Term Project Dissertation Report on

MAKING INDIA DRONE HUB OF THE WORLD

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CERTIFICATE

This is to certify that Mr. Vibhor Sharma, has completed the term project titled "MAKING INDIA DRONE HUB OF THE WORLD" under the guidance of Mr. Mohit Beniwal as part of Executive Master of Business Administration (EMBA) curriculum of Delhi School of Management, New Delhi.

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Mentor Name and Signature

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DECLARATION

I, Vibhor Sharma Roll No. 2K22/EMBA/26 student at Delhi School of Management, Delhi Technical University, Bawana Road Delhi – 110042 studying in EMBA 2022-2024 hereby declare that I have completed the project on "MAKING INDIA DRONE HUB OF THE WORLD" during the semester 4th of academic year 2023-2024 under the guidance of project guide Mr. Mohit Beniwal. I take sole responsibility for ensuring the quality, originality, and authenticity of this work.

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I sincerely thank to all of them in helping me to carrying out this project work. Last but not the least, I wish to avail myself of this opportunity, to express a sense of gratitude and love to my friends and my beloved parents for their mutual support, strength, help for everything.

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TABLE OF CONTENTS

1. LIST OF TABLES

2. LIST OF FIGURES

3. LIST OF ABBREVIATIONS

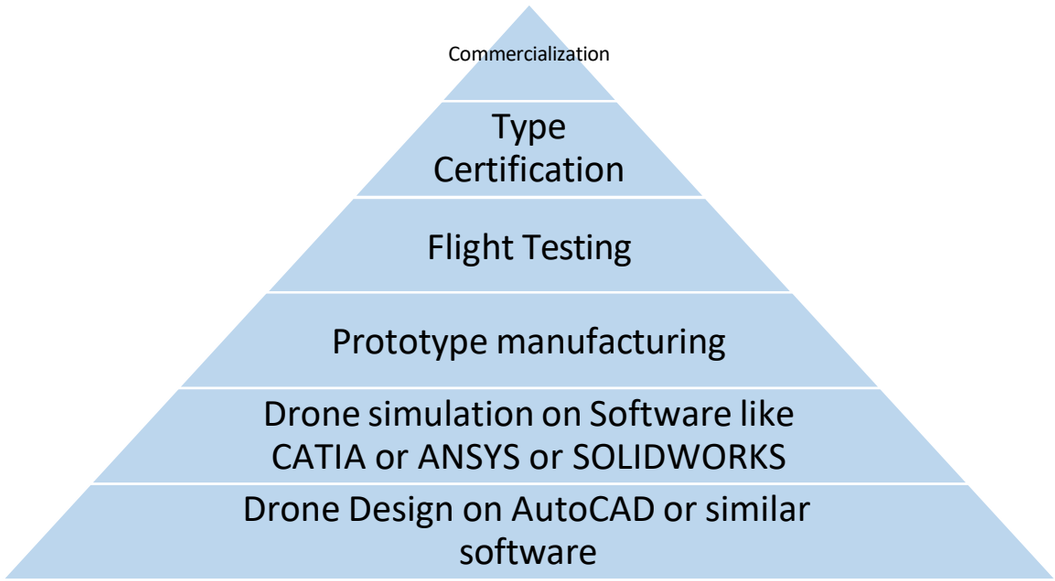
	Term
BVLOS	Beyond Visual Line of Sight
CoE	Centre of Excellence
C-UAV	**Counter-Unmanned Aerial Vehicle**
DGCA	**Directorate General of Civil Aviation**
DIRAC	**Drone Industry Research Assistance Council**
DRD	**Drone Directorate**
EV	Electric Vehicle
FAA	Federal Aviation Administration
G2G	Government 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

4 CHAPTER 1 – INTRODUCTION AND EXECUTIVE SUMMARY

There are more than 300 companies in India that are directly involved in manufacturing or designing of drones and its components.

Lifecycle of a drone company –

Lifecyle of Drone development



These companies are either developing indigenous products or are rebadging and assembling the imported components as Made in India.

Per the Govt. of India order dated 10-02-2022 the import of drones is banned in India, except for R&D and military use.

This ban was done to boost and encourage the indigenization of drone technology in India

In India any one can manufacture a drone, but to commercially sale it, the drone needs to be Type Certified by QCI or Bureau Veritas.

These organizations rely on the certifications against some tests, endorsed by private testing labs.

The actual government fees for type certification is 100 INR, but the expenses for the drone to match the standards for Type certification cost approximately 20 lakhs INR as these tests are time taking and number of labs present to conduct such tests is very few, in the country.

The major reason of high cost for confirming to Type certification compliance is the rigorous and time taking tests of drones for tests listed below -

1. Cold Test
2. Hot Test
3. Humidity Test
4. Fire Retardant test
5. Tensile Strength
6. Material Grade
7. Compression Test
8. Ageing Test – IS9000
9. Failure Test
10. Tensile Strength – IS9000
11. Battery Test
12. BIS Testing – IS16046
13. Life Cycle Test - IS16046

The such high cost to get the Type certification of drones lead to a lot of Start-Ups not being able to afford the test and country being deprived of good and economical drones developed indigenously.

Every Start-up relies on funding by investors, when the cost of development is so high and funds get exhausted only in testing the start up is unable to mass manufacture and commercialize the drone.

India as of now has to import its military drones and India is lagging behind in terms of giving the world - great drones.

The retail cost of an agricultural drone ranges from 5 to 6 lakh INR, whereas the actual cost as per bill of materials is just 3-4 lakhs including recovery of R&D cost.

The sole reason of such expensive drones is the high testing cost.

4.1 Case studies of the challenges of some Drone Start-Ups

4.1.1 An IIT Delhi's TIH incubated Hyderabad based Counter drone start up, Arka Aerospace, has to waste half of the time in traveling across the city just to test its drones for various conformances due to lack of any facility that has all testing equipment in one place.

4.1.2 A Delhi based hydrogen propelled drone start up, Green Aero Propulsion, has no testing facility in the country to test its hydrogen cell based drone, lack of such facility leads the start-up, to test and certify its drone out of the country, increasing

the R&D cost by 3 fold.

4.1.3 An IIT Delhi's TIH incubated swarm drone start up, Bot Labs had to constantly travel to Gr. Noida, to test its swarm drone capabilities due to Delhi being red zone for flying. Ultimately they had to relocate to Greater Noida from IIT Delhi.

4.1.4 A IIT Delhi's TIH incubated fixed wing drone Start-Up had to relocate its entire manufacturing and R&D center to Rohtak from IIT D, due to unavailability of an air strip for the takeoff and landing of its drones.

The above case studies show, the lack of comprehensive testing facilities across India. The TIH of IIIT Delhi, IHFC has envisioned to develop a comprehensive and holistic drone testing facility spanning over 10 acre of green zone for entire drone development and testing lifecycle, named as Drone technology park (DTP), situated at Sonipat Campus of IIT Delhi.

4.2 DTP as a Facility aims to accomplish the following objectives

i. Encourage indigenization of the entire drone and drone component manufacturing and development of drone ecosystem in India
ii. In making Type Certification affordable
iii. Technology transfer of drone technology to industry
iv. Provide testing equipment and testing ground for drone developers
v. To bring together drone component manufacturers and drone designers
vi. Common platform for collaboration on training, research, new product development and commercialization
vii. Drone and its component prototype manufacturing
viii. Creating world class testing facility for drone Startups
ix. Skill Development, Training, research, New product development
x. Lab to market

4.3 DTP Vision

To establish itself as a Centre of Excellence (CoE) that will act as one stop shop for entire drone development cycle and generate revenue to become self-sustainable

4.4 DTP will earn revenue out of the below

i. Equipment usage on per test and hourly basis
ii. Indoor flying zone usage
iii. Outdoor flying zone usage
iv. Netted flying zone usage
v. Runway usage

4.5 Policy

i. DTP will be open to any UAV developer, irrespective of the user being
    a. Start up
    b. Manufacturer
    c. Industry
    d. Government
    e. Armed forces
    f. Researchers
ii. DTP will incubate UAV Start-ups and connect them with industry
iii. DTP will act as a place for training drone pilots
iv. DTP will run academic courses and challenges for school students
v. DTP will showcase the product offerings of incubated start ups

4.6 Growth of DTP

i. DTP's product offering will be unique in the entire country
ii. DTP will face stiff competition in terms of Type certification, from individual labs and organizations like Bureau Veritas and private labs that issue certificates for tests to drones
iii. DTP offering a holistic service for overall drone development and design lifecycle, will be a unique facility in itself and is supposed to grow as the idea is welcomed by industry and start up and researchers.
iv. Through a collaboration with DFI, DTP can reach out to the 230 member companies of theirs and advertise about DTP
v. Via digital marketing and SEO, the ads will be run for DTP so that it gets a good traction and people come to use the facility.

vi. Drone component development will be emphasized at DTP so that small players in the ecosystem can also grow and cross selling can be done at DTP among drone component designers and drone developers

4.7 Structure of DTP

i. DTP will house - Start ups, Grand Projects, READY Students, Grand Projects Researchers
ii. Industry like Honeywell and other drone development companies.
iii. DTP as a facility will offer the below –
    a. Flight zones
    b. Netted testing area
    c. Indoor and outdoor testing area
    d. GPS denied & jamming flights
    e. Testing labs - Prototype manufacturing through CNC and lathe machine
    f. Solidworks/Ansys/AutoCAD for drone simulations and design
    g. Drone Training and Simulation lab for programs with NECTAR and NSDC

4.8 Technology USP of DTP

i. DTP to have a Indoor flying facility with high speed motion detectors for swarm drone testing
ii. This facility can have an amphitheatre as well for drone games with obstacles

4.9 IHFC, TIH of IIT Delhi, set up by Ministry of Science and Technology, in March 2024 conducted a Brain Storming session with –

4.9.1 Academia

4.9.2 Start-Ups, and

4.9.3 Industry and Government Bodies

The inputs are listed in below sections –

4.9.1 <u>DTP Brainstorming session with Academia and TIH</u>

1. Professor, PES University, Bangalore
    - Testing of particular type of drones for a specific use
    - Payload testing facility and equipment infrastructure required
2. Research Assistant, PES University, Bangalore

- The facility must have the equipment to execute the tests required for DGCA type certification of drones
- Teaching or training facility for swarm robots

3. Professor and CEO, Meiyur Technologies
   - DTP must support design and analysis of High Altitude - Long Endurance (HALE) drones
   - At Virginia university, there is a netted facility of 1 km length and 75 m in height
   - There should be in netted facility within which drones can be tested
4. Chief Research Scientist, IISc, Bangalore
   - Labs that enable standardisation should be established
   - Small scale company should be supported
   - Drone and bird collision avoidance systems should be developed
5. Assistant Professor, IIT Mandi, Mandi
   - IIT Mandi can offer an extended facility of DTP Sonipat
   - Mandi has extreme weather conditions in which drones can be tested
   - Equipment for stability testing
   - There should be an indoor facility and an outdoor facility
   - The closed facility at DTP should have high ceiling
   - The closed facility should be able to test swarm drones
6. CTO, TIH, IIT Bombay, Mumbai
   - DTP should have a facility which should be fixed and covered, that should have motion sensors, obstacles, cameras
   - Equipment for endurance test and Battery test should be there
   - The facility should have capability to test fixed wing drones with an area of 10,000 $ft.^2$ and height of 30 feet
7. Assistant Professor, IIIT Delhi, Delhi
   - There should be Indoor testing facility for swarm drones testing
   - There should be an outdoor facility for GPS denied flights, precision landing testing
   - There should be a short-term training programme for research assistants to understand everything about drones
8. Professor, IIIT Hyderabad, Hyderabad
   - IHFC should hire a specialised person that can train, maintain the high-end equipment of the indoor facility like sensors and motion cameras

- This person must have technical understanding of drones and act as a bridge among Accademia and start up, should have market knowledge and create a bridge among Accademia and industry
- There should be motion capture systems within the indoor testing area

9. Project Director, TIH IIT Palakkad, Palakkad
    - IHFC should collaborate with armed forces and know what kind of testing equipment they need at DTP
    - DTP should recreate scenarios of high-altitude of approximately 5000 meter and the conditions for the same
    - There should be an airstrip on which fixed wing aircraft can be tested.

4.9.2 <u>DTP Brainstorming session with Start Ups</u>

1. CEO, Arka Aerospace, Hyderabad
    - A workspace in DTP is outdoor testing area that should be air-conditioned and have glass walls and ceiling for continuous testing and flying of thrones so that the pilots or not exposed to the hot temperatures throughout the day
    - The workplace should be secured so that start-ups can leave and store their equipment and drones during the non-testing times. This will help start-ups in saving time in packing and packing their equipment and drones every day and lose sunlight.
    - For component level,
        - Thrust stands for motor,
        - Propeller,
        - Propulsion systems to develop characterisation of systems
        - Load test of battery
        - Indoor or pseudo indoor testing
        - Motor levett separate system
    - The trust stands should be capable enough to test 40 to 45 inches of propellers
    - Battery charging stations with safety to prevent fire hazards
    - An elevated watchtower kind of thing for telemetry and antenna placing
    - For drone level testing
        - Airspace

        - Tethered system so that the drone can be hanged and tested
        - CNC machine for carbon fibre machining and cutting
    - Phase 1 equipment required
        - Closed room for tethered testing
        - Area where the equipment and drone and material can be safely secured
    - Equipment for telemetry calculation
    - Have all equipment at one place
    - Have a set up where equipment of drone should not have to be moved and could be a pseudo permanent set up
    - Airspace will get crowded, in case there are multiple start-ups testing their drones at DTP
    - Reliable internet connection to test 4G spectrum drones
2. CEO, Green Aero Propulsion
    - Thrust stands for 100 KG+ drones
    - Lab where drones with turbo propulsion and turbine engine will be tested. These will be working on liquid fuel and hydrogen fuel with a safety buffer area of approximately 2000 square feet around the testing lab
    - Test stand that can accommodate engines with trust value is beyond 1000 newtons
    - The charges of using this equipment should be subsidised
    - Engine test beds
    - Equipment for endurance test
3. Director, JetAerospace
    - A new plan was developed by Kritika, for the development of DTP
    - This plan will have all the equipment that are required for type certification of drones set up by DGCA
    - DTP must have the equipment that is required for type certification of drones

4.9.3 <u>DTP Brainstorming session with Industry and Government bodies</u>

1. Colonel, Indian Air Force.
    - Include Aero modelling, drone racing and drone games.
    - Have DGCA certified people at DTP as the exam fees for the same is very high

- RPTO to be set up at DTP so that students can be certified in house.

2. Group Captain(Retd.), Indian Air Force
    - A large airspace is required.
    - Ground systems and Air space integration is required
    - Area around DTP should be mapped which is less populated, so that unmanned fixed wing drones can be tested and there is no risk to the living population
    - Make air corridor for testing drones that should have a certain height a certain length and should be an envelope of flying drones - for testing larger fixed wing UAV
    - A large envelop of airspace for extreme manoeuvre, point-to-point navigation, climb and decent check, flight profile check
    - Compare DTP with existing capabilities
    - Make an implementation plan that is for phase wise development
    - Navy must provide an interim facility while IHFC develops DTP and the large water tank for underwater drone testing
    - Provision for 24X7 drone testing should be at DTP, along with Online booking of airspace of DTP should be available along with the reasonable costing.
3. Colonel, Indian Army.
    - Define curriculum for army for drone testing and training
    - Collaborate with army for drone training.
4. Principal Scientist, Principal Scientific Bureau.

- Identify the gap between and a adopters and what developer is developing. DTP should work on decreasing the gap between the developer and end user.
- Sufficient visit from industry and uses of drones at DTP
- Flight models, parts, and requirements needs to be gathered before development
- Solve military, police, NDRF requirements
- Simulate high-altitude and high wind speed scenario via business
- DTP must have simulation of material of air frame of drone, propulsion system, payload of different types, control systems
- Interface standardisation
- Make payload and airframe standardised for making to fit on other drones.

5. Former Director of Operations, Drone Federation of India.
    - Focus on Aerospace part - wind Tunnel, runway
    - IIT Kanpur has a helicopter lab, DTP can collaborate with them to develop the layout plan
    - Airstrip is missing in India for start-ups
    - Testing of drones and analysis of the issues in it
    - Skill Council of India should be collaborated to train at DTP for training of drone pilot.
6. Commodore, Indian Navy.
    - Unmanned underwater drones-autonomous underwater vehicles
    - Testing area like a large swimming pool type of a water tank that is 50 m wide hundred metre long and 15 m deep. Water, pumping and filtration issues will be there.
    - A factory space for manufacturing and tooling facility
    - Work space with CNC and let machines
    - Factory space for PCB, printing and testing
    - 3-D printers
    - 2 to 3 workshops with area of 700 meter by 300 meter
    - Good office Space

    Navy's contribution-
    - Can provide the requirements, reviews, design, collaborate for centre of acceleration development
    - Facilitate testing in open sea for drones.

    Design roadmap for expensive and plan of DTP to be pre-designed

    Plan construction in advance for all phases.

4.10 EXECUTIVE SUMMARY

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. 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.

4.11 SELF SUSTAINABLE INDIA AND THE SIGNIFICANCE OF DRONE MANUFACTURING IN INDIA

Atmanirbhar Bharat, 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.

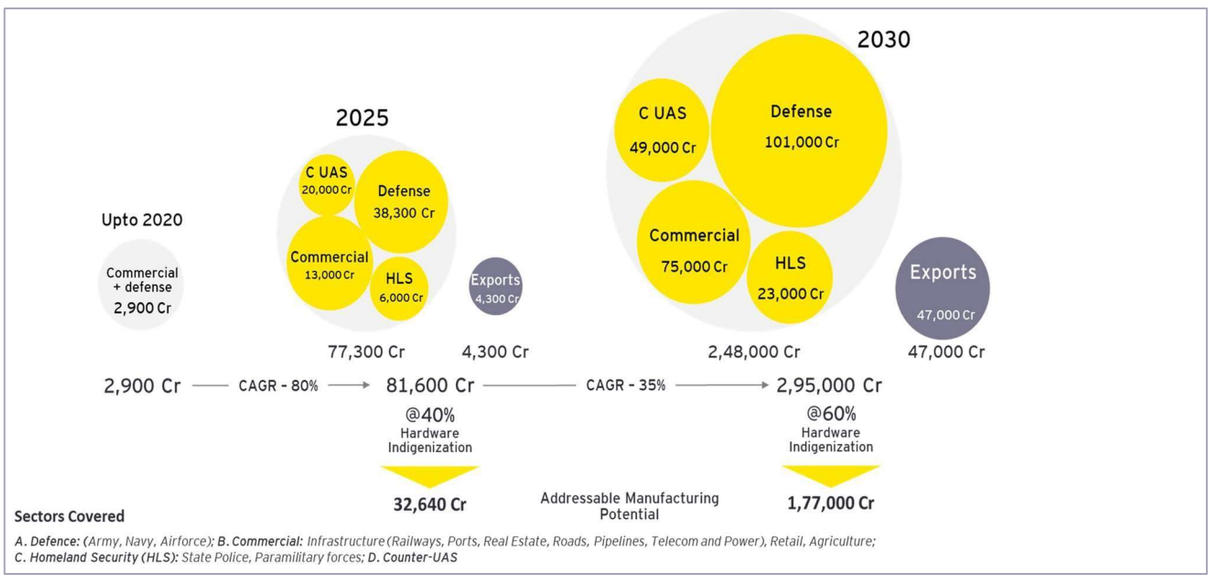
Given the parameters of the Atmanirbhar Bharat Abhiyan, drone manufacturing meets the requirements to a compelling degree. There is a huge potential of the manufacturing of drone components in the country.

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.

No.	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

4.12 Market Potential

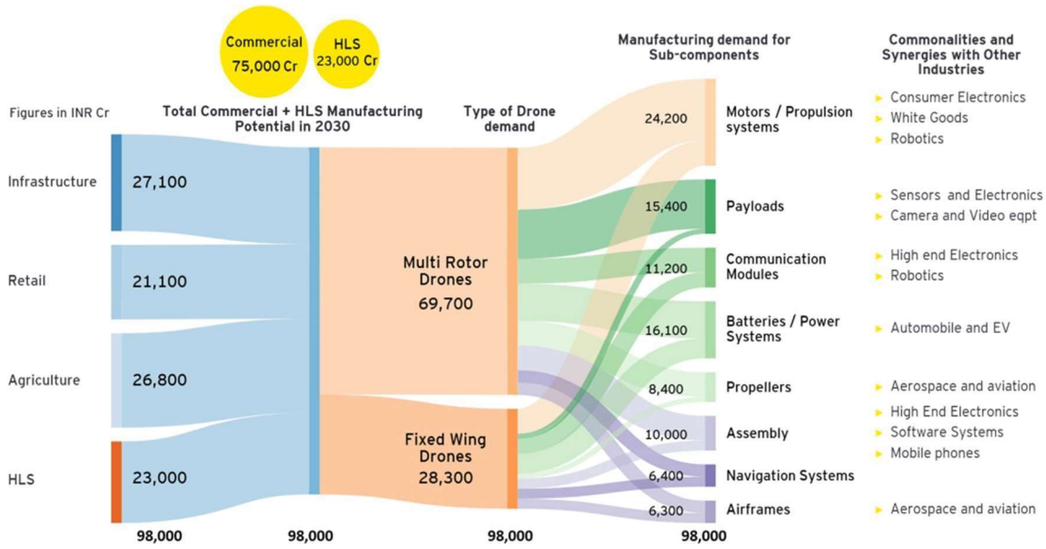
As per analyst estimates, India has the unique opportunity to realize approximately INR 1.8 Lakh crore of aggregate domestic manufacturing potential through focused implementation of drone indigenization projects, across ***defense***, ***commercial***, ***homeland security*** and ***counter UAV*** sectors.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



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.

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.



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4.12.1 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.

4.13 Key recommendations

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.

5 CHAPTER 2 – OVERVIEW: THE DRONE ECOSYSTEM

5.1 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.

So.	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

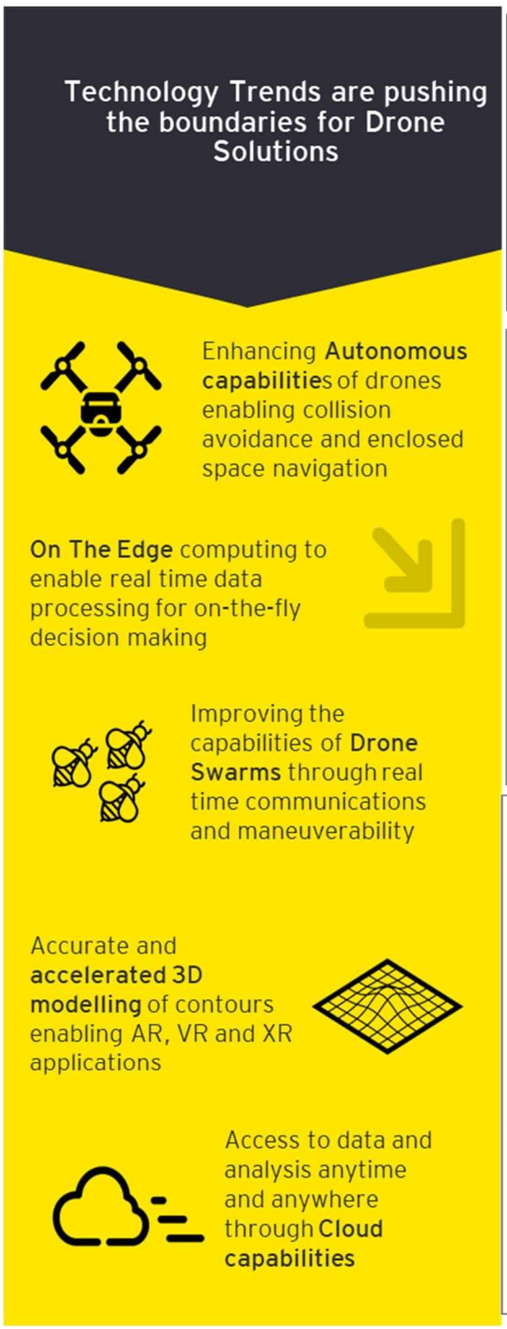
No	Sector	Drone Applications
6.	Housing and urban affairs	a. Construction Monitoring b. Planning/ Digital Elevation model c. Incident reporting
7.	Railways	a. Surveillance and Incidence Response b. Visual Inspections and Maintenance c. Construction Monitoring
8.	Road transport and highways	a. Visual 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 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

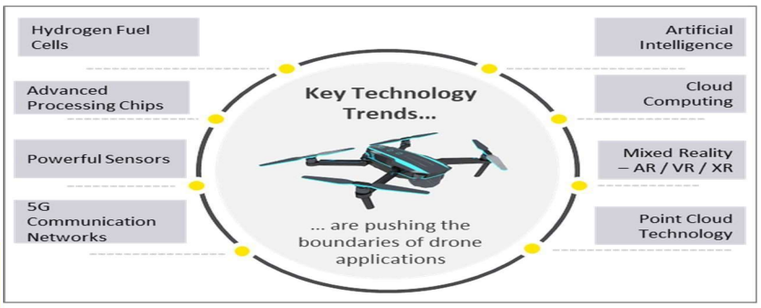
5.2 End Users

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.

5.3 Key Technology Trends

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





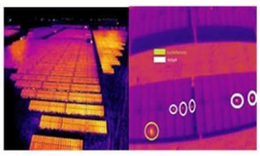
Solutions: Aerial Thermal Inspection of equipment and assets

Thermal Inspection

- Identification of anomalies not normally visible with visual inspection

Applicable Industries

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



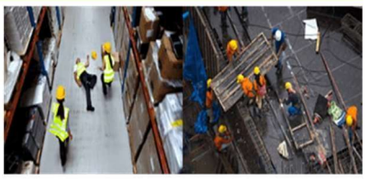
Solutions: Construction progress monitoring and monitoring of safety parameters

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

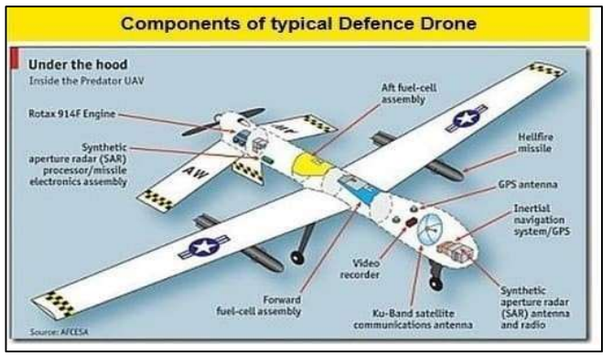
5.3.1 Drone enabled Solutions

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.

5.4 The Value Chain

5.4.1 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.



5.4.2 Counter-drone systems

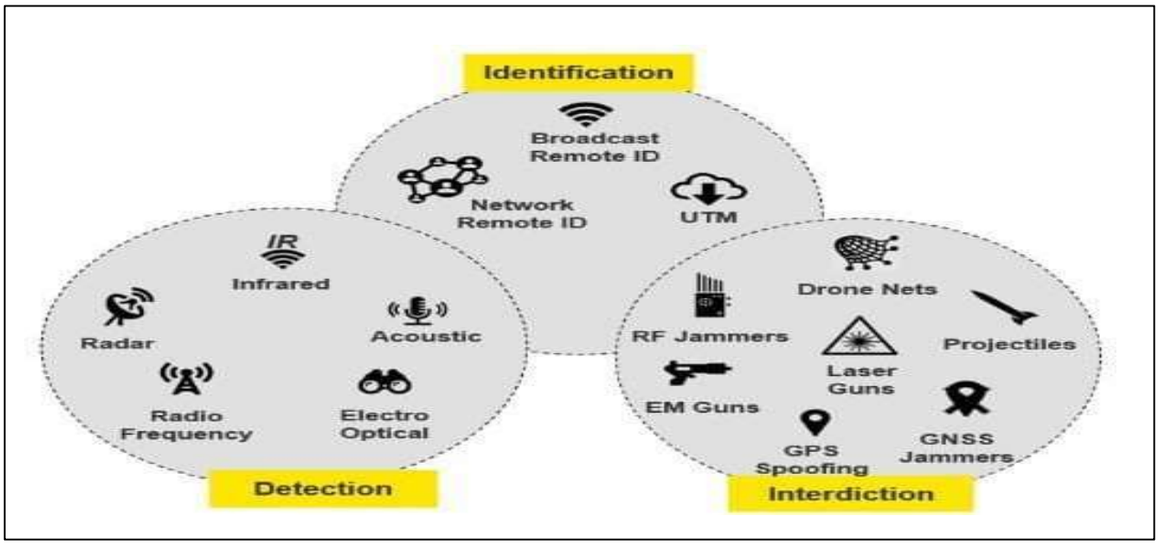
Counter drone systems are often a combination of multiple technologies tailored to suit the application. The salient features of counter drone systems are:

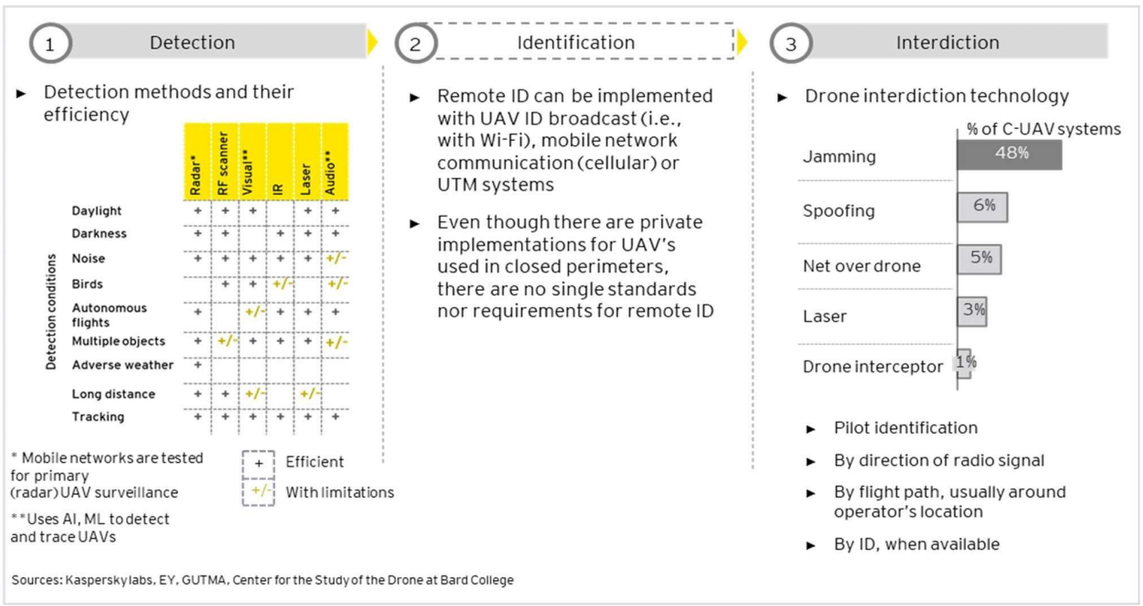
- The most popular drone detection techniques are radar, RF detection, EO, and IR, or a combination thereof.
- Identification is heavily dependent on the regulatory infrastructure available / to be developed in a geography.
- The most popular interdiction technique is jamming.

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.

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.

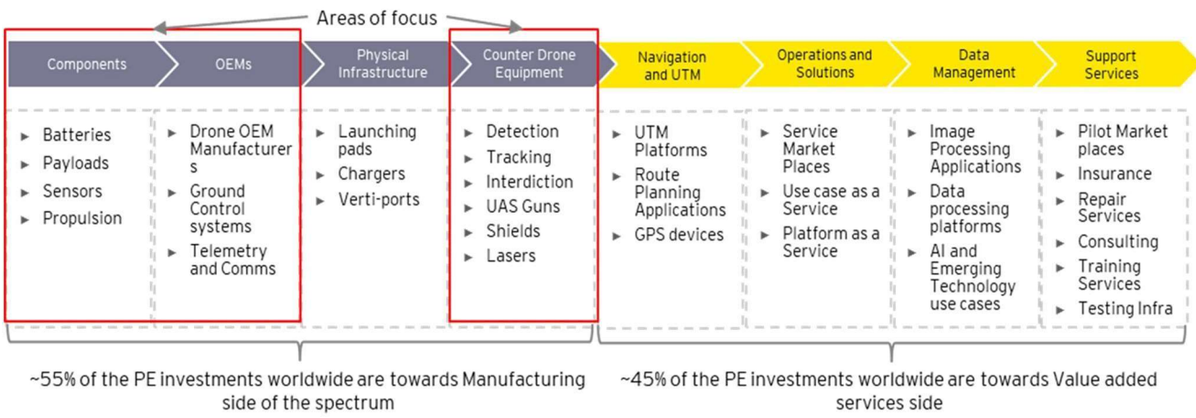




5.4.3 Manufacturing and value-added service components

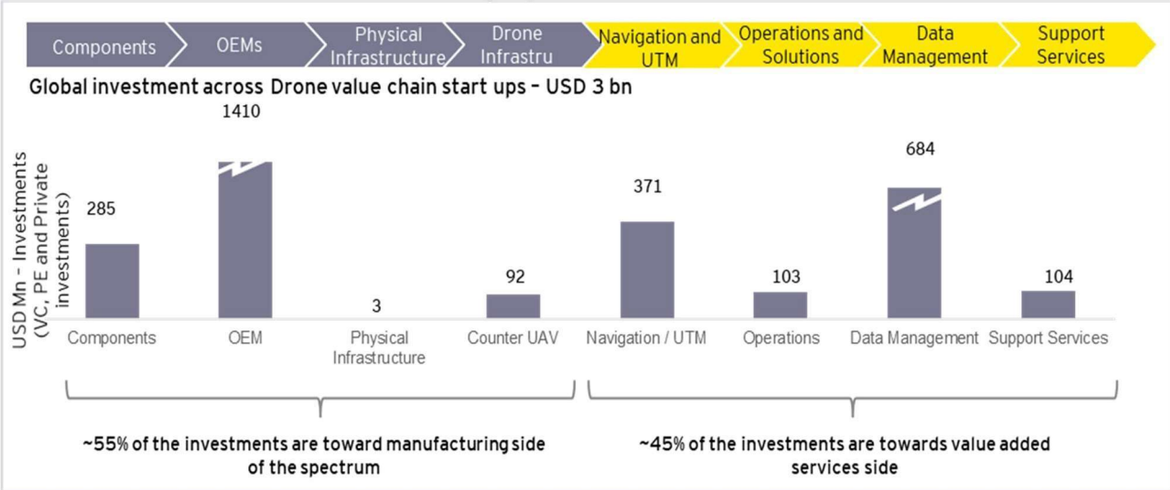
The drone value chain spans across manufacturing and value-added services components. India must focus on both the manufacturing side, and the value-added spectrum side, of the value chain, for several compelling reasons: -

- **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.**



5.4.4 Global investments

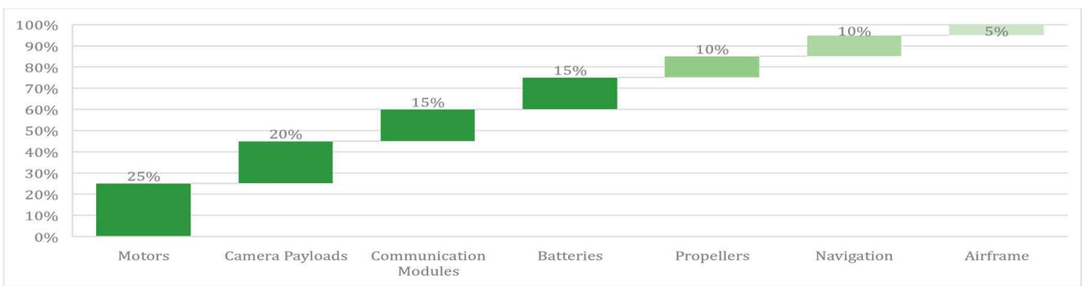
Investments in startups indicate significant global interest on both, the manufacturing, and the value addition services side of the spectrum. Analysts estimate that up to 55% of the PE investments worldwide occur in the manufacturing side, and approximately 45% towards the Value-Added Services side.

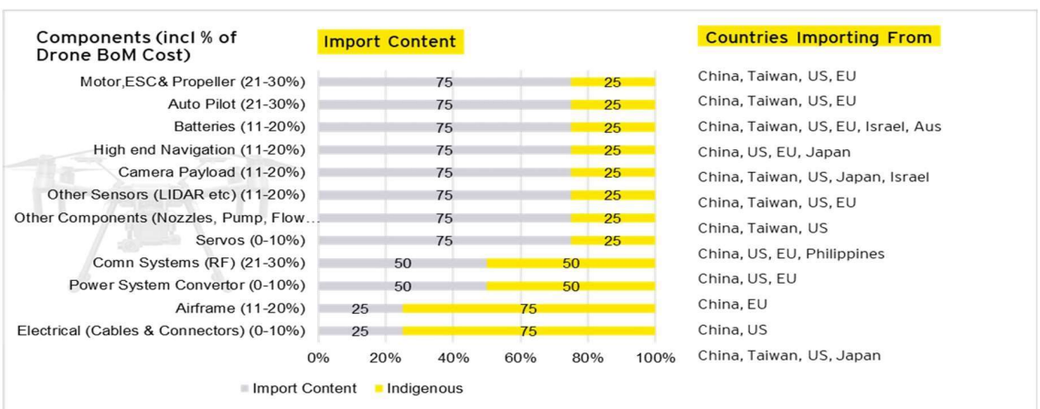


5.4.5 Manufacturing Value Chain: Commercial Drones

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.

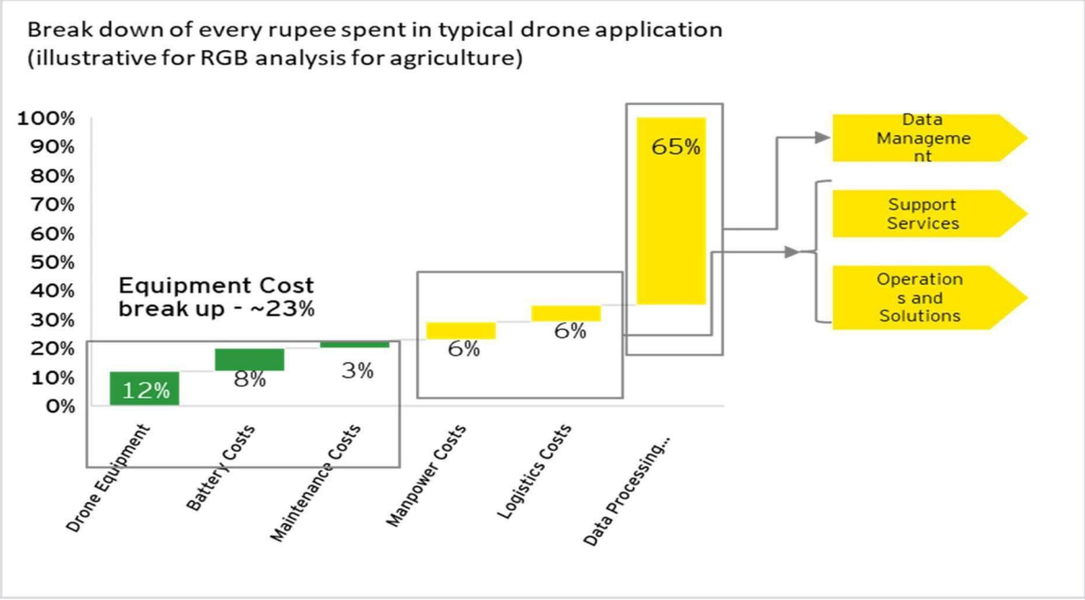




5.4.6 Value Added Service Components: Commercial Drones

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.

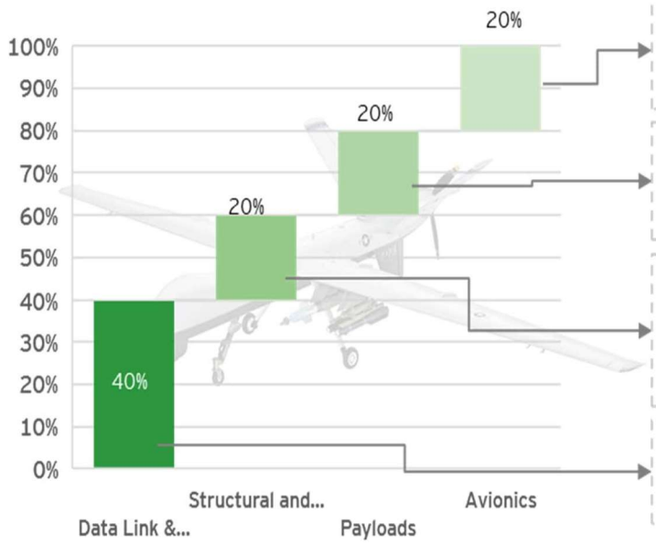
It is, therefore, pertinent to enable regulations to realize domestic demand to sustain the ecosystem. It would also be critical to ensure control over the data trail from Indian use cases and applications.



5.4.7 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

6. CHAPTER 3 – ACTION PLAN

6.1 Demand Creation

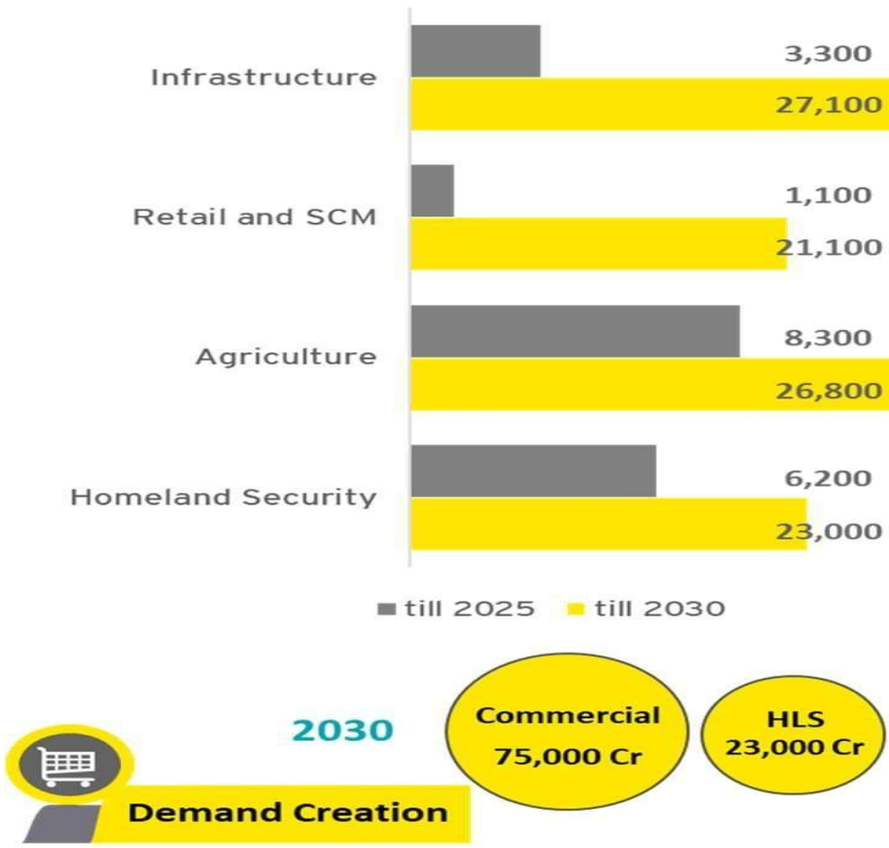
The government would play a critical role in creation of a viable market for drones, so that the country can realize its own manufacturing potential. The government's fillip through its role as market maker has a potential to expand demand to approximately INR 75,000 Cr in the Commercial sector, and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

6.1.1 Demand Push Through Ministries

i. *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).

ii. *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.

iii. *Ministry of Urban Development.* The Ministry should recommend drone- enabled solutions within the illustrative smart city solutions under the AMRUT mission.



6.1.2 Infrastructure

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

6.1.3 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 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.

6.1.4 The Three Ps: Procurement Processes, Permissions and PSUs

6.1.4.1 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.

6.1.4.2 Permissions

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

6.1.4.3 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.

6.2 A MANUFACTURING BOOST

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

6.2.1 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.

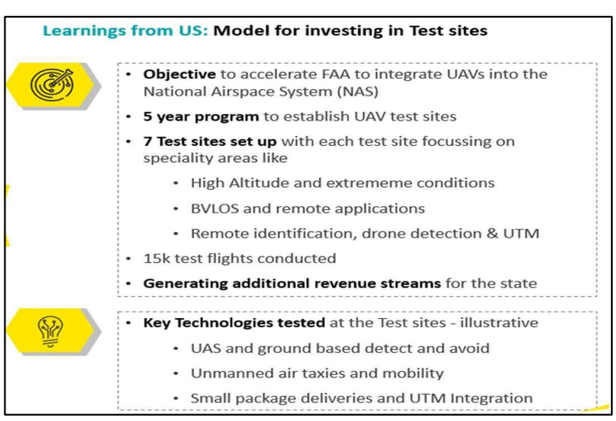
Further, financial institutions may consider giving collateral-free, and personal guarantee free loans up to 100% for companies seeking to invest in testing and manufacturing infrastructure in this sector, as this would also help in reducing the capital-intensive requirements in drone manufacturing.

6.2.2 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 establish a 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.



6.2.3 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.

6.3 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'.

6.4 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.

6.4.1 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.

6.4.2 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.

6.5 Other Action Points

6.5.1 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.
- 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.

6.5.2 G2G deals

India primarily depends on G2G deals for defense procurement. 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.

6.5.3 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.

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.

6.5.4 Inter-Ministerial Committee on Drones And Counter Drones

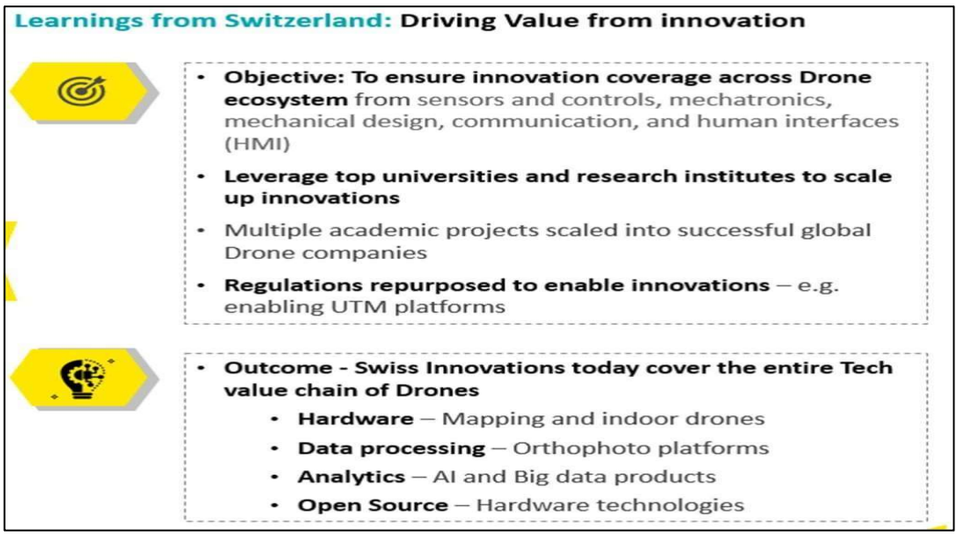
An Inter-Ministerial Committee on drones and counter-drones (IMC) may be constituted with representation from all the concerned Ministries / Departments dealing with the Drone and Counter Drone sector. IMC should regularly meet and deliberate to address the issues and bottleneck pertaining to the sector. 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.

6.5.5 Innovation

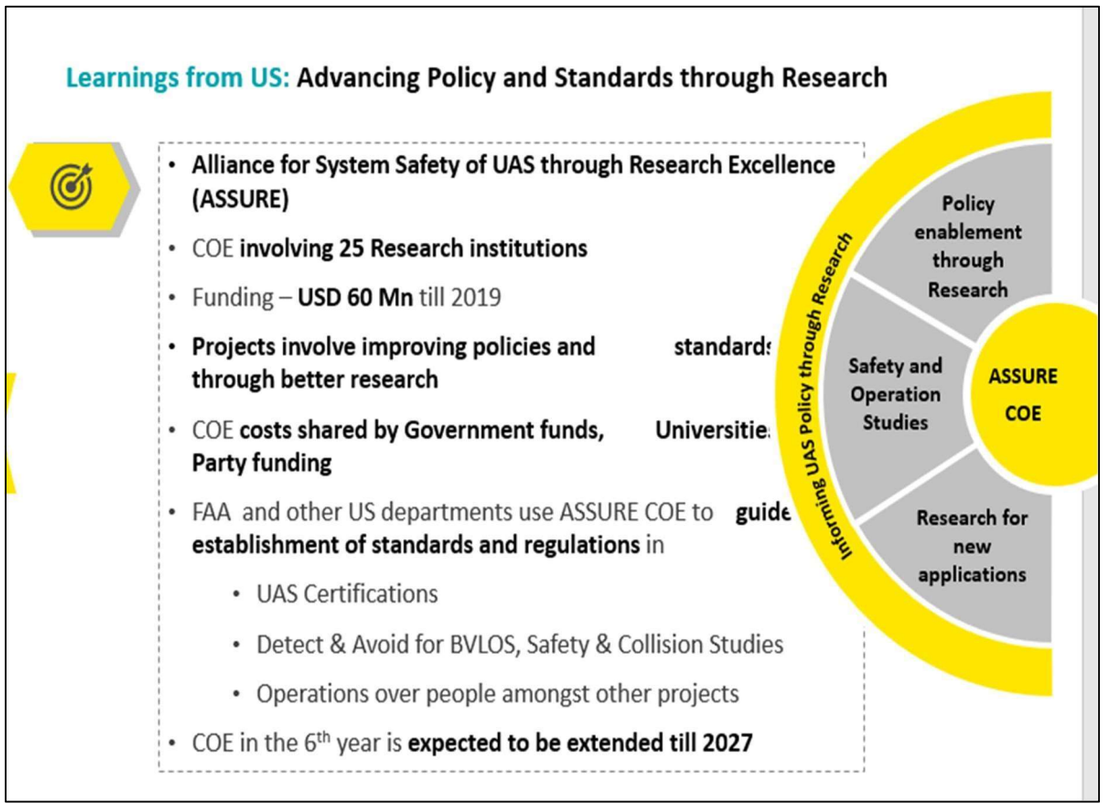
Innovation key to build intellectual property. Indigenization of drone manufacturing requires accelerating innovation and building Indian unicorns. To this end, there must be a modality to incentivize innovation in drone manufacturing. Support from the government would be required for:

- 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.



6.5.6 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.



7 CHAPTER - 4 - 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.

In order to boost and push forward the Indian drone eco system, the government and private firms need to come forward and set up multiple test and accreditation facilities for drones.

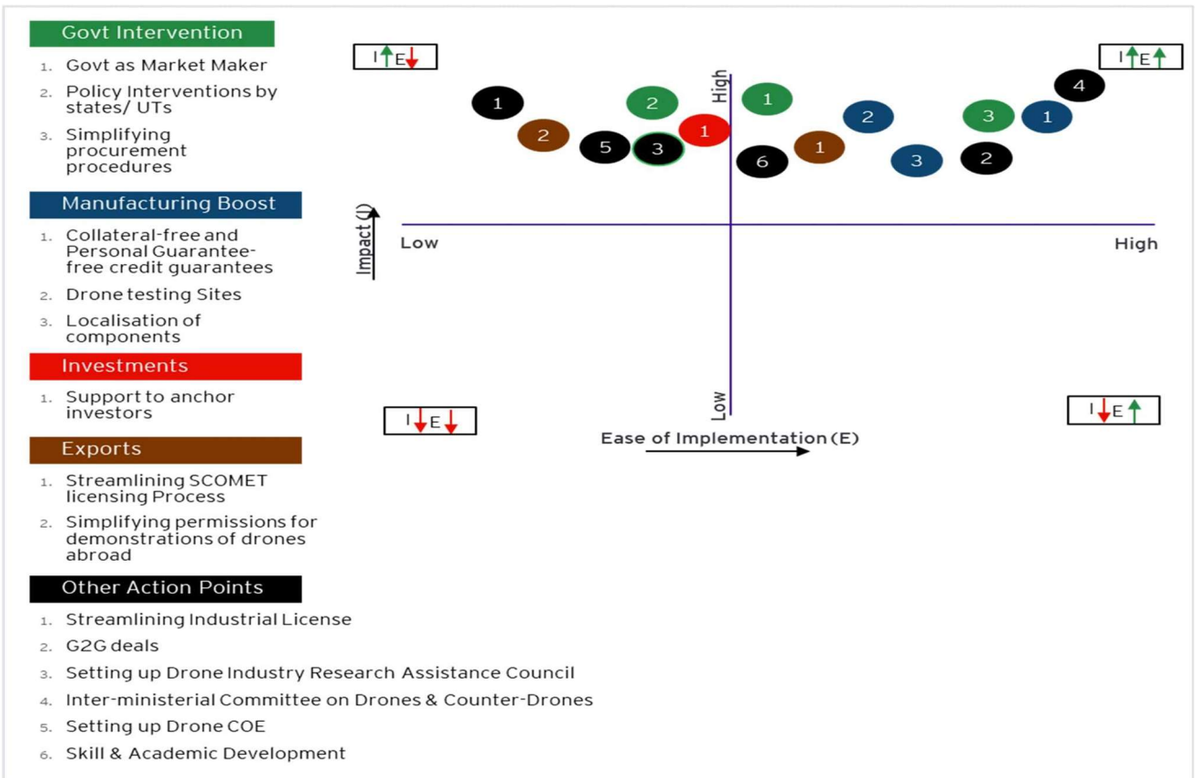
More and more researchers and Start-Ups to be funded on equity or IP based funding, so as to encourage the development of drones.

More and more test facilities and subsidies on Type Certification tests to be pushed by the government so that MSME can also enter the market.

Tax rebates should be given to the organizations developing drones and an government regulated e-commerce platform for trading drones and drone components

Incubators should be mandated to incubate and fund drone start ups.

Impact vs. ease of implementation of recommendations



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