-summary

62   World Economic Forum, *Advanced Drone Operations Toolkit: Accelerating the Drone Revolution*, 2018, https://www3.weforum.org/docs/WEF_Advanced_Drone_Operations_Toolkit.pdf

63   Naini Thaker, "Drone Rules, 2021: What it means for India's drone technology sector", *Forbes India*, September 13, 2021, https://www.forbesindia.com/article/take-one-big-story-of-the-day/drone-rules-2021-what-it-means-for-indias-drone-technology-sector/70363/1

64   Saurabh Sinha, "Indian drone makers getting export orders as data security fears shroud Chinese UAVs", *Times of India*, May 26, 2022, https://timesofindia.indiatimes.com/business/india-business/indian-drone-makers-getting-export-orders-as-data-security-fears-shroud-chinese-uavs/articleshow/91808148.cms

65   Soumyarendra Barik, "India has potential to become world's drone hub, says PM Modi", *The Indian Express*, May 27, 2022, https://indianexpress.com/article/india/india-has-potential-to-become-worlds-drone-hub-pm-modi-7939598/

66   ETNow Digital, "Govt invites applications for PLI scheme for drones and drone components", *ETNow*, May 5, 2022, https://www.timesnownews.com/business-economy/economy/govt-invites-applications-for-pli-scheme-for-drones-and-drone-components-article-91336396

67   Ministry of Agriculture & Farmers Welfare, *Providing agricultural services through drone application under Sub-Mission on Agricultural Mechanization (SMAM): Additional Guidelines – Regarding*, https://farmech.dac.gov.in/revised/2022/OM_for_Drone_Guidelines_underSMAM.pdf

68   ET Bureau, "Centre releases traffic management framework for drones", *The Economic Times*, October 26, 2021, https://economictimes.indiatimes.com/tech/tech-bytes/centre-release-traffic-management-framework-for-drones/articleshow/87282630.cms

Endnotes

Endnotes

69   Anirudh Rastogi et al, "New Drone Rules: A mature regulatory regime for drone-based deliveries", *Medianama*, December 15, 2021, https://www.medianama.com/2021/12/223-drone-rules-facilitate-deliveries-views/

70   Ministry of Agriculture & Farmers Welfare, *Providing agricultural services through drone application under Sub-Mission on Agricultural Mechanization (SMAM)*

71   Ministry of Agriculture & Farmers Welfare, *Providing agricultural services through drone application under Sub-Mission on Agricultural Mechanization (SMAM)*

72   Hemant Kashyap, "This Is The Right Time To Manufacture Drones In India: PM Modi At Drone Festival of India 2022", *Inc42*, May 27, 2022, https://inc42.com/buzz/right-time-manufacture-drones-india-pm-modi-drone-festival-of-india-2022/

73   Directorate General of Civil Aviation, Digital Sky Platform, https://digitalsky.dgca.gov.in/flight-training-organizations.

74   Aviation World, *Skill Development*, https://aviationworld.in/skill-development/.

75   Shouvik Das, "Indian colleges step up efforts in drone studies amid skill shortage" *Mint*, March 17, 2022, https://www.livemint.com/education/news/indian-colleges-step-up-efforts-in-drone-studies-amid-skill-shortage-11647495961125.html

76   Chetana Belagere, "AASSC ties up with Bengaluru-based company to launch drone learning course" *The New Indian Express,* October 12, 2021, https://www.newindianexpress.com/cities/bengaluru/2021/oct/12/aassc-ties-up-with-bengaluru-based-company-to-launch-drone-learning-course-2370879.html; Aviation World, *Skill Development*, https://aviationworld.in/skill-development/

77   Yaruqhullah Khan. "To become a drone-manufacturing hub, India must invest in R&D aggressively: Aarav Unmanned Systems' co-founder Vipul Singh", *Money Control*, December 21, 2021. https://www.moneycontrol.com/news/business/to-become-a-drone-manufacturing-hub-india-must-invest-in-rd-aggressively-aarav-unmanned-systems-co-founder-vipul-singh-7850991.html

78   "India's first Centre of Excellence for drone development to come up at IIT-Hyderabad",*Times of India*, April 19, 2019, https://timesofindia.indiatimes.com/city/hyderabad/indias-first-centre-of-excellence-for-drone-development-to-come-up-at-iit-h/articleshow/68947258.cms

79   "IIT Guwahati gets droneport, launches drone technology and skill development centre", *Telegraph India*. November 9, 2021, https://www.telegraphindia.com/edugraph/news/iit-guwahati-gets-droneport-launches-drone-technology-and-skill-development-centre/cid/1838099

80   Zee Media Bureau, "Uttar Pradesh to be drone manufacturing hub, companies lined up, says CM Yogi Adityanath", *Zee News*, December 23, 2021, https://zeenews.india.com/india/uttar-pradesh-to-set-up-drone-manufacturing-units-companies-lined-up-says-cm-yogi-adityanath-2421842.html

81   Bureau of Indian Standards, Ministry of Consumer Affairs, Food and Public Distribution, https://consumeraffairs.nic.in/organisation-and-units/division/bureau-indian-standards.

82   Gregory Tassey, *Standardisation in Technology-Based Markets*, National Institute of Standards and Technology, 1999, https://www.nist.gov/system/files/documents/2017/05/09/researchpolicypaper.pdf

83   Civil Aviation Safety Authority, *Register your drone*, Australian Government, https://www.casa.gov.au/drones/registration-and-flight-authorisations/register-your-drone

84   Federal Aviation Administration, *How to Register Your Drone*, United States Government, https://www.faa.gov/uas/getting_started/register_drone/

85   M Sarasathy, "Explained: Here's what a standard drone insurance policy will look like in India" *Money Control*, February 12, 2021, https://www.moneycontrol.com/news/business/economy/explained-heres-what-a-standard-drone-insurance-policy-will-look-like-in-india-6500491.html

86   Lok Sabha, *Report on the Joint Committee on the Personal Data Protection Bill, 2019*. http://164.100.47.193/lsscommittee/Joint%20Committee%20on%20the%20Personal%20Data%20Protection%20Bill,%202019/17_Joint_Committee_on_the_Personal_Data_Protection_Bill_2019_1.pdf

87   ISACA, *The seven categories of privacy that every enterprise must address*, 2017, http://chiefit.me/wp-content/uploads/2017/01/Privacy-Infographic_res_eng_0117.pdf

88   Michał Mazur et al, *Clarity from above-PwC global report on the commercial applications of drone technology*, May 2016, PricewaterhouseCoopers, https://www.pwc.pl/pl/pdf/clarity-from-above-pwc.pdf

89   Ananth Padmanabhan. *Civilian Drones and India's Regulatory Response*, Carnegie India, 2017, https://carnegieindia.org/2017/03/10/civilian-drones-and-india-s-regulatory-response-pub-68218.

90   Srijan Pal Singh, "Drones in India: weighted down by regulation, sector struggles to find wings" *The Economic Times*, December 21, 2019, https://economictimes.indiatimes.com/small-biz/startups/newsbuzz/drones-in-india-weighed-down-by-regulation-sector-struggles-to-find-wings/articleshow/72912821.cms?from=mdr.

Endnotes

Images used in this paper are from Getty Images/Busà Photography.

ORF OBSERVER RESEARCH FOUNDATION

Ideas . Forums . Leadership . Impact