Making India the drone hub of the world

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FICCI

EY

Building a better working world

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About the report

FICCI, in collaboration with EY, has developed this paper as a deep dive into the steps to be taken to make India the *drone hub of the world*. The paper highlights the existing manufacturing ecosystem that already produces components required by the drone industry and recommends measures to give a boost to the manufacturing of drones. Steps are thereafter spelled out to attract investments in the sector, boost exports, and spur innovation in conjunction with academia. The paper ends with a brief snapshot of the way forward, wherein the recommendations are weighed in terms of impact and ease of implementation.

Disclaimer

Foreword

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India has shown exemplary resilience in emerging from the COVID-19 pandemic crisis. With diminishing downside risks to the nation's medium-term growth, India is enjoying macroeconomic tailwinds and is well placed in dealing with the challenges emanating from current geopolitical developments.

Over the next decade, India is poised to exploit an opportunity that we cannot afford to miss —the drone revolution. The global drone market is poised to become a US$ 54 Billion market by 2025. Our estimates indicate that the drone manufacturing potential in India could be worth US$ 4.2 Billion by 2025, growing to US$ 23 Billion by 2030. Making India a drone manufacturing power would contribute to the country's target of a US$ 5 trillion economy with a larger focus on *Make in India* opportunity and once delivered, its success will contribute to national prosperity across multiple sectors.

The nation has the potential and the opportunity to emerge as a drone hub on the global stage. A strong case exists for a symbiotic relationship between the government and industry to realize our vision to make India the drone hub of the world by the year 2030.

This report explores how the government, in conjunction with the industry, could realize that vision. It gives us a sense of great satisfaction to note that the government has kick-started the journey towards making India the global hub of drone, with setting up a Drone Directorate under DGCA, implementing the PLI scheme for the drone sector, notifying the Drone Amendment Rules, 2022 to the Drone Rules,2021, setting up the Digital Sky platform, besides promulgating an SOP for drone application in spraying for soil and crop nutrients.

We hope that the report will offer important and useful insights for all stakeholders.

Preface

Akshya Singhal
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Atmanirbhar Bharat, the clarion call given by the Honorable Prime Minister Shri Narendra Modi, envisages India to occupy its rightful place as a significant player in the global economy, largely through measures that will be self-supporting and self-creating. In this context, a strong case exists for India to emerge as a global powerhouse in drones, as there would be a tremendous demand of drone services, and also the thrust on manufacturing. This coming of drones to the Indian skies is being eagerly awaited, much like the 'second coming', after the Internet and GPS technologies that have revolutionized the Indian marketplace.

The Ukraine conflict has provided a fresh impetus toward the employment of drones. Apart from defense and security, drones will find increasing utilization in agriculture, retail and infrastructure sectors, amongst others. The drone value-chain spans across manufacturing and value-added service components, impacting a large spectrum of industries and end-users, thereby having a significant manufacturing potential. Drones offer a large gamut of solutions across industries for aerial thermal inspection, aerial visual inspection, construction monitoring, surveillance and incident response, e-commerce delivery, warehouse inventory management, Intelligence, surveillance and reconnaissance missions, and as loitering munitions and target drones.

This report highlights various steps that need to be taken by all stakeholders, including the government and industry, to make the vision of making India as a drone hub a reality. India's drone story will have a trickle-down effect across multiple sectors, and thus have the potential to alter the Indian marketplace.

We would like to thank FICCI for giving us an opportunity to present this report and we hope you find it insightful.

1. Executive summary

1.1 Overview

Right from the 'ion-propulsion' based mythical Pushpak Vimana, flying machines have been transformational in their capabilities throughout history. The employment of unmanned flying vehicles wherever possible, have been game-changing. Since the mid-1800s, militaries around the world have exploited drones for training, target practice, air strikes, bomb detection and hostage negotiation. In 1849, the Austrian Navy attempted to use two hundred incendiary bombs in an effort to capture Venice, while since the 1900s, the US military began exploring drone technology to build practice targets for training. 1935 was an epochal year when actor and model-airplane enthusiast Reginald Denny became the first civilian to develop a remotely piloted vehicle. The Vietnam War forced the US military to exploit drones to cut down on losses of pilots; this movement culminated in the Predator program in the nineties, bringing drones to the center stage. The commercial application of drones came into the spotlight only after 2013, when Amazon announced its intention to exploit drones for delivery of goods.[1] Today, as drone technology pans out and finds widespread application, it would have a ubiquitous impact on a scale rivaling that of the Internet or that of GPS.

Drone technology is a sunrise sector, poised for exponential boom worldwide. India finds itself to be at a critical juncture in the evolutionary timeline of drone technology, wherein we have a time-critical window of one to two years to internalize and capitalize on drone technology to emerge as the drone manufacturing hub of the world.

1.2 Atmanirbhar Bharat and the significance of drone manufacturing in India

Atmanirbhar Bharat[2], which means self-reliant India', is the vision of the Honorable Prime Minister of India, with a mission of making India "a greater and more significant aspect of the worldwide economy". It is possible to accomplish this vision by seeking after arrangements that are effective, serious, and strong, and acting naturally, supporting and self-creating. The Atmanirbhar Bharat Abhiyan aims to cut down import dependence by focusing on substitution while improving the quality and safety standards of made in India products to enter the global value chain. It is a program to project India into the global market and gain a significant position. The Honorable Prime Minister envisages quantum jumps in the economy, instead of merely incremental, and such quantum jumps are to be driven by 'new-age technologies '.

Given the parameters of the Atmanirbhar Bharat Abhiyan, drone manufacturing meets the requirements to a compelling degree. There is a huge potential of the manufacturing of drone components in the country.

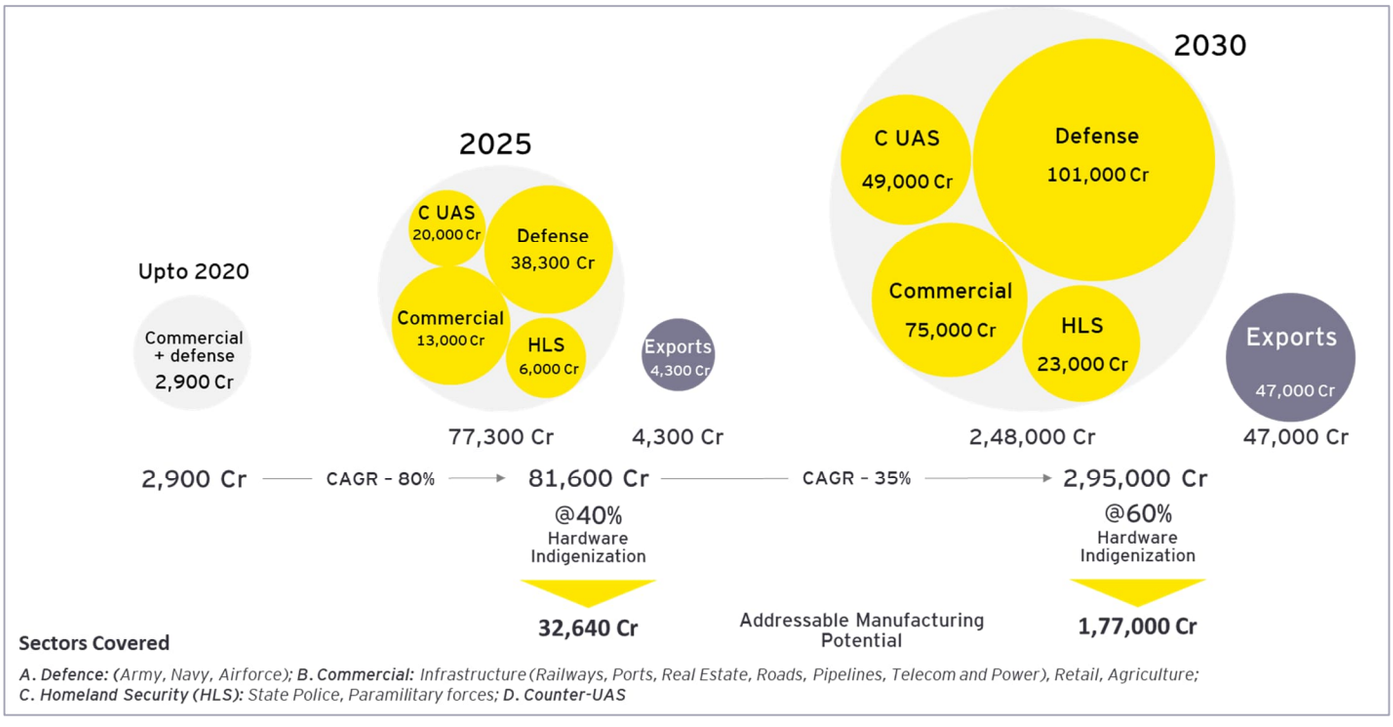
Item #	Sub-Component of drones	Commonalities/ Synergies with Other Industries
1.	Motors/ propulsion systems	Consumer electronics, white goods, electronics
2.	Payloads	Sensors and electronics, cameras and video equipment
3.	Communication modules	High-end electronics, robotics
4.	Batteries/ power systems	Automobiles, EV
5.	Propellers	Aerospace and aviation
6.	Assemblies and navigation systems	High end electronics, software systems, mobile phones
7.	Airframes	Aerospace and aviation

The latent availability of components within multiple elements of Indian Industry makes it feasible for the concerned industry expertise to be re-oriented towards manufacturing of drones.

[1] Alkobi, J. (2019). 'The evolution of drones: from military to hobby and commercial'. Retrieved from https://percepto.co/the-evolution-of-drones-from-military-to-hobby-commercial/
[2] Aatmanirbharbharat (mygov.in)

1.3 Market potential

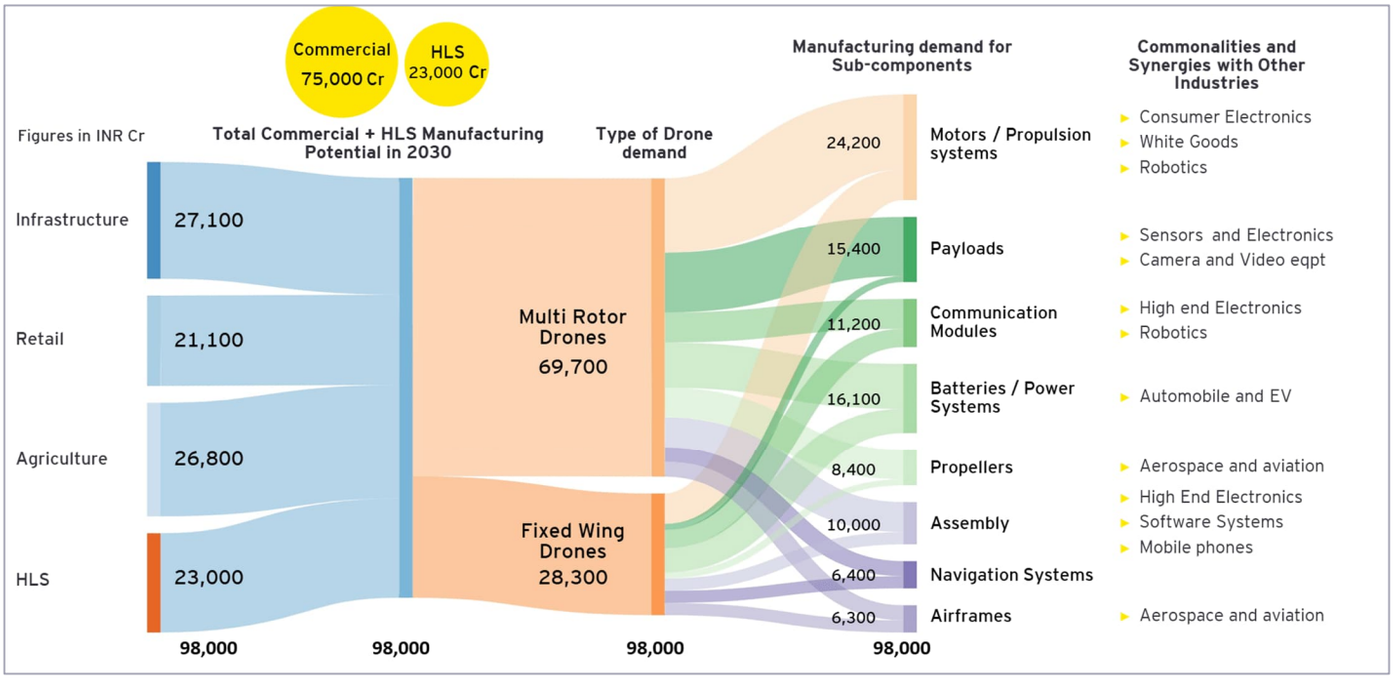
As per analyst estimates, India has the unique opportunity to realize approximately INR 1.8 Lakh crore of aggregate domestic manufacturing potential through focused implementation of drone indigenization projects, across *defense*, *commercial*, *homeland security* and *counter UAV* sectors. Analysts expect a CAGR of 80% in 2020 to 25, followed by a CAGR of 35% in 2025 to 30[3].



The rise of the drone manufacturing industry in India will result in significant manufacturing trickle-down effects across the subcomponent value chain, right across motors/ propulsion systems, payloads, communication modules, batteries/power systems, propellers, assembly, navigation systems and airframes. These subcomponents have commonalities and synergies with allied industries, which would get a fillip in turn.

[3] Aggregated estimates from sources mentioned in the end

The *commercial sector* largely comprises *the infrastructure, retail* and *agriculture*. Taken together with homeland security, it is estimated that a manufacturing potential of INR 98,000 crore in 2030 across fixed wing and multi-rotor drones. The manufacturing demand for the sub-components of these drones would find extant commonalities and synergies with multiple industries as depicted below[4].



1.3.1 A call to action

For India to meet its manifest destiny as a drone manufacturing hub, it is essential that various ministries and departments synergize their efforts to ensure rapid progress and to overcome roadblocks on a war-footing. In conjunction, the industry needs to scale rapidly and systematically. To enable this scale-up of industry, it is crucial for the government to play a market-maker role and generate demand by adopting drone technology in transformative projects like SWAMITVA. A two-pronged collaborative approach, encouraging startups as well as supporting large companies, would be the key to all-round success.

It would be pertinent to identify a few 'anchor' companies willing to commit to manufacturing drones in India in as little time as is practicable. The government should provide an opportunity to such 'anchor' companies s to present their plans and their expectations, so as to include the outcomes toward orchestrating a holistic and timely push towards drone manufacturing in the country.

India has introduced market leading regulations and policy interventions under the guidance of the Honorable PM, addressing both- the demand side (through drone policy) and the supply side (though PLI and import bans). The rest of the world will catch up subsequently in terms of this regulatory ecosystem and the drones market will rapidly grow worldwide, but India has a unique advantage right now. Thus, we need to act quickly to cement our position in both manufacturing and services — both to serve the local economy and be ready for the global boom.

An analogy from the IT Industry would be appropriate. One of the reasons we were able to dominate the IT services industry and be the Number One Provider of IT services in the world is that we were able to tap into our young, technically qualified workforce at a time where internet penetration and IT adoption was booming worldwide.

We have a similar chance to be the Number One provider of drone related offerings globally

[4] https://www.droneregulations.info/index.html
https://www.newamerica.org/international-security/reports/world-drones/who-has-what-countries-with-armed-drones/
https://investinisrael.gov.il/HowWeHelp/downloads/UAVs%20and%20Drones.pdf
https://www.goldmansachs.com/insights/technology-driving-innovation/drones/
https://tracxn.com/explore/Drones-Startups-in-United-Kingdom
https://tracxn.com/explore/Drones-Startups-in-Russia
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https://www.loc.gov/law/help/regulation-of-drones/comparative.php
https://www.statista.com/statistics/879577/estimated-us-unmanned-aerial-vehicle-market-volume/
https://dronecenter.bard.edu/files/2019/10/CSD-Drone-Databook-Web.pdf

1.4 Vision, mission and objectives

It is, therefore, essential to unambiguously lay down the Vision, Mission and Objectives for the country as we embark on our journey to emerge as the drone hub of the world.

1.4.1 Vision.

To make India the drone hub of the world by 2030, offering the most competitive and innovative manufacturing capabilities

1.4.2 Mission.

Achieve manufacturing potential of INR 180,000 crore (US$ 23 billion)[5] by 2030 and capture 25% of global drone market share through exports from India.

1.4.3 Objectives.

- To develop a dynamic, robust, and competitive drone industry to cater to the needs of India and the world with high-quality products
- To reduce dependence on imports and take forward 'Atmanirbhar Bharat' initiatives, through domestic design and development
- To promote export of Drone and Counter-UAS solutions and become part of the global drone value chains
- To create an environment that encourages R&D, rewards innovation, creates Indian IP ownership and promotes a robust and self-reliant Drone Industry

1.5 Key recommendations

Action theme	Action plan	Key recommendations
1. Demand creation	a. Government as a market maker	Ministry of Defence: Between 5 to 10% of the defence capital budget to be allocated for procurement of drones on out-right purchase or lease-based model as well as upgradation of the existing drone fleet (excluding MRO services).
		Ministry of Home Affairs: Drone adoption should be encouraged under central schemes like the Nirbhaya scheme and specific allocation for drone procurement under the Police Modernization budget should be made. This shall help add a force-multiplier effect to the law enforcement agencies.
		Ministry of Urban Development: Drone-enabled solutions to be included within the Smart City framework recommended by MoUD, implemented under the AMRUT mission.
		Infrastructure ministries (Road transport and highways, Railways, Power, Telecom) to issue directives to departments and PSUs to encourage faster adoption of drones.
		Government to increase the usage of drone technologies by adopting them in transformational projects.
	b. Policy interventions by states / UTs	States to provide active policy support and incentives for encouraging manufacturing and deployment of drones. Some of the recently announced state drone policies should be adopted across all states as best-practice model after suitable changes.
	c. Simplify procurement procedures	Procurement commitment of at least 25% of quantities even in case of single vendor scenarios will accelerate process of adoption Simplify tendering process by establishing use-case wise standard specifications across the government departments.

[5] *Sectors Covered*

A. Defence: (Army, Navy, Airforce); B. Commercial: Infrastructure (Railways, Ports, Real Estate, Roads, Pipelines, Telecom and Power), Retail, Agriculture; C. Homeland Security (HLS): State Police, Paramilitary forces; D. Counter-UAS

Action theme	Action plan	Key recommendations
2. Facilitate manufacturing	a. Provide collateral-free and personal guarantee-free credit guarantee and project finance loans to drone startups and MSMEs	Financial institutions should provide collateral-free and personal-guarantee free project finance loans at low interest rates to Start-up or MSME companies that have received confirmed government or private sector orders. This will enable them to use the funds toward their working capital needs to fulfill orders. This will also prevent local companies from seeking FDI just to fulfill working capital requirements. Further, financial institutions may consider giving collateral-free, and personal guarantee free loans up to 100% for companies seeking to invest in testing and manufacturing infrastructure in this sector, as this would also help in reducing the capital-intensive requirements in drone manufacturing.
	b Drone testing sites	Government to formulate policy framework/guidelines for states to apply for testing sites.
		Leverage PPP models to incentivize private investments to set up, operate and maintain the test sites.
	c. Components	Increase localization to get quality with economy of scale Government to support local manufacturing of components and value addition. There are strong opportunities in components like battery, airframe and motors for drones, which is visible along with demand emerging from other associate industry to build a case for local manufacturing of battery cell, carbon fiber and light-weight BLDC motors for drones. Other high-value components like Auto Pilot, Navigation, LIDAR/RADAR, which are heavily dependent on chips and sensors, are not being manufactured in India and could be seen as long-term focus areas.
3. Attract investments	Support to anchor investors	To inspire confidence within the Indian drone ecosystem, prominent companies in India and abroad need to take a lead in kick-starting manufacturing activities and pursue investments. The government should afford an opportunity to present 'plans' and 'expectations' by a few anchor companies willing to commit investments.
4. Exports	a. Streamline SCOMET license	Streamline and remove ambiguities in SCOMET licensing processes The Government has regulated the export of dual-use items and technologies under India's Foreign Trade Policy. There is currently a lack of clarity among industry on when to export under which category, and how to ascertain if a drone falls in neither of the three categories ('Munitions'-6A010, 'Special Materials'-8A912, and Unmanned Aerial Vehicles-5-5B) and would therefore not be a SCOMET item. DGFT could consider creating strict Service-level Agreement (SLA) for each application to ensure predictable timelines for processing each application. Currently, manufacturers are encountering processing times of anywhere between 4 to 16 weeks per application. For each export, DGFT is currently reviewing the OEMs product itself in addition to the due diligence of the end user. The product verification happens even if the exact same product is being exported to another end-user, adding time and duplication of DGFT's effort to the export process. DGFT may create a mechanism (leveraging their database of exported items) to allow OEMs to apply for an "export approved" label for their products prior to an actual export application being submitted. This will help reduce timelines, with DGFT only having to conduct the end user due diligence at the time of export of the prior "export approved" product.
	b. Permission for demonstration in other countries	Taking drones abroad for international exhibitions / demonstrations is very cumbersome and lengthy process, thus hampering international marketing activities for Indian manufacturers. At present, each demo permit application requires to be certified by the end user in the foreign country for whom the demo is being carried out. The time period for bringing the drone back to India post the demo is 90 days. Demo permits are provided only point to point i.e., single country basis. A possible way out:

Action theme	Action plan	Key recommendations
		► DGFT may allow OEMs to export via self-declaration for purposes of demonstrations and trade shows ► DGFT may also allow the provision of extending the demo period on an existing and active application. DGFT may also consider allowing a multi-country export mentioned clearly in the application to reduce the cost of OEMs needing to re-import and re-export their products when needing to demonstrate between geographies.
5. Other actionable points	a. Streamline industrial license	The mechanism of giving a license (other than that for defense items) is not spelled out clearly, and neither is the license requirement being enforced. Due to this, several companies who have the industrial License (IL) for drones are being put under undue compliance and cost disadvantage vis-à-vis companies that do not take a license. It is required to have a level playing field in this matter. Remove the need for Industrial Licensing for UAS that are not a part of the defense items list. To expedite the process of establishing and operationalize manufacturing facilities for defense drones, it is recommended that IL be issued within a time frame of six months period.
	b. G2G deals to support drone manufacturing	ToTs / Strategic Partnerships/ Offsets to be focused on filling TRL gaps in research, design, manufacturing, and testing technology.
	c. Funding support	Government to provide innovation funding for strategic and high-risk technologies and innovations and invest to build Indian ecosystem players.
		Dedicated fund to provide grants for research in drone enabled technologies and policies.
	d. Inter-Ministerial Committee on drones & counter-drones	An Inter-Ministerial Committee (IMC) on drones and counter-drones be constituted with representation from all the concerned ministries / departments dealing with the drone and counter drone sector. IMC should regularly meet and deliberate to address the issues and bottleneck pertaining to the sector. The Committee may also choose to co-opt or invite any other department, ministries, stakeholders or experts as required and invited by the chair. The IMC should look into all the issues including innovation, technology development, regulations, mother technology development, global value chains, testing, skill development, training, global standards, reciprocity issues, custom duties to make this sector globally competitive and to become the manufacturing hub for the world.
	e. Innovation	Set up a mechanism for transformation of innovation into commercially viable products to bridge gaps between prototyping to production.
		Set up accelerators for innovation and growth of indigenous drone related IPs and start-ups.
	f. Skill and academic development	Subsidize skilling costs for training and development of human resources.
		Formulate drone research, development, manufacturing, and services related curriculums in IITs, Rajiv Gandhi National Aviation University (RGNAU) and other academic institutions.

Considerable fast-tracked activity has been underway toward the goal of making India a global drone hub. The Government has extended the PLI scheme to UAS through a notification on 15 Sep 2021. A 'Digital Sky' platform is operational. To synergize activities across the board, a Drone Directorate has been formed under the DGCA. SOPs for drone application in spraying for soil and crop nutrients has been published by the Ministry of Agriculture and Farmers Welfare.

2. Overview: the drone ecosystem

2.1 Use cases

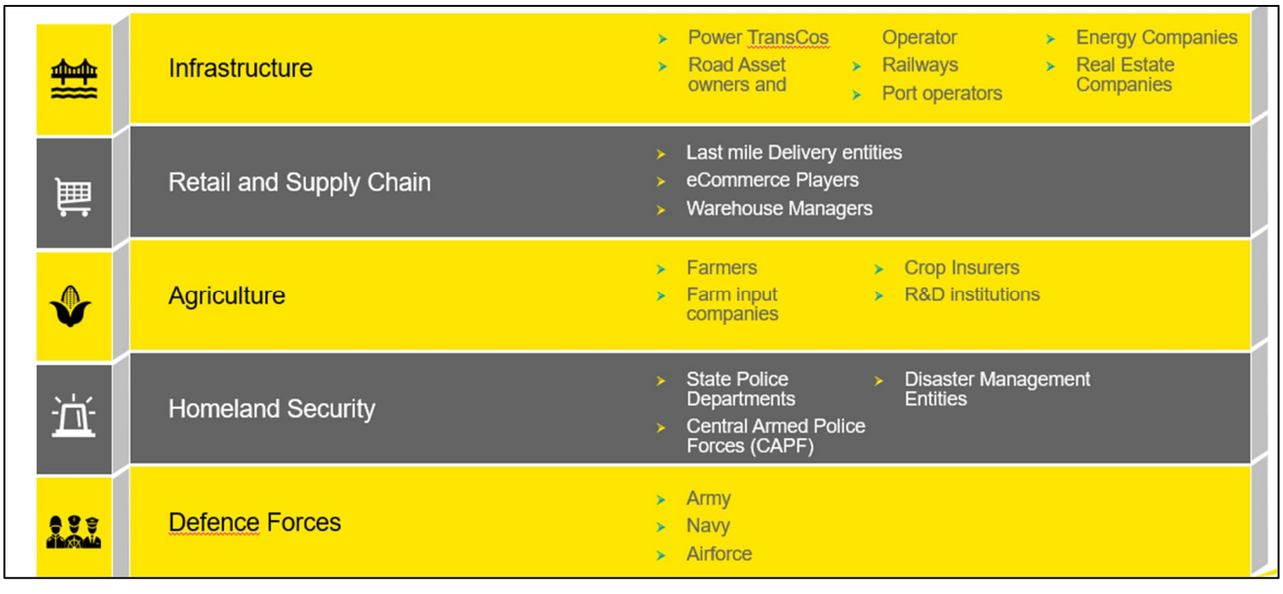
Drones are increasingly finding potential to be employed in multiple use cases across infrastructure, retail, agriculture, homeland security, and many other sectors. A snapshot of the burgeoning use cases for drones is given below.

S No.	Sector	Drone applications
1.	Agriculture and farmers welfare	a. Soil health scans, field water needs estimation b. Irrigation schedule planning c. Irrigation, fertilizer, pesticide spray efficacy mapping d. Plant size, crop health monitoring e. Farm output estimates f. Vegetation indices, plot statistics g. River erosion / restoration tracking h. Insurance claim surveys i. Agri data exchange for drones
2.	Health and family welfare	a. Delivery of medicines and other medical equipment b. Pathology tests— sample collection from remote or epidemic/ pandemic affected areas
3.	Panchayati Raj	a. Land records / property rights (SWAMITVA)
4.	Defense	a. Combat b. Surveillance c. Communication in remote areas d. Swarm attack e. Counter drone
5.	Home Affairs	a. Key technology for disaster response and management i. Impact assessment during disasters ii. Transport medicines, food and essentials in disaster affected areas iii. Search and Rescue b. Patrolling in remote areas c. Surveillance at international borders / Counter insurgency d. Announcement in under naxal activities / riots/ distress e. Traffic monitoring and management f. Crowd monitoring
6.	Housing and urban affairs	a. Construction Monitoring b. Planning/ Digital Elevation model c. Incident reporting
7.	Railways	a. Surveillance and Incidence Response b. Visual Inspections and Maintenance c. Construction Monitoring
8.	Road transport and highways	a. Visual Inspections b. Incident Response c. Construction monitoring
9.	Ports, shipping and waterways	a. Visual Inspections b. Maintenance and Incident Response
10.	Mining	a. Monitoring and inspection b. Automatic surveying and mapping c. Stockpile management d. Haulage road Optimization
11.	Power	a. Monitoring of power lines and other assets b. Surveillance and incidence response

S No.	Sector	Drone applications
		c. Visual inspections and maintenance
12.	Petroleum and natural gas	a. Monitoring of pipelines and other assets b. Surveillance and incidence response c. Construction monitoring
13.	Environment, forests and climate change	a. Monitoring of hazardous activities b. Assessment of pollution levels and tracking the source c. Monitoring and safety of wildlife / poaching activities
14.	Information and broadcasting	a. Robust aerial platform for photography / videography b. Economical substitute of helicopter c. Capabilities to work in difficult conditions without life at risk d. Low altitude shooting without disturbing (air flow/ noise) ground crew

2.1.1 End users

The end users across the industry would be many agencies, starting from the national defense forces, state police departments and disaster relief organizations, farmers and insurer, last mile retail delivery entities, and infrastructure companies, viz power, railways, ports, real estate, etc.



2.2 Key technology trends

Several important technologies are fueling the adoption of drone solutions and pushing their boundaries.

Technology Trends are pushing the boundaries for Drone Solutions

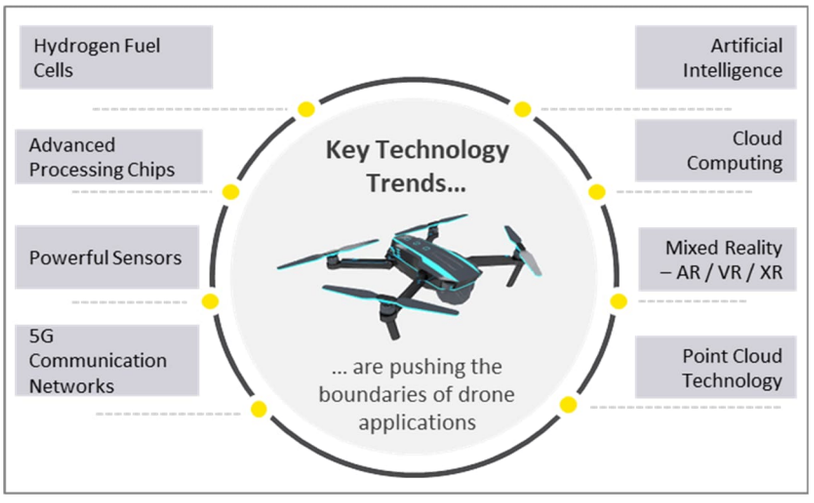
Enhancing **Autonomous capabilities** of drones enabling collision avoidance and enclosed space navigation

On The Edge computing to enable real time data processing for on-the-fly decision making

Improving the capabilities of **Drone Swarms** through real time communications and maneuverability

Accurate and **accelerated 3D modelling** of contours enabling AR, VR and XR applications

Access to data and analysis anytime and anywhere through **Cloud capabilities**



Solutions: Aerial Visual Inspection of equipment and assets

Visual Inspection

- Close range inspection of hard to reach places
- Safer than human interventions
- Faster data collection for evidence based actions

Solutions: Aerial Visual Inspection of equipment and assets

- Roads
- Railways
- Ports
- Transmission lines
- Pipelines

Solutions: "Eye in the Sky" perspective for effective surveillance and incidence response

Visual Inspection

- Aerial surveillance of crowd / areas of interest
- Thermal imagery for night time surveillance
- Incident / accident response

Applicable Industries/Bodies

- State Police Departments
- Central Armed Police Forces
- Roads
- Railways
- Disaster management

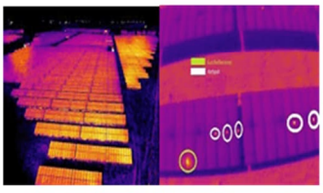
Solutions: Aerial Thermal Inspection of equipment and assets

Thermal Inspection

- Identification of anomalies not normally visible with visual inspection

Applicable Industries

- Solar farms
- Railways
- Ports
- Transmission lines
- Pipelines



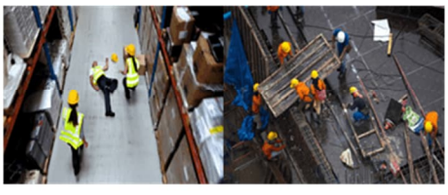
Solutions: Construction progress monitoring and monitoring of safety parameters

Project monitoring

- Aerial monitoring of project progress
- Enables visualisation and measurements from same datasets
- Deterrent effect for safety violations

Applicable Industries

- Real estate
- Roads
- Railways
- Ports
- Pipelines



Solutions: Construction progress monitoring and monitoring of safety parameters

Retail and Supply Chain management

- Last mile deliveries of e-commerce shipments
- Deliveries of medical supplies and vaccines
- Warehouse inventory count and verification

Applicable Industries

- E-commerce
- Supply chain

Solutions: ISR missions for Defense forces

ISR Missions for Area of Interest

- Situational awareness
- Threat capability coverage
- Targeting analysis
- Battle damage assessment

Applicable Industries

- Defense forces
- Central Armed Police Forces

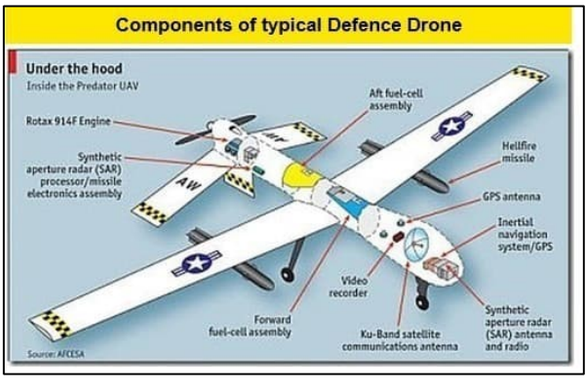
2.2.1 Drone enabled Solutions

Most of the drone enabled solutions in various use-cases involve aerial thermal inspection, aerial visual inspection, construction project monitoring, surveillance and last mile delivery, and Intelligence, Survey and Reconnaissance (ISR) missions for the defense forces.

2.3 The value chain

2.3.1 Components of commercial and typical defense drones

Typically, commercial drones consist of propellors, motors, camera/payload, landing gear, GPS motors, rradio receiver, battery and gymbal. Defense drones would, in addition, possess advanced features, such as synthetic aperture radar/ missile electronics assembly, inertial navigation systems, missiles and video recorders.



2.3.2 Counter-drone systems

Counter drone systems are often a combination of multiple technologies tailored to suit the application. The salient features of counter drone systems are:

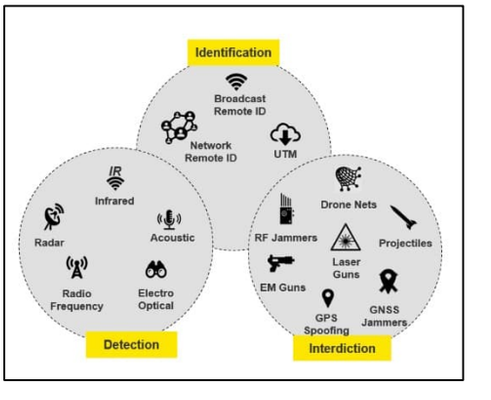
- The most popular drone detection techniques are radar, RF detection, EO, and IR, or a combination thereof.
- Identification is heavily dependent on the regulatory infrastructure available / to be developed in a geography.
- The most popular interdiction technique is jamming.

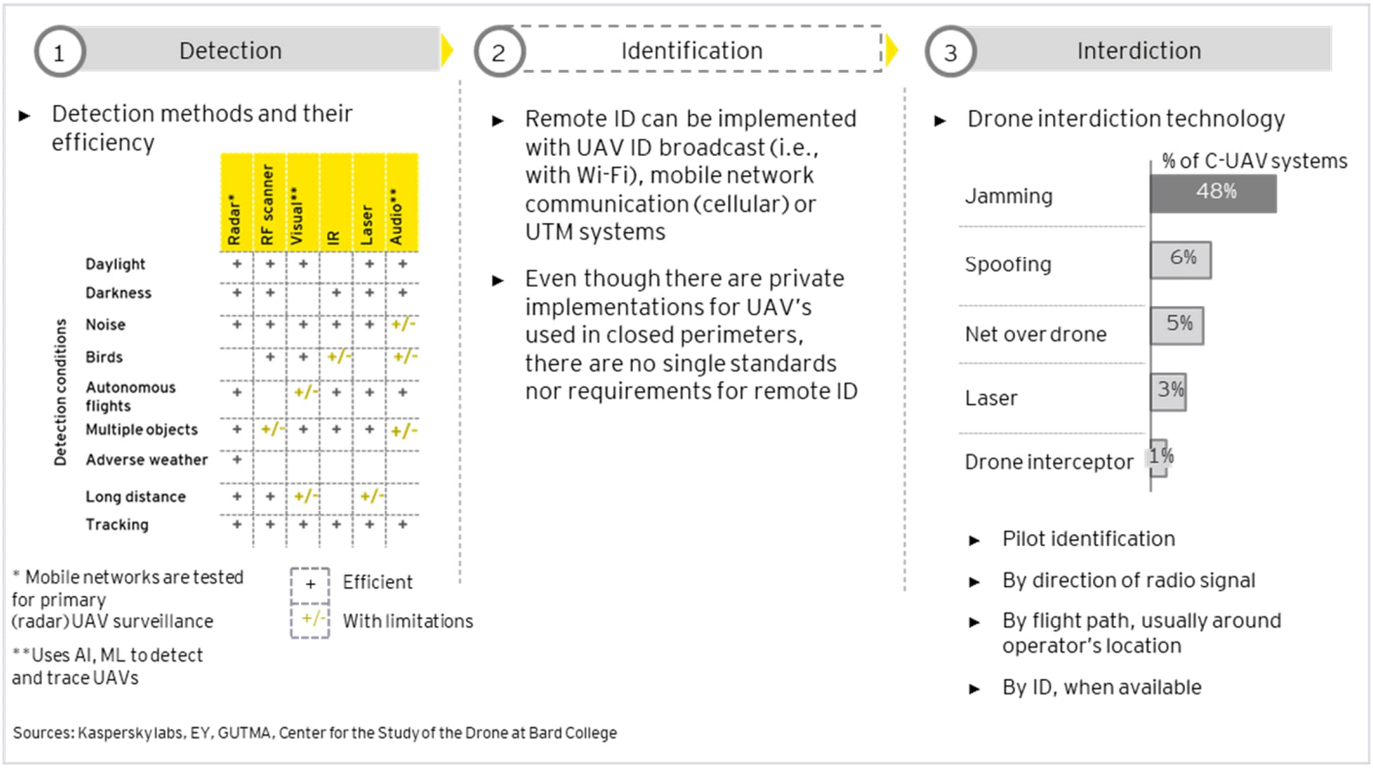
Based on the sophistication of counter-drone systems in terms of detection technologies and interdiction mechanisms, they are classified into the following, for this report:

- Small: Basic RF detection, no interdiction capabilities
- Medium: Detection is a combination of RF and EO, basic RF jamming for interdiction.
- Large: Detection is a combination of RF, IR and Radar technologies, Interdiction comprises the RF, GPS spoofing and EM guns.

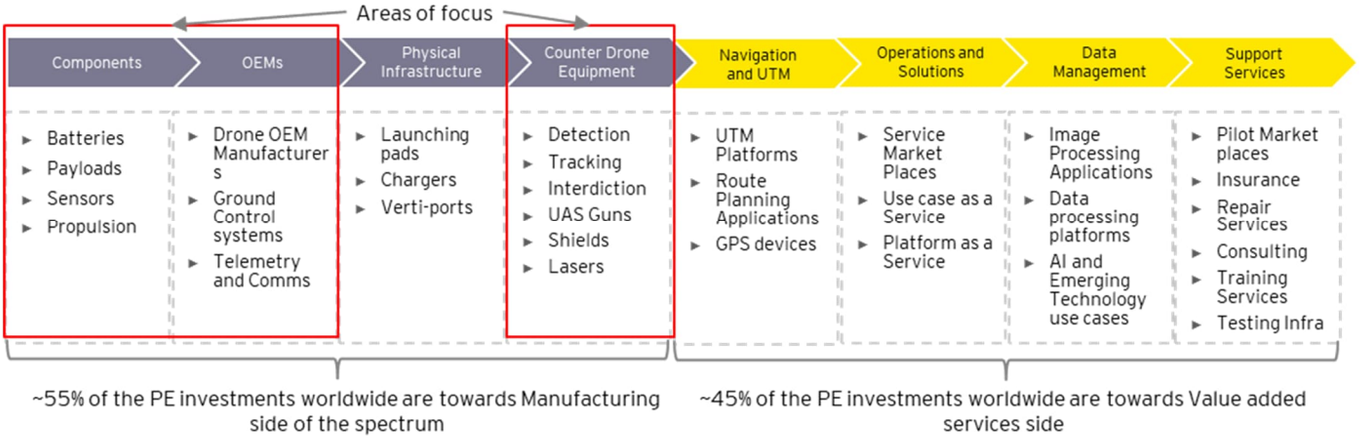
2.3.2.1 Counter-drone technology.

Counter drone functions through a process of detection, identification and interdiction. Detection methods involve the exploitation of radar, radio frequency, electro-optical, acoustic, or infra-red spectrums, whose effectiveness against objects varies as per ambient conditions. Identification mechanisms are not standardized. Interdiction is carried out largely through jamming, while spoofing, ‘net-over-drone’, and laser techniques exist as well.





2.3.3 Manufacturing and value-added service components

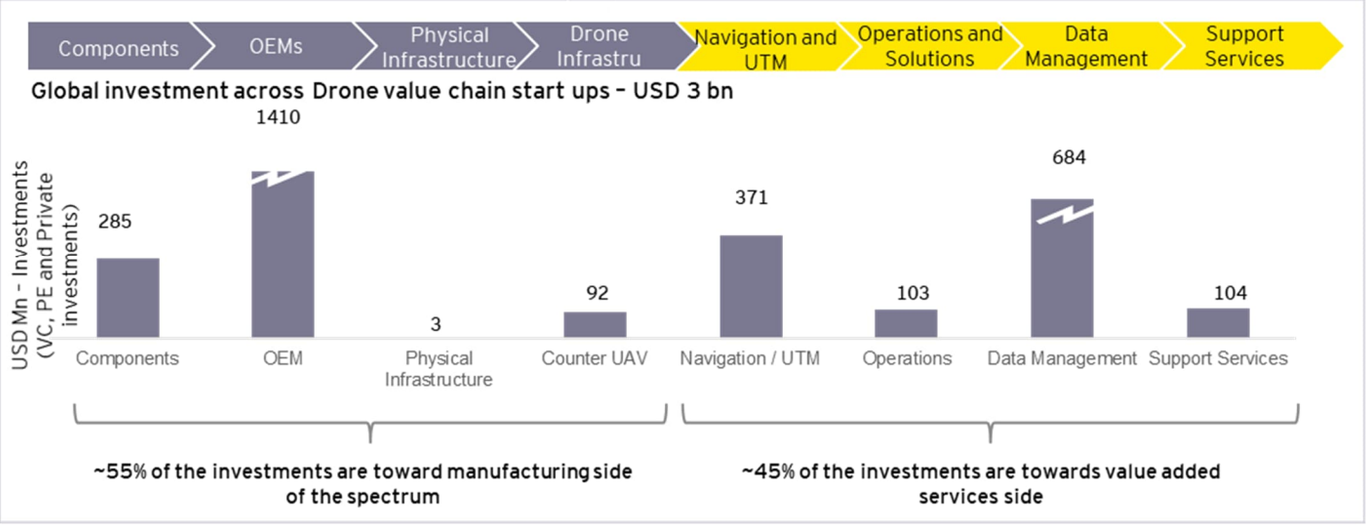


The drone value chain spans across manufacturing and value-added services components. India must focus on both the manufacturing side, and the value-added spectrum side, of the value chain, for several compelling reasons: -

- To enhance the manufacturing ecosystem and provide greater control over specifications to meet regulation requirements.
- High synergies exist with high value manufacturing industries like electronics and batteries. Moreover, there is a significant scope of value addition as drone applications have a high component of data and technology services
- The drone ecosystem would be highly complementary to India's strengths in software, technology and IT capabilities, resulting in a huge potential for future service exports.
- India's full-spectrum capability would mitigate security risks and ensure data control for Indian applications and government use cases
- Indigenizing key elements of component and manufacturing value chain are important to make India a global drone hub.

2.3.4 Global investments

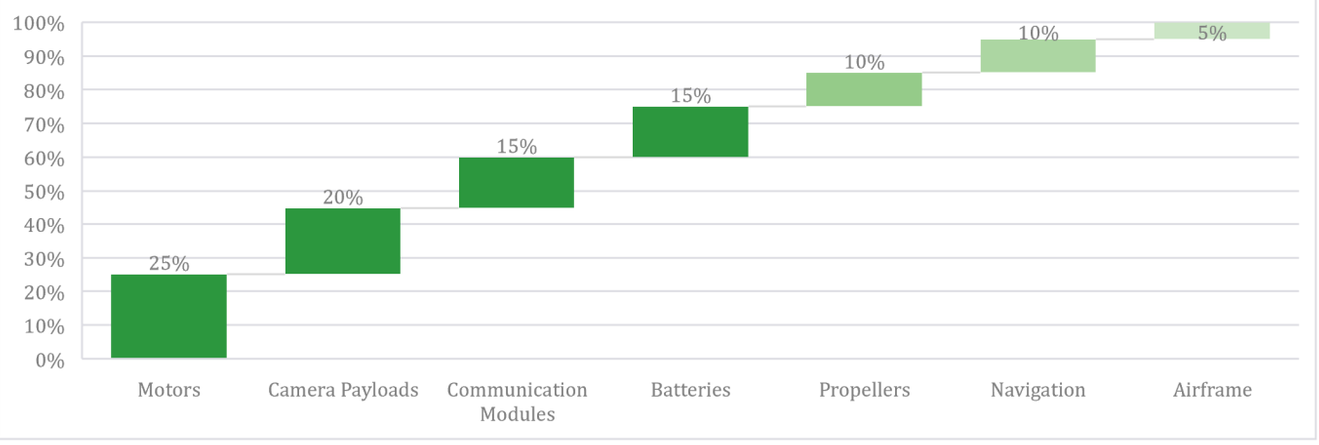
Investments in startups indicate significant global interest on both, the manufacturing, and the value addition services side of the spectrum. Analysts estimate that up to 55% of the PE investments worldwide occur in the manufacturing side, and approximately 45% towards the Value-Added Services side[6].



2.3.5 Manufacturing value chain: commercial drones

Motors, camera payloads, communication modules and batteries comprise up to 75% of the manufacturing value chain of commercial drones. Almost the entire Bill of Materials (BOM) of commercial drones consists of imported components today, with China being a major supplier of the drone BOM. The key impediment to local manufacturing is generic as well as UAV specific local demand.

However, most of the components are common with other electronics and robotics industries in the country. These key components would therefore require a strong domestic demand to be self-sustaining.



[6] https://www.droneregulations.info/index.html
https://www.newamerica.org/international-security/reports/world-drones/who-has-what-countries-with-armed-drones/
https://investinisrael.gov.il/HowWeHelp/downloads/UAVs%20and%20Drones.pdf
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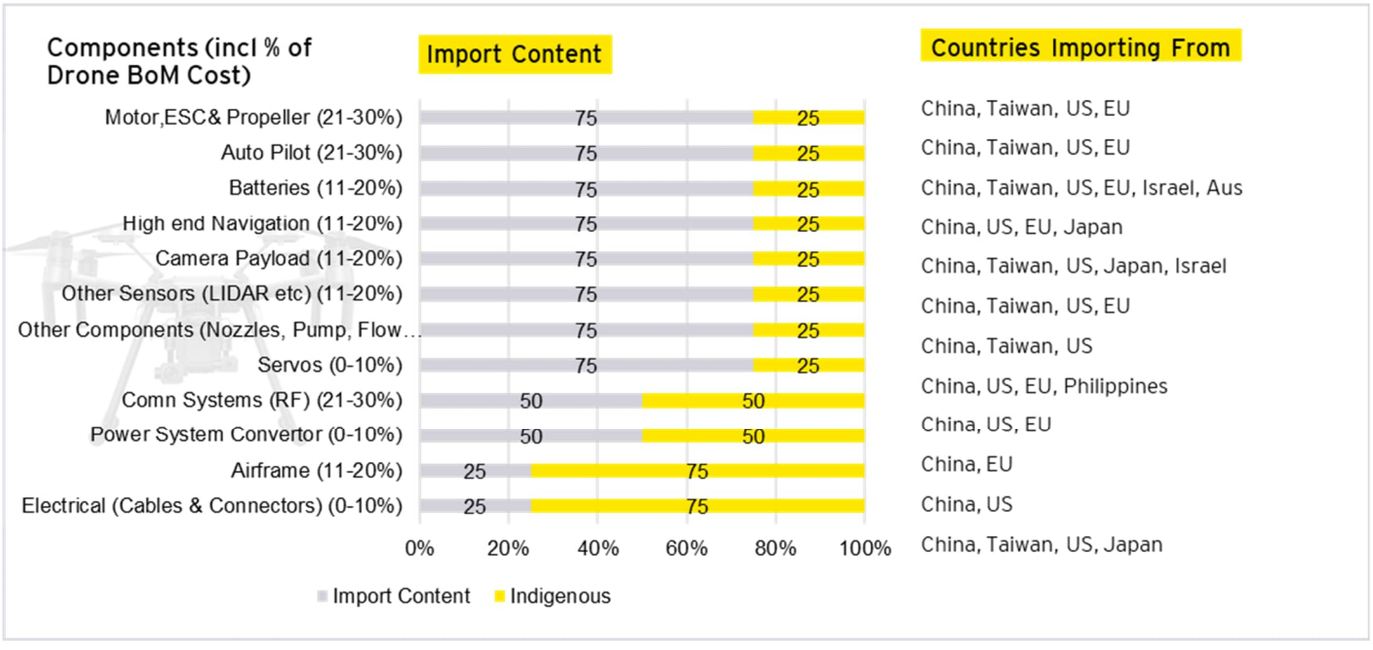
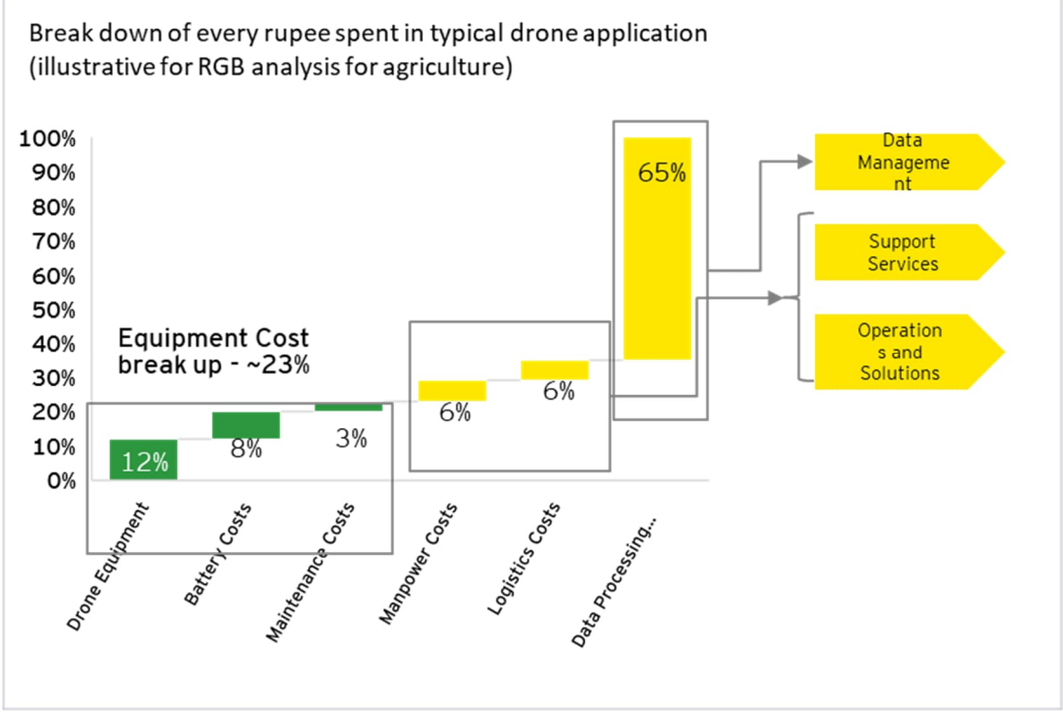


2.3.6 Value added service components: commercial drones

While manufacturing plays a critical part, significant value addition potential exists in service components in the case of commercial drones. High Input costs in typical drone applications are attributable to non-manufacturing portions of the value chain; in the case of agriculture, analysts estimate nearly 65% of the net value would accrue from data management, support services, operations, and solutions. However, India has significant 'white-spaces' in such value-added services. Limited domestic demand due to Indian regulations prevents Indian service providers from attaining economies of scale. Essential support services like training, drone insurance, testing have low availability which impacts quality of services.

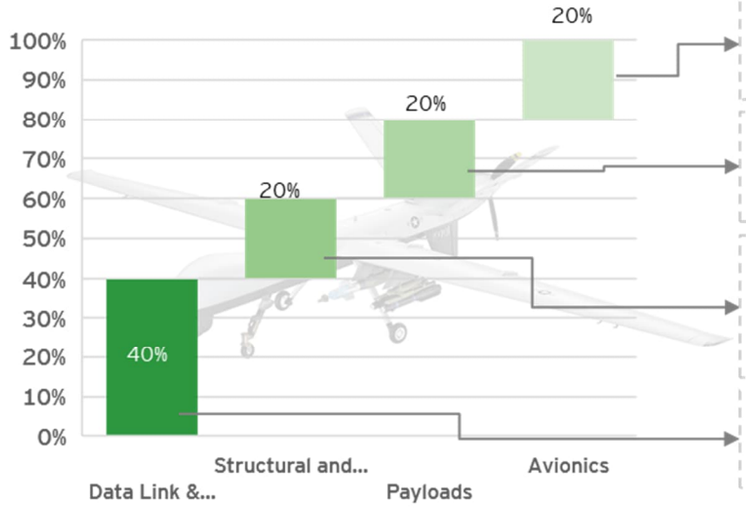


It is, therefore, pertinent to enable regulations to realize domestic demand to sustain the ecosystem. It would also be critical to ensure control over the data trail from Indian use cases and applications.

2.3.7 Manufacturing value chain: defense drones

While sufficient manufacturing and integration capabilities exist in respect of defense drones, unavailability of technology remains a major impediment.

Key components in manufacturing value chain



What are our challenges in the Defense and HLS Drone manufacturing ecosystem?

- **Controlled by strategic suppliers –** Key flight control systems capabilities are tightly controlled by few foreign suppliers - e.g., Powerful onboard computers and their associated software
- **Limited capabilities in payloads –** Covers ~20 % of defense drone systems. Manufacturing capabilities will need to enhanced through Transfer of Technology (ToT) arrangements
- **Labor intensive value addition –** Covers ~20 - 30% of defense drones. Currently value addition done after importing raw materials - e.g., Composite Airframe structures. Potential to enhance the scale of through Indian manufacturers
- **Mature Capabilities –** Reasonably matured Indigenous capabilities which serve not only Indian customers but enable defense exports as well.

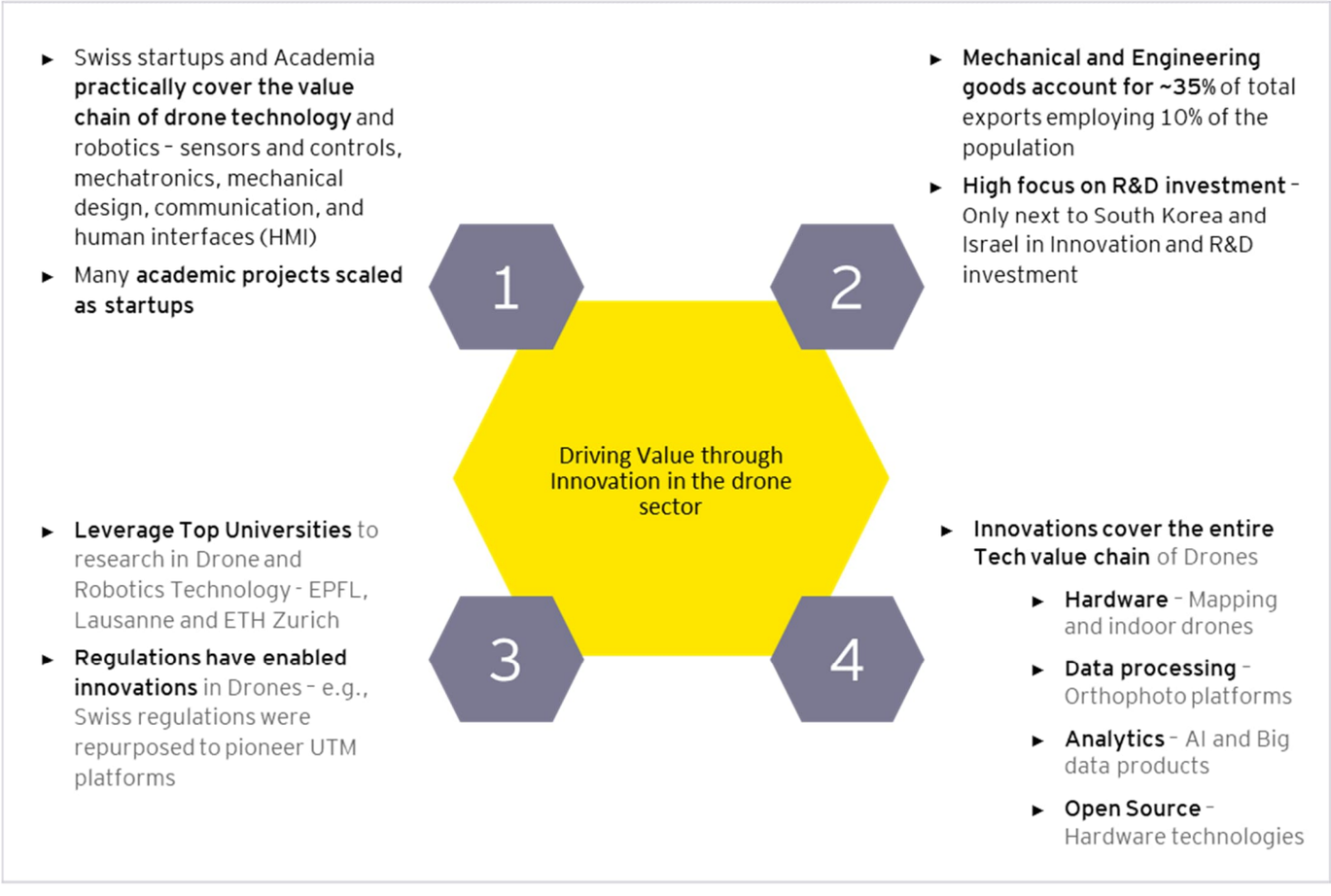
* Inputs from the Drone Working Group and EY Analysis ; BoM = Bill of Materials

3. Global flagbearers

Several nations across the world are taking a lead in investment and progress in drone technology, testing, and manufacturing. Of mention as a frame of reference are Switzerland and the US.

3.1 Switzerland: making for the world

The Swiss drone system is pivoted around innovation and *'make for the world'.7*



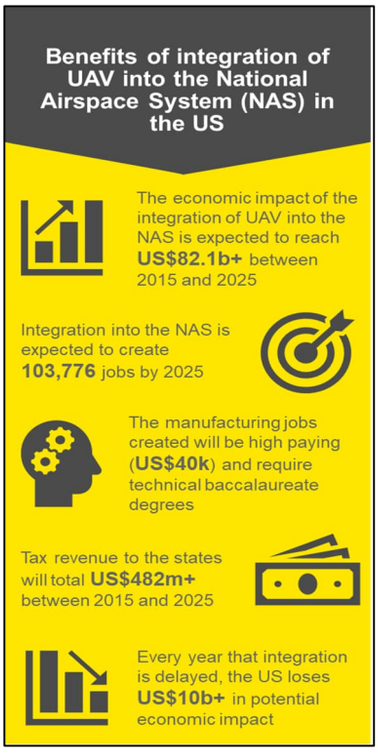
- Swiss startups and academia practically cover the value chain of drone technology and Robotics – sensors and controls, mechatronics, mechanical design, communication, and human interfaces (HMI)
- Many academic projects are scaled as Start-ups, strengthening the link between academia and industry.
- Top Universities, such as EPFL, Lausanne and ETH Zurich, have been leveraged to research in drone and robotics technology.
- Regulations have enabled innovations in drones. For instance, Swiss regulations were repurposed to pioneer Unmanned Traffic Management (UTM) platforms.
- Mechanical and Engineering goods account for approximately 35% of total exports, employing 10% of the population.
- High focus on R&D investment. Switzerland stands next only to South Korea and Israel in Innovation and R&D investment.
- Innovations cover the entire tech value chain of Drones, viz.
  - Hardware – Mapping and indoor drones.
  - Data processing – Orthophoto platforms.
  - Analytics – AI and Big data products.
  - Open Source – Hardware technologies.

[7] Source: EY research, https://droneapps.co/case-study-the-swiss-drone-ecosystem/; https://www.homeofdrones.org/.

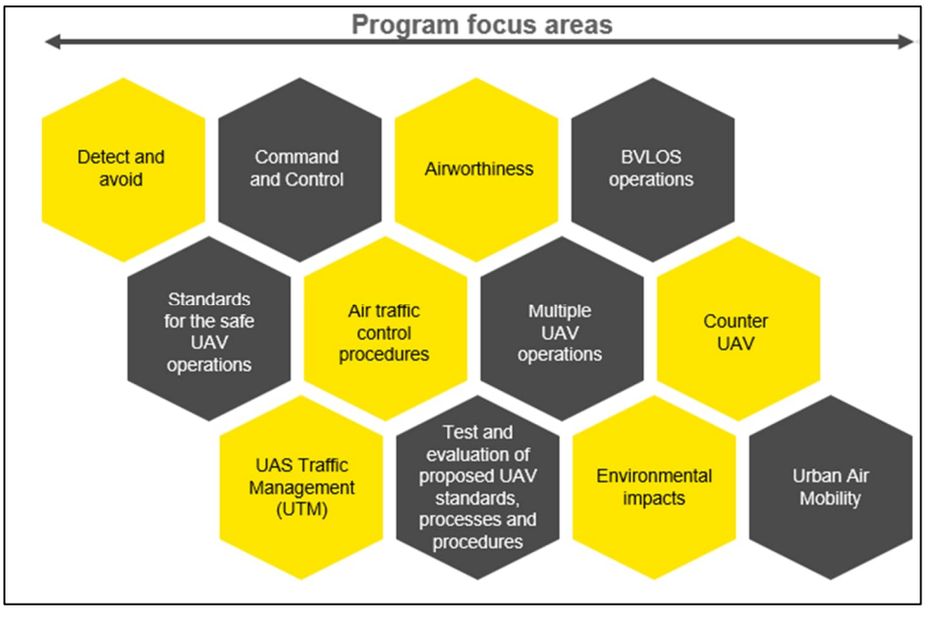
3.2 The US: a holistic approach for drone integration in the national airspace

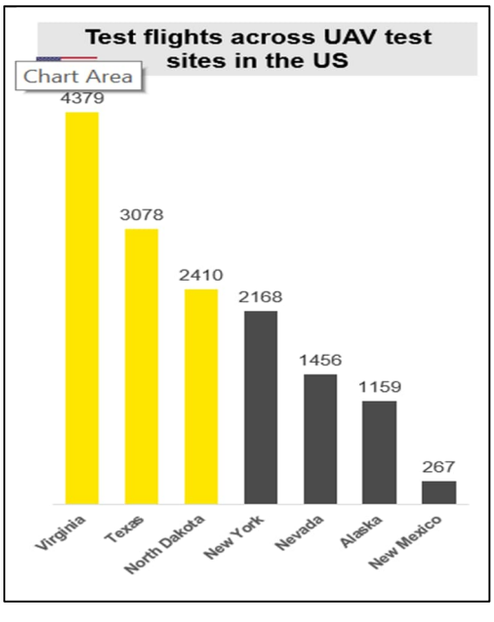
The Federal Aviation Administration's (FAA's) vision for fully integrating drones into the National Airspace (NAS) entails drones operating harmoniously, side-by-side with manned aircraft, occupying the same airspace and using many of the same air traffic management systems and procedures. FAA understands that *collaboration across industry, government, and academia will propel the successful integration efforts*. This holistic approach manifests itself in several initiatives[8]: -

- *Focus Are Pathfinder Program*- an industry partnership program to develop and validate operational concepts for certification, operations, and safety beyond established or proposed policies and procedures
- *Drone Advisory Committee- provides the FAA with advice on key UAS integration issues by helping to identify challenges and prioritize improvements.*
- *UAS Data Exchange*- A collaborative approach between government and private industry facilitating the sharing of airspace data between the two parties.
- *UAS Integration Pilot Program*- brought state, local, and tribal governments together with private sector entities, such as UAS operators or manufacturers, to test and evaluate the integration of civil and public drone operations into the national airspace system.



3.2.1 US drone test sites: enabling drone testing infrastructure by leveraging the ecosystem





[8] https://www.faa.gov/uas/programs_partnerships/integration_pilot_program/
https://www.faa.gov/uas/programs_partnerships/
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https://www.faa.gov/news/updates/?newsId=75399
https://www.industryweek.com/technology-and-iiot/emerging-technologies/article/21960764/what-is-the-importance-of-unmanned-vehicles-to-our-economy
https://www.faa.gov/uas/programs_partnerships/test_sites/
https://www.gao.gov/assets/710/703726.pdf

The FAA Modernization and Reform Act of 2012 directed the Federal Aviation Administration (FAA) Administrator to initiate a five-year program to establish UAV test sites to support the FAA in integrating UAS into the national airspace system. The FAA's seven designated test sites for UAV have facilitated approximately 15,000 flight tests since 2015.

The FAA has selected these test sites through a rigorous process. Out of 25 proposals from 24 states, the FAA finally selected seven, based on exacting parameters for *geography, climate, location of ground infrastructure, UAV research needs, airspace use, safety,* and *aviation experience*.

Each of the designated Test sites has a distinct charter[9]: -

- *Alaska test site:* Supports research and test activities related to public operations, civil/commercial operations, mixed manned and unmanned operations, HALE, and high-altitude balloon operations. The site possesses experience operating in the Arctic under extreme climactic conditions.
- *North Dakota test site:* Identifies emerging and potential threats posed by UAV in both military and civilian environments, and enables UAV operators to develop and deploy protective technologies in response to identified threats
- *Nevada test site:* Continues to advance FAA policy and procedures for the Nevada and National UAV Industry in technology advancements for BVLOS technologies in urban/non-urban environments, remote identification, drone detection, and the UTM system.
- *New Mexico test site:* Operates a fully enclosed UAV propulsion test facility with digital data acquisition systems, dynamometer capacity to 100 horsepower, and the capability to control temperature and relative humidity inside the test chamber.
- *New York test site:* Focuses on test range infrastructure development, data collection and analysis as the foundation for an integrated test environment with full NASA Live Virtual Constructive – Distributed Environment capability. (LVC-DE)
- *Virginia test site:* Research has led directly to innovative approvals and operations for industry partners, including the first nationwide BVLOS over people waiver. Pioneered and validated a rigorous safety-case process that has become an exemplar in the industry.
- *Texas test site:* Continues to expand its research and development into autonomous systems operations, including collision avoidance and use of on-board sensor systems.

3.3 Turkey: projecting drone power at the global stage

Perhaps the most dramatic ascension to the world drone power stage has been that of Turkey, which, in a few short years, has begun to rival the European drone industry in the array, versatility and lethality of its drones. [10]

Turkey's rise as a drone power reflects the critical role of coordinated state-guided industrial policy, in conjunction with local technical talent. Turkey's interest in armed drones emerged in 2008, when they sought permission to purchase the MQ-1 Predator from the US, and instead the US offered it the non-armed version of the reapers. After refusing the US offer, Turkey purchased unarmed Heron TPs from Israel in 2010, and has since taken an ambitious approach to domestic production of armed UAVs.

The last four years have seen an exponential growth in Turkey's drone industry, resulting in the deployment of several flagship military drones: -

[9] FAA (data as on 31 December 2018)
[10] RUSI, n.d. Armed Drones in the Middle East- Turkey. https://drones.rusi.org/countries/turkey/

- Anka MALE UAV – The 'Anka' (Phoenix) program was a result of the felt need in 2004 by the Turkish defense forces for a Medium Altitude Long Endurance (MALE) Drone. Developed by the Turkish Aerospace Industries (TAI), the Anka, with a payload of 200kg, ability to fly at an altitude of 30,000 feet with an operational endurance of 24 hours[11], joined service in 2020. The Anka can undertake for day and night reconnaissance, surveillance, fixed/mobile target detection and real-time image intelligence, even in unfavorable weather conditions.
- Bayraktar UAV – The Bayrakter derives its name from Selcuk Bayraktar, who developed his first drone at MIT in 2007 before he turned 21. The Bayraktar eventually evolved into the TB2 variant, a potent weapon system with a range of 150 km, and the ability to carry a payload of 120 pounds (55 kg).
- Karayel UAV - Developed by Vestel, the Karayel is designed for reconnaissance and surveillance missions, with the ability to fly 22,500 feet at a maximum of 80 knots, with an operational range of 150 km, and the ability to carry a combination of cameras, laser designators and rocket munitions.
- Goksunger UAV – The Turkish Aerospace Industries (TAI) is currently working on the Goksunger, targeting a speed of 380 km/h and carrying an infrared sensor.
- Kamikaze drones – STM, an indigenous company, offers the triad of the Togan, the Alpagu and Kargu. The Togan acts as a 'spotter'. A single person can operate the Alpagu – that is rocket shaped– day and night, while the Kargu acts as a kamikaze drone, fitted with rotary wings, carrying munitions, and guaranteeing minimal collateral damage.

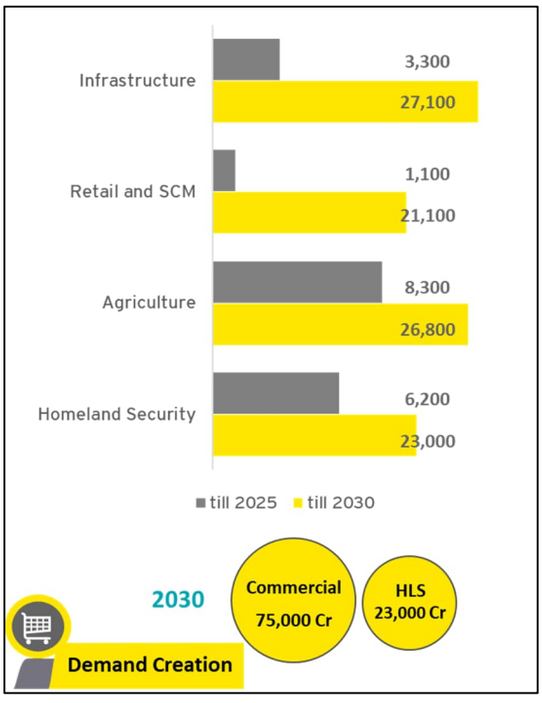
In the geopolitical context, Turkey's relatively low-cost drones have spurred exports, and have seen deployment in numerous battlefields, including Libya, Syria and now, in Ukraine. The EU acknowledges the Turkish drones as a potent force, [12] destined to disrupt existing power structures and even the methods of warfighting.

[11] Global Defence Corp., 2020. Advancing Drone Industry in Turkey. https://globaldefencecorp.com
[12] Gettinger, Dan, 2019. Turkey's Military Drones: An Export Product that's Disrupting NATO. https://thebulletin.org

4. Action plan

4.1 Demand creation

The government would play a critical role in creation of a viable market for drones, so that the country can realize its own manufacturing potential. The government's fillip through its role as market maker has a potential to expand demand to approximately INR 75,000 Cr in the Commercial sector, and INR 23,000 Cr in the Homeland Security sector. As much as 60% of the commercial manufacturing potential will arise from Government dominated sectors.



4.1.1 Demand push through ministries

- *Ministry of Defence.* It is recommended that between 5 to 10% of defense capital budget be allocated for procurement of new drones as well as upgradation of the existing fleet (excluding MRO).
- *Ministry of Home Affairs.* MHA could allocate budget for drones in central schemes like the "Nirbhaya scheme". Specific allocation for drone procurement under the Police Modernization budget will act as a force multiplier to the law enforcement agencies.
- *Ministry of Urban Development.* The Ministry should recommend drone-enabled solutions within the illustrative smart city solutions under the AMRUT mission.

4.1.2 Infrastructure

A policy push is recommended to accelerate the usage of drones in key infrastructure areas like railways, roads, power, mines, telecom, and utilities.

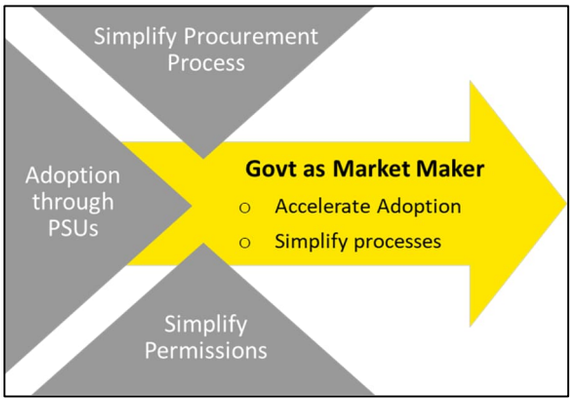
4.1.3 State governments/ Union Territories

The government could encourage drone adoption in states / Union Territories through policy interventions. For instance, the recently promulgated Drone Policy of the Gujarat Government[13] aims to create 25,000 jobs in the drone sector and envisions enhanced drone usage through targeted interventions by various departments, in a wide array of fields including monitoring vehicle emissions, counting lions in Gujarat forests, spraying pesticides, sowing seeds and supplying medical items.

4.1.4 The Three Ps: Procurement Processes, Permissions and PSUs

4.1.4.1 Simplifying procurement processes

- A strong case exists to simplify the tendering process of drones by establishing use-case wise standard specs across government departments.
- Considering that drones are an emerging technology and all companies working on the same are startups, procurements process should not have a heavy Pre-Q criterion (most drone companies do not have significant revenue at this stage) — the process should be QCBS based i.e., Quality cum Cost-Based Selection.
- Adoption would be dramatically accelerated if there were to be procurement commitment of at least 25% or 50% of quantities, in the case of nearest specifications or single-vendor scenarios, respectively.



[13] THE DRONE Promotion & Usage Policy | CMO Gujarat

4.1.4.2 Permissions

There is a need to provide expedited permissions for a specific project/duration if the area is falling in a Red/Yellow zone.

4.1.4.3 PSUs

In the past, various ministries have directed their respective PSUs to actively explore / adopt drones in their operations. However, regulatory challenges have stymied implementation efforts. Respective ministries could re-issue such directives to encourage faster adoption of drones while delivering additional benefits.

4.2 A manufacturing boost

There are several steps that need to be taken to facilitate manufacturing of drones in India.

4.2.1 Collateral-free and personal-guarantee free loans

Many drone startups are unable to access bank credit from traditional channels, mainly due to high credit risk. VC (often foreign) funding remains the only option for such companies.

Financial institutions should provide collateral-free and personal-guarantee free project finance loans at low interest rates to Start-up or MSME companies that have received confirmed government or private sector orders This will enable them to use the funds toward their working capital needs to fulfill orders. This will also prevent local companies from seeking FDI just to fulfill working capital requirements.

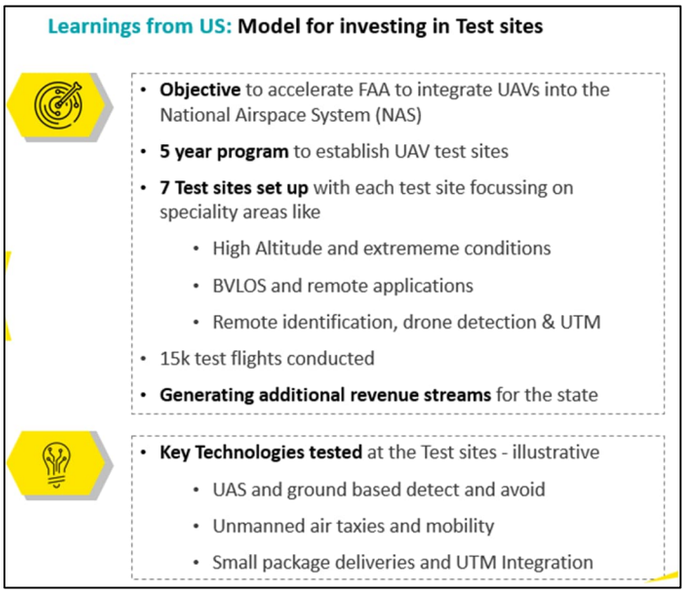
Further, financial institutions may consider giving collateral-free, and personal guarantee free loans up to 100% for companies seeking to invest in testing and manufacturing infrastructure in this sector, as this would also help in reducing the capital-intensive requirements in drone manufacturing.

4.2.2 Drone testing sites

Drone testing infrastructure is a critical part of the innovation infrastructure, as it provides a safe space for drone manufacturers and researchers to test technologies in real-world scenarios.

Support is required across various layers:

- The government should establisha Central framework for states to apply for testing sites.
- Dedicated 'Sandbox' testing sites need to be setup in safe zones across the states.
- Test sites can even be revenue generators while accelerating development and testing of UAV and C-UAV technologies
- It is imperative to leverage PPP models by states to incentivize investments to set up, operate and maintain the test sites.



4.2.3 Increased localization of components

Government to support local manufacturing of components and value addition. There are strong opportunities in components like battery, airframe and motors for drones, which is visible along with demand emerging from other associate industry to build a case for local manufacturing of battery cell, carbon fiber and light-weight BLDC motors for drones. Long-term focus areas remain other high-value components like Auto Pilot, Navigation, LIDAR/RADAR, which are heavily dependent on chips and sensors and are not being manufactured in India.

4.3 Investments

To kickstart investment into the drone manufacturing sector, the government may provide an opportunity to a few 'anchor companies', willing to commit investments in as little time as possible, to present 'plans' and 'expectations'.

4.4 Exports

India's aspiration to become a drone hub for the world can only be realized if exports are enabled. In this regard, it is essential to provide Indian manufacturers a level playing field. Removing anomalies from the 'Special Chemicals, Organisms, Materials, Equipment and Technologies' (SCOMET) list would go a long way in empowering Indian manufacturing entities.

4.4.1 Streamlining and removing ambiguities in the SCOMET licensing process

In SCOMET list, UAVs are categorized into the following three different broad categories: -

- Category 6 - Classified as "Munitions List" - 6A010.
- Category 8 - Special Materials and Related Equipment, Material Processing, Electronics, Computers, Telecommunications, Information Security, Sensors and Lasers, Navigation and Avionics, Marine, Aerospace and Propulsion - 8A912.
- Category 5 – 5B - Unmanned Aerial Vehicles.

These categories permit different interpretations and most micro and small UAVs could either require or not require a SCOMET license, depending on the interpretation by individual officers.

The government should issue specific clarifications to clearly interpret that UAVs with specifications below those specified in 8A912 are free to be exported without authorization.

Furthermore, DGFT could consider creating strict Service-level Agreement (SLA) for each application to ensure predictable timelines for processing each application. Currently, manufacturers are encountering processing times of anywhere between 4 to 16 weeks per application.

For each export, DGFT is currently reviewing the OEMs product itself in addition to the due diligence of end user. The product verification happens even if the exact same product is being exported to another end-user, adding time and duplication of DGFT's effort to the export process. DGFT may create a mechanism (leveraging their database of exported items) to allow OEMs to apply for an "export approved" label for their products prior to an actual export application being submitted. This will help reduce timelines, with DGFT only having to conduct the end user due diligence at the time of export of the prior "export approved" product.

4.4.2 Simplifying permission for demonstration in other countries

Taking drones abroad for international exhibitions / demonstrations is a very cumbersome and lengthy process, hampering international marketing activities for Indian manufacturers. At present, each demo permit application requires to be certified by the end user in the foreign country for whom demo is being carried out. The stipulated time period for bringing the drone back to India post the demo is 90 days.

Demo permits are provided only point to point i.e., single country basis.

A possible way out:

- DGFT may allow OEMs to export via self-declaration for purposes of demonstrations and trade shows
- DGFT may also allow the provision of extending the demo period on an existing and active application.
- DGFT may also consider allowing a multi-country export mentioned clearly in the application to reduce the cost of OEMs needing to re-import and re-export their products when needing to demonstrate between geographies.

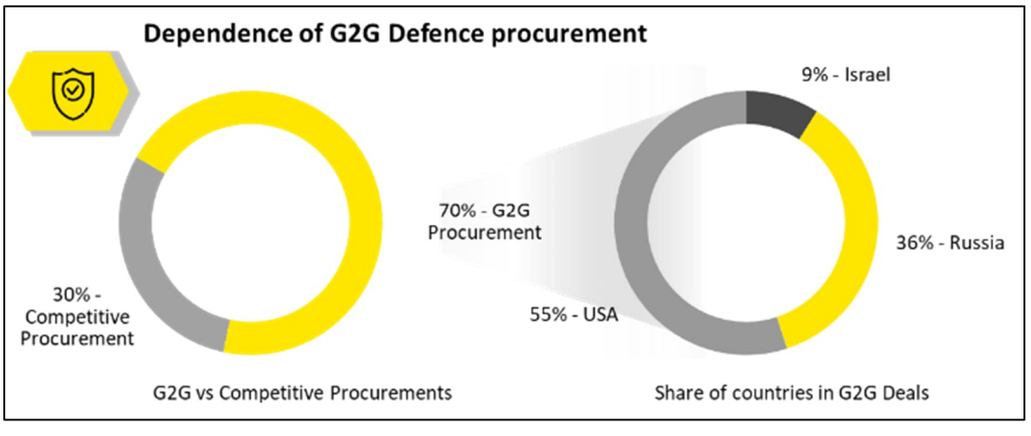
4.5 Other action points

4.5.1 Streamlining industrial license

- Manufacturing of drones above one-hour flight or greater than 25 knots wind gust resistance is a Licensed (Industrial License (IL)) activity as per defense Items List. There is also a requirement of license for any electronic aerospace item as per DPIIT (Press Note 3).
- However, the mechanism of giving a license (other than that for defense items) is neither spelt out clearly, nor is the license requirement being enforced.
- Due to this, several companies who have the IL for drones are being put under undue compliance and cost disadvantage vis-à-vis companies that do not take a license. It is therefore necessary to have a level playing field on this aspect.

4.5.2 G2G deals

India primarily depends on G2G deals for defense procurement.[14] There are obvious advantages to G2G purchases; G2G deals fast track the procurement process, aim to lower costs, remove intermediaries in the process, besides strengthening bilateral relationships.



However, G2G deals often suffer from limited competitiveness in the procurement process. Further, technology transfer, while it happens, is typically dated with limited indigenous manufacturing.

In the context of drone manufacturing, the government should enable relevant Transfer of Technology in G2G Defence deals. G2G- ToTs / Strategic Partnerships/ Offsets should be focused on filling Technology Readiness Level (TRL) gaps in research, design, manufacturing, and testing technology as pre-identified by Indian R&D, DPSUs and industry.

[14] Behal, R (n.d.) Government to Government Deals – Playing it Safe ; www.defproac.com/?p=3961

4.5.3 Funding support

It is recommended that the government provide innovation funding for strategic and high-risk technologies and innovations and invest inbuilding Indian ecosystem players. A leaf could be taken out of the successful model of the proven innovation model in the biotechnology sector, where The Biotechnology Industry Research Assistance Council (BIRAC) acts as an Interface Agency to strengthen and empower the emerging Biotech enterprise to strategically address nationally relevant product development needs.

Innovation Stage	How BIRAC enables innovation?	BIRAC Impact on innovation
Commercialization	• **Leverage partnerships** – e.g. with BIRAC – DeitY, USAID partnership	**What was created?** - 24 Intellectual Properties - 1.2 Lakh sq ft of incubation space - 5 University Innovation Clusters - Various infrastructure for innovation **BIRAC Ecosystem** - Revenues – USD 225 Mn - 270 companies supported - 360 projects **Outcomes** - 11 New technologies - 17 affordable products
Late Stage Development	• **BIRAC Fellows** across University partners • Roadshows, IP and start up Workshops • **Networking platforms** for attracting investments	
Early Stage Development	• **Industry as validation partners** for concept • **Multiple collaboration models** across industry, academia and public sector partnership	
Proof of Concept	• **Innovation funding** on PPP basis • **Govt partnership and support** for high risk innovations	
Idea	• **Seed Grants** up-to INR 50 Lakhs • **Mentorship** and technical coaching	

Similarly, regarding drone manufacturing, there is a need to setup a Drone Industry Research Assistance Council (DIRAC) in a PPP model. The role of DIRAC would be to: -

- Set up accelerators for innovation and growth of indigenous drone related IPs and start-ups.
- Establish collaboration models of partnership across industry, academia and the public sector.
- Provide innovation funding for strategic and high-risk technologies and innovations on behalf of the Government.
- Act as a bridge for transformation of innovation / prototypes into commercially viable products to bridge gaps between prototyping to production.

4.5.4 Inter-Ministerial Committee on drones and counter drones

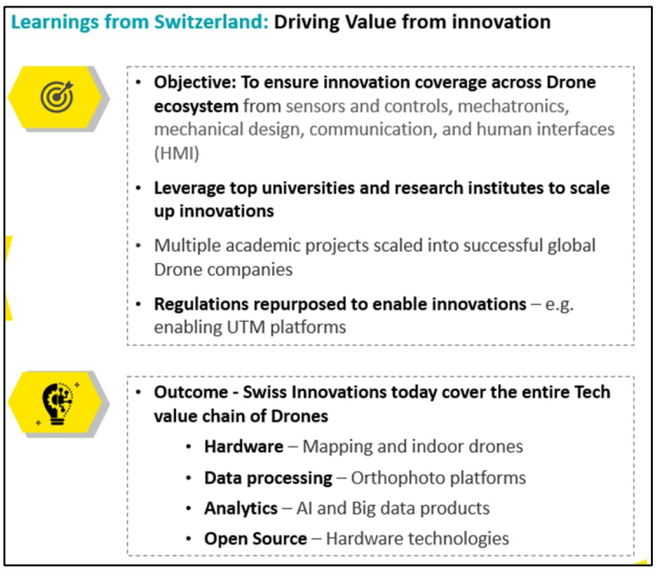
An Inter-Ministerial Committee on drones and counter-drones (IMC) may be constituted with representation from all the concerned Ministries / Departments dealing with the Drone and Counter Drone sector. IMC should regularly meet and deliberate to address the issues and bottleneck pertaining to the sector. The Committee may also choose to co-opt or invite any other department, ministries, stakeholders, or experts as required and invited by the Chair.

The IMC should look into all the issues including innovation, technology development, regulations, mother technology development, global value chains, testing, skill development, training, global standards, reciprocity issues, custom duties to make this sector globally competitive and to become the manufacturing hub for the world.

4.5.5 Innovation

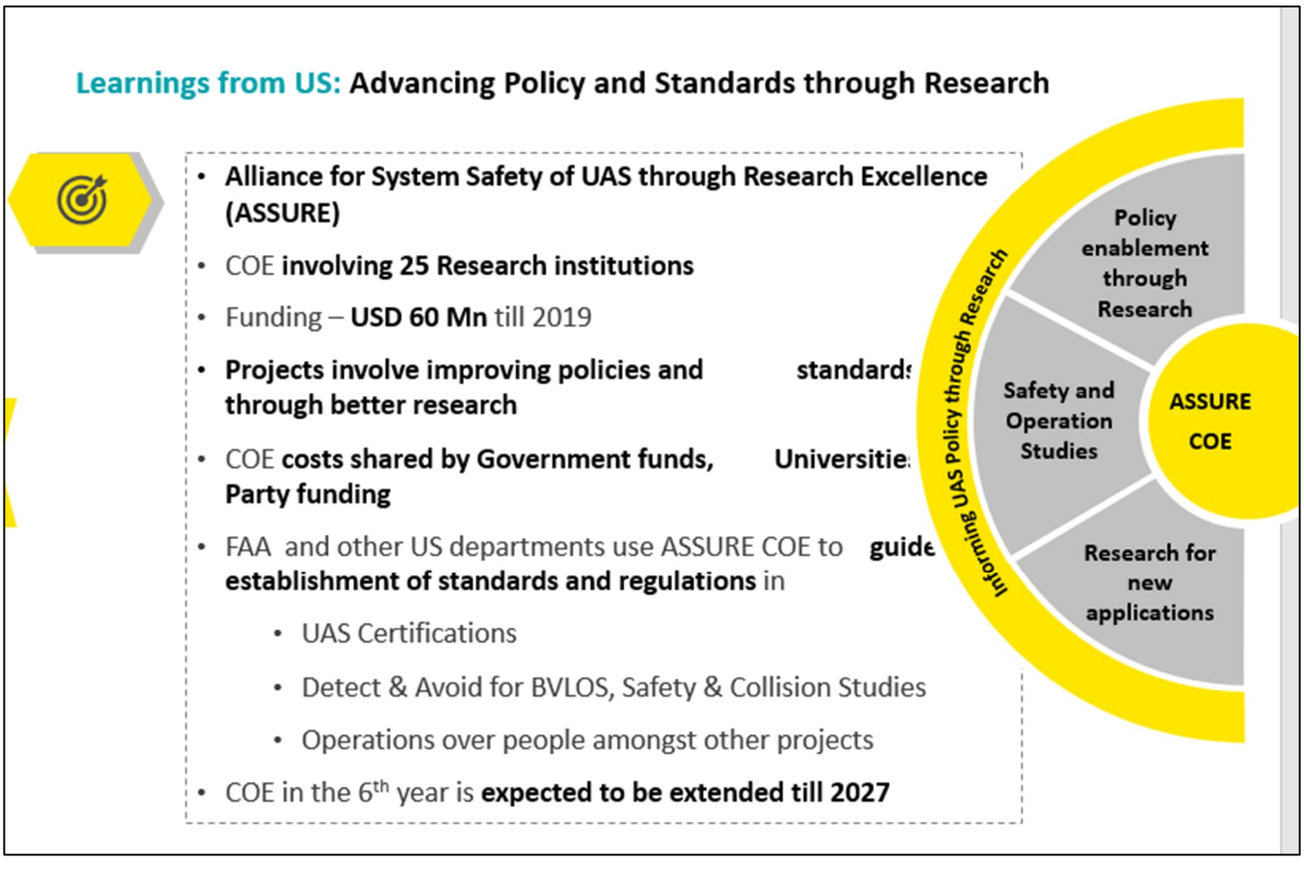
Innovation key to build intellectual property. Indigenization of drone manufacturing requires accelerating innovation and building Indian unicorns. To this end, there must be a modality to incentivize innovation in drone manufacturing. Support from the government would be required for:

- Creation of a dedicated fund to provide Grants for research in drone enabled technologies and policies
- Deployment through incubation centers for growth of indigenous drone related IPs and startups.
- Funding (via fund of funds) to scale the share of Indian ecosystem across drone technology and manufacturing value chain.
- Subsidizing skilling costs for training and development of human resources.
- Set up a mechanism for transformation of innovation into commercially viable products to bridge the gap between prototyping and production.
- Set up accelerators for innovation and growth of indigenous drone-related IPs and startups.



4.5.6 Skill and academic development: setting up a drone CoE

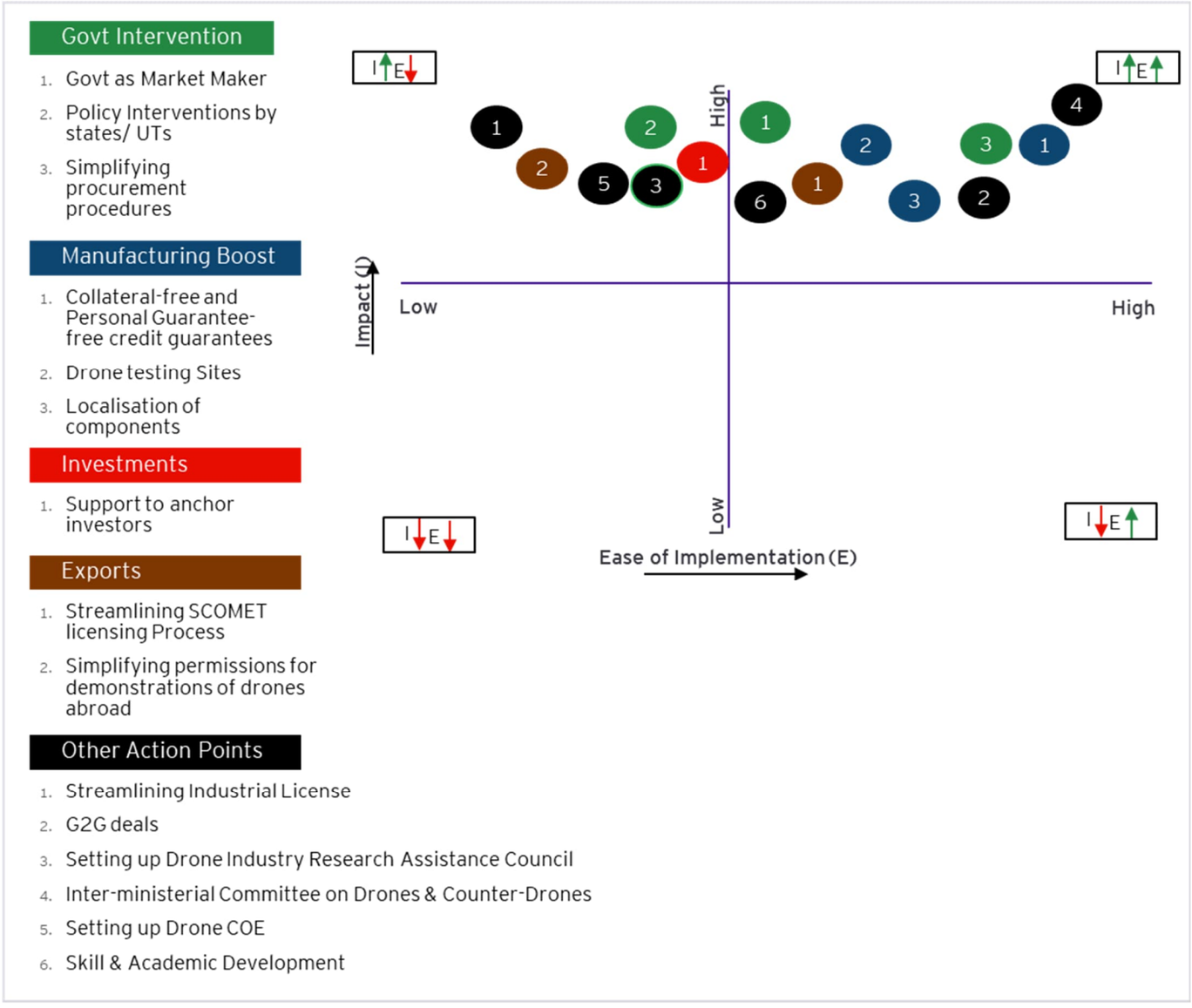
To provide a fillip to skill and academic development in the country, it is essential to set up a multi-institute Drone CoE to enable research towards advancing technology and policies to meet industry requirements. Research projects need to be focused on improving policy decisions, drone adoption and enabling new technologies. Initially seed funded by the government, the COE can be gradually self-funded through research and grants from 3rd parties and PSUs. Government could thus evaluate innovation funding for similar high-risk technologies and innovations. The Drone CoE could subsidies skilling costs for training and development of human resources, formulate Drone Research, Development, Manufacturing and Services related curriculums in IITs, Rajiv Gandhi National Aviation University (RGNAU) and other academic institutions.



5. Way forward

It is imperative for all stakeholders to synergize action toward making the vision of India becoming a drone manufacturing hub a reality. A snapshot of the recommendations, viewed through the twin layers of impact and ease of implementation, is reproduced below. Regardless of the inter-se differences, it is evident that while some of the recommendations may be relatively more intricate to implement, all the recommendations will bear high impact, and if taken together holistically, will deliver a transformational impact on the landscape of Indian industry.

Impact vs. ease of implementation of recommendations



Abbreviations

Acronym	Term
BVLOS	Beyond Visual Line of Sight
CoE	Centre of Excellence
C-UAV	Counter-Unmanned Aerial Vehicle
DGCA	Directorate General of Civil Aviation
DIRAC	Drone Industry Research Assistance Council
DRD	Drone Directorate
EV	Electric Vehicle
FAA	Federal Aviation Administration
G2G	Government to Government
LOS	Line of Sight
MoCA	Ministry of Civil Aviation
NAS	National Airspace
PLI	Production-Linked Incentive
SCOMET	Special Chemicals, Organisms, Materials, Equipment and Technologies
ToT	Transfer of technology
TRL	Technology Readiness Level
UAV	Unmanned Aerial Vehicle
UTM	Unmanned Traffic Management

Sources of inputs

Industry	Sub Sectors	Sources for inputs
Infrastructure	Roads, Ports and Pipelines	Total Length of Highways - https://morth.nic.in/sites/default/files/Annual_Report_English_2018-19.pdf Length of roads to be constructed - https://theprint.in/india/governance/80-highway-work-resumes-after-lockdown-target-is-to-complete-12000-km-of-roads-in-2020-21/438747/#:~:text=The%20ministry%20is%20hopeful%20of,cent%20of%20our%20ongoing%20projects. Number of ports - http://www.ipa.nic.in/index1.cshtml?lsid=26 https://www.pngrb.gov.in/data-bank/NGPLReports23062020.pdf http://petroleum.nic.in/sites/default/files/arep2020.pdf https://www.livemint.com/budget/news/budget-2020-national-gas-grid-to-be-expanded-to-27-000-km-from-16-200-km-11580543817921.html
	Railways	Length of Railway Track - https://economictimes.indiatimes.com/industry/transportation/railways/189-new-rail-lines-under-construction-government/articleshow/70258890.cms?from=mdr Length of Track to be constructed - https://indianrailways.gov.in/railwayboard/uploads/directorate/stat_econ/Year_Book/Year%20Book%202018-19-English.pdf
	Real Estate	Number of Towers - https://www.business-standard.com/article/companies/india-needs-100-000-telecom-towers-to-cater-to-rising-data-demand-118052400278_1.html Number of construction sites - https://www.maiervidorno.com/industry-expertise/construction/#:~:text=As%20per%20the%20industry%20body,cancelled%20owing%20to%20COVID%2D19
	Telecom Infrastructure	
	Pipelines, Transmission lines, Wind and Solar Power	CEA (https://powerline.net.in/2020/06/09/transmission-trends-2/#:~:text=The%20transmission%20line%20length%20(at,cent%20by%20the%20central%20sector.) https://indianwindpower.com/pdf/GWEO_2016.pdf https://mnre.gov.in/img/documents/uploads/0ce0bba7b9f24b32aed4d89265d6b067.pdf
Agriculture	Crop Management	*Gross Cropped Area (GCA) is the total area sown once as well as more than once in a particular year. When the crop is sown on a piece of land for twice, the area is counted twice in GCA. Source: http://www.yieldgap.org/india (cropping pattern for 2010-11)* *Cereals - Source: Agri expert (1 spray each at sowing and growth stages; 2 sprays for pest and disease detection* *Pulses - Source: Agri expert* *Cotton - Source: Agri expert (longer duration; more chances of pest)* *Oilseeds - Source: Agri expert (longer duration; more chances of pest)* *Vegetables - Source: Agri file on vegetable spraying* *Sugarcane - Source: Agri expert* *Fruits and Other Crops - Source: Agri expert* 12- No of KVKs in India - https://icar.org.in/content/krishi-vigyan-kendra
	Crop Insurance	
Retail	Retail and SCM	► KPMG / CII Institute of Logistics report of 2018 ► Spire Research – 2018 ► Knightfrank - india-warehousing-report-india-warehousing-market-report-2019-6468.pdf ► Care Ratings: https://www.careratings.com/upload/NewsFiles/Studies/Warehousing%20Industry%20October%202018.pdf

Industry	Sub Sectors	Sources for inputs
Urban & Rural Dev Homeland security	Mapping and Cartography	Survey of India Website
	State police agencies	► https://pib.gov.in/Pressreleaseshare.aspx?PRID=1595275
	Central Armed Police Forces (CAPF)	► https://www.itbpolice.nic.in/Aboutus_new/history&role/history&role.html ► https://en.wikipedia.org/wiki/Border_Security_Force ► https://en.wikipedia.org/wiki/Central_Reserve_Police_Force ► https://en.wikipedia.org/wiki/Assam_Rifles ► https://www.cisf.gov.in/cisfeng/about-us/
	Disaster management agencies	► https://en.wikipedia.org/wiki/List_of_districts_in_India ► ndmindia.nic.in
Counter Drones	Counter Drones	Working Group Inputs and EY analysis

FICCI Drones Department

FICCI has many specialized committees where key concerns of the industry are debated and discussed with the specific aim of presenting the recommendations to the government for favorable decisions. FICCI has identified drones as one of the priority areas. FICCI Committee on drones has been working on the policy advocacy and the regulatory framework to facilitate the growth of ecosystem for drones in the country.

Some of the focus areas are:

- Regulatory evolution
- Industry licensing regime
- Import/export-regulation
- Counter drone technologies
- UAV exports
- Demand analysis for drones
- User sensitization and demand creation

Key initiatives:

- Driving policy conversations revolving around the drone sector between industry, academia, and the government.
- Worked toward laying foundation of drone industry in India by aggregating demand towards facilitating increased drone technology adoption in the country, help forge manufacturing partnerships, attract investments to Indian drone companies and start-ups, promote innovation and promote exports.
- An important point of contact for Government – Academia - Industry interface on matters pertaining to drones and counter-drones.
- Activities have generated curiosity among stakeholders in the non-drone segment of the industry as well.
- Working with DPIIT on realizing the vision of 'Atmanirbhar Bharat' and 'Making India a Drone Hub of the World'

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Established in 1927, FICCI is the largest and oldest apex business organization in India. Its history is closely interwoven with India's struggle for independence, its industrialisation, and its emergence as one of the most rapidly growing global economies.

A non-government, not-for-profit organisation, FICCI is the voice of India's business and industry. From influencing policy to encouraging debate, engaging with policy makers and civil society, FICCI articulates the views and concerns of industry. It serves its members from the Indian private and public corporate sectors and multinational companies, drawing its strength from diverse regional chambers of commerce and industry across states, reaching out to over 2,50,000 companies.

FICCI provides a platform for networking and consensus building within and across sectors and is the first port of call for Indian industry, policy makers and the international business community.