



Overview of Global Tooling & PEC Market

August 17th, 2024

FROST & SULLIVAN

INDUSTRY OVERVIEW

MACROECONOMIC OVERVIEW

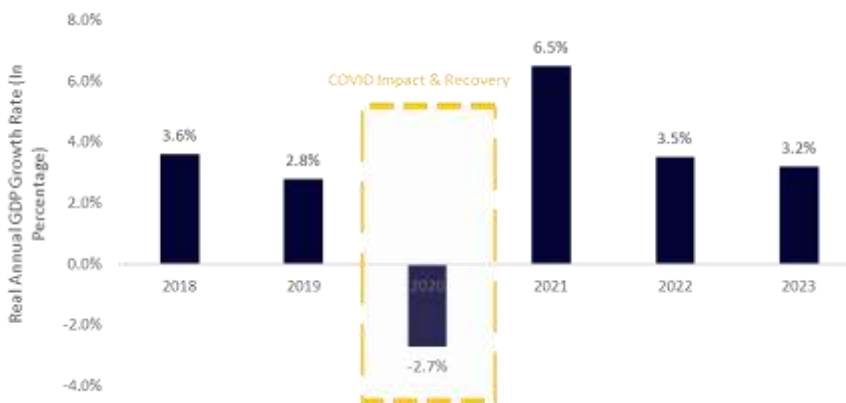
Overview of Global GDP (Trends in GDP Growth between 2018-2023)

The global economic performance in the historical study period of 2018 to 2023 has been tumultuous with alternating periods of recovery and slowdowns. As per IMF measures, 2018 witnessed robust economic growth on a global scale of 3.6%. 2019 saw a slight deceleration to 2.8% in global GDP growth due to trade tensions, geopolitical uncertainties, and slowing economic activity in key regions.

The outbreak of the COVID-19 pandemic in 2020 heralded the largest global economic contraction of -2.7% due to disrupted economies at large, leading to widespread lockdowns, supply chain disruptions, and a sharp decline in consumer demand. Much of global economies proved resilient with 2021 witnessing a rebound of 6.5% in global GDP growth with measures to bolster economic activity across various countries like implementation of fiscal stimulus measures, monetary policy support, and the rollout of vaccines.

Global GDP growth moderated to 3.5% in 2022 due to aftereffects of the pandemic, continuing supply chain disruptions, and uncertainties surrounding inflation and interest rates. In 2023, global GDP growth continued on a positive trajectory, registering a growth rate of 3.2%, moderated by the Ukraine- Russia Crisis and the Israel- Palestine crisis.

Percentage change in Global GDP, 2018-2023

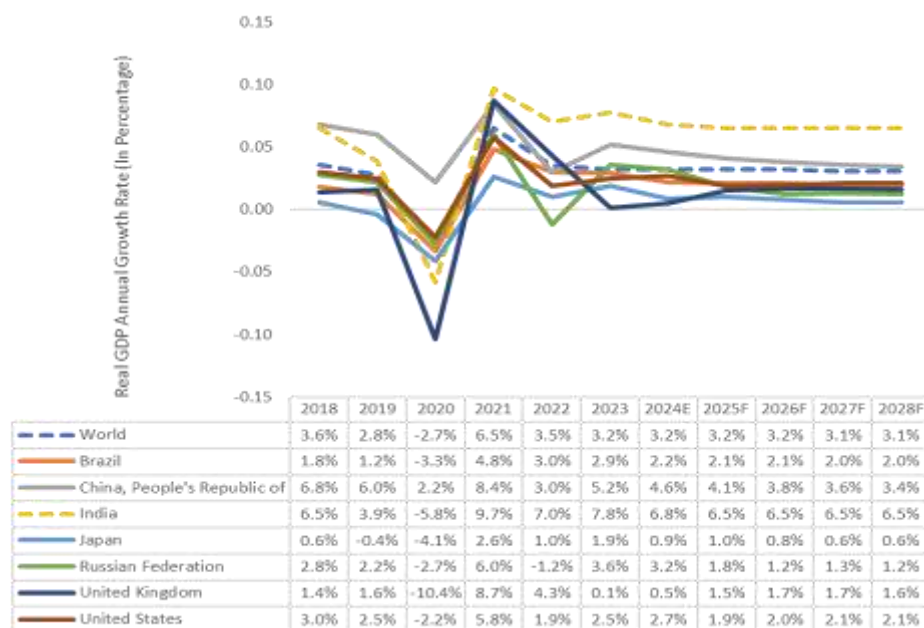


Source: https://www.imf.org/external/datamapper/NGDP_RPCH@WEO/WEO_WORLD

GDP Growth trend Comparison for Key Economies

Within the global canvas, the depth and pace of recoveries of key economies have been varied and noteworthy during this historical period. India is by far the fastest growing and stable major economy globally during the period 2021E to 2028F.

GDP growth trends in Key Economies, 2018-2028



Source: https://www.imf.org/external/datamapper/NGDP_RPCH@WEO/WEO_WORLD

USA: Stable Economy amid concerns of economic slowdown

In 2018 and 2019, the US economy exhibited healthy economic performance with growth rates of 3.0% and 2.5%, respectively on the back of increased consumption in 2019, which accounted for 77% of the total growth in 2019. 2020 witnessed a contraction of -2.2%, due to the impact of the COVID-19 pandemic in line with the global downturn. The US economy rebounded strongly in 2021 with a robust growth rate of 5.8%, in response to swift recovery measures and fiscal stimulus efforts. The growth rate stabilized at 1.9% in 2022 and 2.5% in 2023 -. The GDP growth in 2024 is forecasted at 2.7% amidst concerns of economic recession according to IMF and expected to grow to 2.1% during the forecast period 2024E-2028F.

United Kingdom: Stable, Low Growth

In 2018 and 2019, the UK experienced modest-low growth rates of 1.4% and 1.6%, respectively, indicating a slow growing and stable economic environment on account of Brexit uncertainties which has led to reduced business investments. 2020 witnessed one of the most significant economic contractions globally of a major economy of -10.4%, due to the impact of the COVID-19 pandemic and Brexit uncertainties, which disrupted trade and investment activities. The UK experienced a recovery of 8.7% in 2021 and 4.3% in 2022, driven by post-pandemic rebound measures and fiscal stimulus efforts. Growth slowed to 0.1% in 2023 on account of high inflation, weak labour market and low production growth. The UK economy entered recession in 2023, with the GDP falling in succession for the last two quarters of 2023.

In the years from 2024 to 2028 forecasted by the IMF, the UK's GDP growth rates are expected to fluctuate between 0.5% and 1.4% in a stable, low growth period as the economy adjusts to post-Brexit realities.

China: Maturing and Stabilizing Growth

The global economic powerhouse of China commenced the study period with robust growth rates of 6.8% and 6.0% in 2018 and 2019, respectively. Onset of the COVID-19 pandemic in 2020 led to only a slight deceleration of 2.2%, in stark contrast to the global contractions at large. China swiftly rebounded in 2021, showcasing a growth rate of 8.4%. Growth moderated to 3.0% in 2022 due to weak consumer demand coupled with falling property markets. Chinese economy grew by 5.2% in 2023 supported by strong economic expansion and is expected to exhibit a GDP growth of 3.4% until 2028, reflecting the country's transition towards a mature economy.

India: Fastest Growing Major Economy

GDP growth for India had been strong at 6.5% and 3.9% in 2018 and 2019. After COVID related contraction of -5.8% in 2020, the Indian economy has bounced back strong in 2021 at 9.7%. The economy was well recovered with 7% growth in 2022 on account of infrastructure reforms and investment by the government, speedy vaccination of the public and the push for privatization. This was further helped by pent-up demand-driven consumption by Tier II and Tier III city employees and businesses, in conjunction with market growth and uptake of the global economy. The growth rate of 7.8% witnessed in 2023 is expected to continue at a rate of around 6.5% during the period 2024E-2028F.

Russia: Economic Uncertainty

Russian economy experienced a modest growth rate of 2.8% and 2.2% in 2018 and 2019, respectively, indicating a relatively stable economic environment. In 2020 the COVID related contraction was -2.7%, on account of the dual impact of plummeting oil prices, due to its reliance on energy exports. Russia rebounded strongly in 2021, with a growth rate of 6.0%, due to gradual recovery of global oil prices and domestic economic stabilization measures. The GDP contracted by -1.2% in 2022, due to the Russia- Ukraine conflict, which impacted Oil exports of Russia. Growth of 3.6% is seen in 2023 following the push in domestic manufacturing. The GDP in 2028 is expected to grow by 1.2% compared to 2027 according to IMF, the average growth during the period 2024- 2029 is expected to average around 1.6%.

Japan: Stable Low Growth Economy

The GDP growth of Japan has been stable at a low of 1.7% between the period 2018-2023, except the COVID related contraction of -4.1% in 2020 and the related rebound of 2.6% in 2021. The GDP growth rates reverted back to 1% and 1.9% in 2022 and 2023, respectively. The growth of GDP is expected to decelerate from 0.9% in 2024 to around 0.6% in 2028, due to geopolitical tensions and higher inflation is expected to be demand driven inflation.

Brazil: Subdued Economic Performance

In 2018 and 2019, Brazil witnessed subdued economic performance with a slow GDP growth rate of 1.8% and 1.2% respectively, due to increase in domestic consumption and investments. The economy experiencing a COVID related contraction of -3.3%, and a robust rebound of 4.8% in 2021. Economic growth further moderated to 3% in 2022 and 2.9% in 2023. The market is expected to grow 2.2% in 2024 owing to delayed monetary tightening and a lower carry forward for the year. The GDP growth between 2024 and 2028 is expected to average around 2.1%.

MACROECONOMIC OVERVIEW OF INDIA

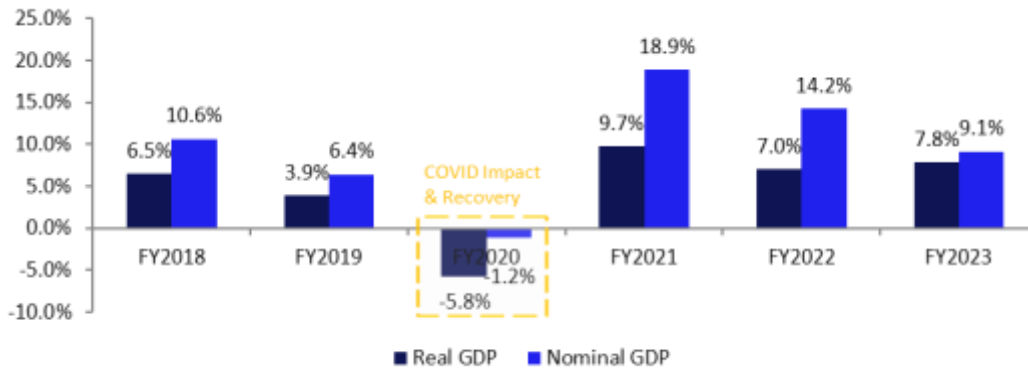
GDP Growth in India

Nominal GDP represents the total value of all goods and services produced within an economy at current market prices and reflects effects of price inflation in addition to real production expansion.

Both Indian nominal and real GDP has been growing significantly in the last 5 years, except the year of the pandemic when both contracted. While nominal GDP has grown between 10-18%, real GDP grew at about 7% from 2018 to 2023.

Growth in both nominal and real GDP for India has been much higher than global counterparts, showing an increasing general prosperity for the Indian masses, which is expected to continue.

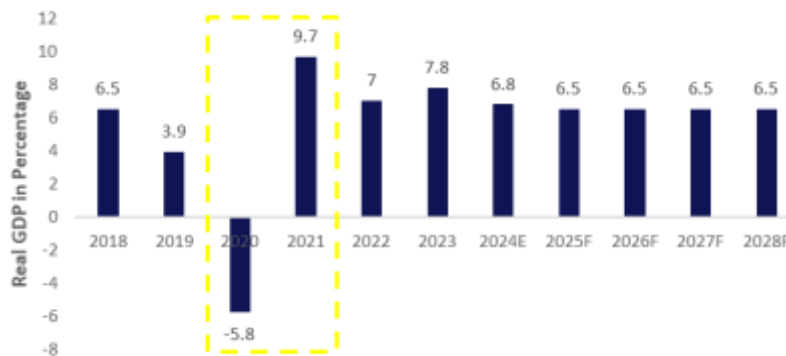
GDP Growth Rates in India, (%), Real and Nominal, 2018-2023



Source: IMF and <https://esankhyiki.mospi.gov.in/catalogue?page=0&product=NAS&search=>

The forecasted real GDP of India is estimated at around 6.6% between the forecast period 2024E-2029F. The strong growth showcases the strong economy of the country driven by investor friendly policies.

Real GDP Growth, FY2018–FY2028 (%)

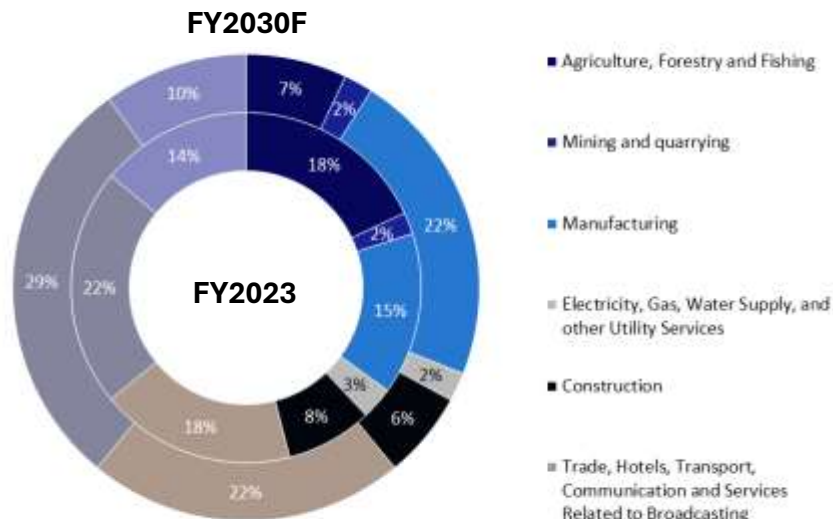


Source: IMF

Overview of Indian Manufacturing Sector

Manufacturing plays a very important role in the overall GDP contribution of India and its share of contribution to Real GDP is expected to increase from 15% in 2022 to 22% in 2030. The ‘Make in India’ program aims at increasing manufacturing sector contribution across 25 sectors, including aerospace and defence amongst others. Additionally, major companies like Foxconn, Oppo, ZTE, Phicomm, Mercedes Benz, BMW, Volvo, Ford, and others have invested in India, setting up manufacturing facilities and R&D centres.

Real GDP Growth in Manufacturing related to other sectors, 2023–2030F (%)



Source: Reserve Bank of India (RBI) Database

In 2019, manufacturing experienced a growth rate of 5.4% in its contribution to GVA due to steady expansion of industrial activities and a favourable economic environment. In 2020, manufacturing sector contracted by 3.0% due to COVID related disruptions -across global supply chains, factory closures, labour shortages, and a sharp decline in consumer demand. In 2021 there was a recovery in manufacturing's contribution to GVA, recording a growth rate of 2.9% and a significant resurgence in manufacturing in 2022, with its growth in contribution to GVA soaring by 11.1%. However, the momentum faltered in 2023, with a deceleration of 0.6% in its contribution to GVA-due to global economic uncertainties, geopolitical tensions, and inflationary pressures.

Trends in manufacturing Index of Industrial Production (IIP)

The trends in the manufacturing index of Industrial Production (IIP) offer a comprehensive insight into the performance and trajectory of the manufacturing sector over the fiscal years spanning from 2017-18 to 2022-23.

Manufacturing Index of Industrial Production, FY2018- FY2023



Source: [https://esankhyiki.mospi.gov.in/catalogue?page=0&product=IIP&search=|Base 2011-12 - 100](https://esankhyiki.mospi.gov.in/catalogue?page=0&product=IIP&search=|Base%202011-12%20-%20100)

In the fiscal year 2017-18, the manufacturing index stood at 126.6, indicating a baseline level of industrial activity and output and serving as a benchmark for subsequent years' performance, providing a reference point for analysing trends and fluctuations in manufacturing production. The manufacturing index increased to 131.50 in fiscal year 2018-19 driven by factors such as increased domestic demand, improved business sentiment, and favourable macroeconomic conditions. However, the fiscal year 2019-20 witnessed a slight decline in the manufacturing index reaching 129.60 due to a combination of domestic and external factors, including subdued investment sentiment, trade tensions, and economic slowdowns in key export markets. The fiscal year 2020-21

marked a significant downturn in the manufacturing index, plummeting to 117.20 spurred by the disruptions caused by the COVID-19 pandemic. As economies gradually reopened and recovery efforts gained traction, the fiscal year 2021-22 witnessed a notable rebound in the manufacturing index and it reached 131.00. This resurgence reflected the initial stages of economic recovery, as pent-up demand, government stimulus measures, and resumption of industrial activities fuelled manufacturing output. The rebound in the index signalled a positive turnaround for the manufacturing sector.

Factors driving growth in the manufacturing in India

- **China+1 Policy**

China has emerged into a global manufacturing hub, with facilities from technology companies to heavy engineering companies and textile manufacturers. Most of the Global manufacturing companies have their manufacturing based in China due to the low-cost labour. Aircraft manufacturers like Airbus and Boeing also have their facilities in China.

Geopolitical tensions and trade related differences made overdependency on Chinese manufacturing a risk for US, who are now making concerted efforts to de-risk their manufacturing supply chain to countries like India. The China+1 strategy was designed to ensure the security of the supply chain of key products by reducing the dependency on China.

The US sourcing in industries like textiles have reduced from 36% in 2015 to around 20% in 2021. Other segments where companies have started considering sourcing outside China include Electronics, Cosmetics and IT. Majority of this have been shifted to countries like Vietnam where the share of their sourcing has increased from 12% to 20% during the above-mentioned period. Other industries have also shifted sourcing away from China. The key advantages of China plus one policy for the investing countries is access to new markets, competitive costing and risk diversification away from China. Other robust developing economies like Vietnam, Bangladesh, India, Mexico and Brazil have benefitted from the China plus one policy. High tech companies like Foxconn and Apple have already set up their manufacturing facilities in India.

- **Make in India**

At its core, Make in India aims to revolutionize India's manufacturing landscape by targeted policy interventions, infrastructure development, and skill enhancement initiatives to empower domestic manufacturers, enhance competitiveness, and integrate India into global value chains. This is done by following measures:

- Targeted policy interventions like streamlining regulatory frameworks, simplifying procedures, and dismantling bureaucratic barriers to create a business-friendly ecosystem.
- Infrastructure development for connectivity, and logistical efficiency by investing in infrastructure projects, upgrading transportation networks, and modernizing logistics and supply chain infrastructure.
- Skill enhancement initiatives, vocational training initiatives, and educational reforms to equip the workforce with the skills, knowledge, and capabilities required to thrive in the modern manufacturing landscape.
- Attraction of foreign direct investment (FDI) into the manufacturing sector in critical sectors such as automotive, electronics, aerospace, and defence
- Promoting indigenous manufacturing and fostering the growth of domestic industries by encouraging homegrown talent, strengthen supply chains, and promote self-reliance to develop Indian enterprises, empowering them to compete globally and capture new markets.

Success of Make in India have been seen in sectors like Railways, Defence, Automotive, Electronics and Aviation. In Railways, GE and Alstom have signed a formal agreement to build locomotives in Bihar. In

Defence, sector Airbus and TATA set up final assembly of helicopter in India. C295 plant is expected to be operational by November 2024 in Gujarat.

The Tejas Program, Light Combat Aircraft of HAL is a success story of Make in India. Boeing is currently sourcing USD 1.00 billion from India and Airbus is expected to double its sourcing from India to USD 1.5 billion in next few years.

- **PLI Scheme and ‘Aatmanirbhar’ Bharat**

The Production-Linked Incentive (PLI) scheme aimed at promoting manufacturing competitiveness, boosting exports, and attracting investments in key sectors of the economy launched across electronics, automobiles, pharmaceuticals, and textiles, offers incentives to companies based on their incremental production and sales over a specified period. At its core, the PLI scheme aims to incentivize companies to expand their manufacturing capacities, adopt advanced technologies, and enhance productivity. The PLI schemes for manufacturing components of EV are an example of similar schemes. One of the key objectives of the PLI scheme is to reduce India's reliance on imports and promote domestic production across strategic sectors. By incentivizing companies to manufacture locally, the scheme seeks to enhance self-sufficiency, reduce import dependency, and bolster India's industrial capabilities. This fosters indigenous manufacturing and positioning India as a global manufacturing hub. Out of the 4,666 items across the ‘For indigenization’ list of Aatmanirbhar Bharat (self-reliant India), around 2,952 products have been indigenized by 2023.

- **Rise in Ease of Doing Business Ranking**

The rise in Ease of Doing Business rankings reflects a concerted effort by countries to improve their business environments, streamline regulatory processes, and attract investments. In the World Bank's Ease of Doing Business Index, India climbed from 142nd position in 2014 to 63rd in 2019, marking a substantial leap. This ascent is attributed to various reforms undertaken by the government, such as the introduction of the Goods and Services Tax (GST), simplification of business registration processes through initiatives like the Make in India campaign, and improvements in the ease of obtaining construction permits and accessing credit. India's ranking in the ease of doing business has shown significant improvements in recent years, reflecting ongoing efforts to streamline regulations and enhance the business environment.

- **Deindustrialization of Europe and Opportunity for Alternate High Quality Manufacturing Bases**

The process of deindustrialization in Europe, characterized by the decline of traditional manufacturing sectors, is unfolding over the past 4-5 years against a backdrop of technological evolution, and changing market dynamics. Global competition, facilitated by trade liberalization and advancements in transportation, has intensified pressure on European manufacturers to remain competitive. Additionally, technological innovations such as automation and digitalization have transformed production processes, by reducing the need for labour.

Investment trends in Aerospace

Focus on the UDAN scheme and Airport Development Projects

UDAN scheme is a significantly successful initiative by the Government of India to improve the connectivity to rural and underserved regions of the country with simultaneous development of airport infrastructure and air connectivity. The scheme was launched in October 2017 and completed 6 years in October 2023, during which time it has facilitated the air travel of more than 13 million air travellers and is expected to grow to 500 million by 2027. Around 499 new air routes have been operationalized since the commence of this initiative. The budget allocation for the UDAN scheme was around USD 60.99 million crores in FY2024-25. There has been significant focus by the central government to develop over 140 airports, including helipads, short runways, and secondary

airports in metros. The government also plans to set up 150 new airports in Tier II and Tier III cities in the next 20 years to improve connectivity under the UDAN scheme.

The Government of India allowed in-principal approval for 21 greenfield airport projects, out of which 13 are functional and the rest are in various stages of construction. These airport projects are a result of Greenfields Airport Policy, 2008:

New Greenfield Airports announced in India

S.No	Airport Name	City	Inaugurated on
1	Shirdi Airport	Maharashtra	01-10-2017
2	Jharsuguda Airport	Odisha	22-09-2018
3	Pakyong Airport	Sikkim	24-09-2018
4	Kannur Airport	Kerala	08-12-2018
5	Kalaburagi Airport	Karnataka	22-11-2019
6	Kurnool Airport	Andhra Pradesh	25-03-2021
7	Sindhudurg Airport	Maharashtra	09-10-2021
8	Kushinagar International Airport	Uttar Pradesh	20-10-2021
9	Donyi Polo Airport	Arunachal Pradesh	19-11-2022
10	Mopa International Airport	Goa	11-12-2022
11	Shivamogga Airport	Karnataka	27-02-2023
12	Rajkot Airport	Gujarat	27-07-2023
13	Utkela Airport	Odisha	31-08-2023

S.No	Airport Name	City	Status
1	Navi Mumbai	Mumbai	Work in Progress
2	Vijayapura& Hassan	Karnataka	Work in Progress
3	Dabra (Gwalior)	Madhya Pradesh	Work in Progress
4	Noida International airport	Uttar Pradesh	Work in Progress
5	Dholera and Hirasar	Gujarat	Work in Progress
6	Karaikal	Puducherry	Work in Progress
7	Dagadarthi&Bhogapuram	Andhra Pradesh	Work in Progress
8	Durgapur	West Bengal	Work in Progress

Source: PIB

AEROSPACE INDUSTRY

International tourism has been significantly impacted by the COVID-19 pandemic, with global international tourist arrivals reaching 1.46 billion in 2019, a growth of 3.7% compared to 2018. In April 2023, WTTC has announced that the global Travel & Tourism sector has recovered 95% compared to pre-COVID. The total jobs in this sector globally amounted to 295 million in 2022, with an addition of 21.60 million jobs in 2022. One in 11 jobs globally are related to travel and tourism industry in 2022.

As the world recovers from the pandemic, there is a focus on sustainable practices in the tourism industry, such as using the latest technology to find innovative solutions to challenges like overcrowding in popular tourist destinations. Developing countries, particularly in Asia-Pacific, are becoming more competitive in the tourism market, with many realizing the importance of addressing restrictive visa regimes to boost economic opportunities and job creation.

The industry has been crucial in shaping the future of tourism, with aviation being the most favored means of transport for international tourism. Air travel and international tourism have been intertwined for decades, with

air travel providing vital links for the global tourism industry. Over half of international tourists travel by air as per ATAG, making it a crucial sector for the tourism industry's sustainable growth.

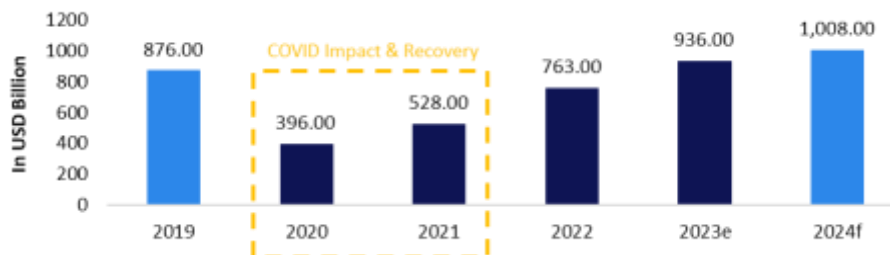
The tourism sector is a significant contributor to the global economy, generating \$8.8 trillion in world GDP (10.4% of the global economy) and supporting 319 million jobs in 2019. The Global tourism body has forecasted that the GDP contribution will grow to USD 15.50 Trillion in 2033 and represent to 11.6% of Global economy, which would generate around 430 million jobs.

Increase in overall global market for tourism and travel leading to increase in Aerospace market. Strong order forecast for new passenger & freighter aircrafts globally leading to an increase in demand for new aero-tooling, airframe production and components.

Growth in the Commercial Aircraft sector

The post COVID air travel passenger volumes has witnessed a rebound and is expected to reach 4.7 billion in 2024E according to IATA. Passenger revenues are expected to reach USD 717 billion in 2024, compared to USD 642 billion in 2023. The airline profits are also expected to reach USD 49.30 billion in 2024, compared to USD 40.7 billion in 2023, according to IATA. These increase in profits are attributed to the increase in passenger numbers, which have in turn been driven by increase in tourism activities, increase in business travel and religious tourism during the last 3 years.

Total Global Spend on Air Travel, 2019-2024 (In USD Billion)



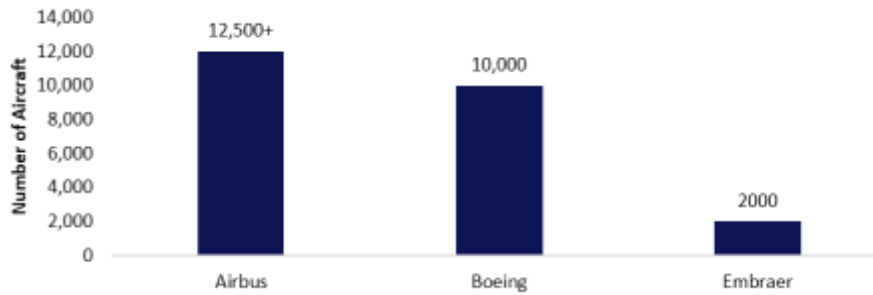
Source: IATA

Global travel has been resilient after being impacted by the COVID pandemic and - recovered to beyond pre-COVID levels by the end of 2023. Global air travel spends had amounted to USD 876 billion in 2019, which had contracted to less than half by a 54% reduction in 2020 due to COVID pandemic. The market recovered 33% to reach USD 528 billion in 2021 and further by 44% to reach USD 763 billion in 2022. The milestone of recovery of air travel spend to pre-pandemic levels of 2019 was reached in 2023 and is further expected to surpass the USD 1 trillion mark in 2024.

Commercial Aircraft Global Fleet Size

The aircraft market is split almost equally between Airbus and Boeing with account for the lion's share of all aircraft purchases globally. Airbus accounting for 12,500+ aircrafts and Boeing for 10,000 aircraft globally in 2023, Embraer also accounts to a total fleet of around 2,000 aircraft. The most popular aircraft families of Airbus are A320 and for Boeing it is B737. Majority of the historical deliveries were in Americas and Europe, however the next two decades are expected to be dominated by deliveries in Asia Pacific region.

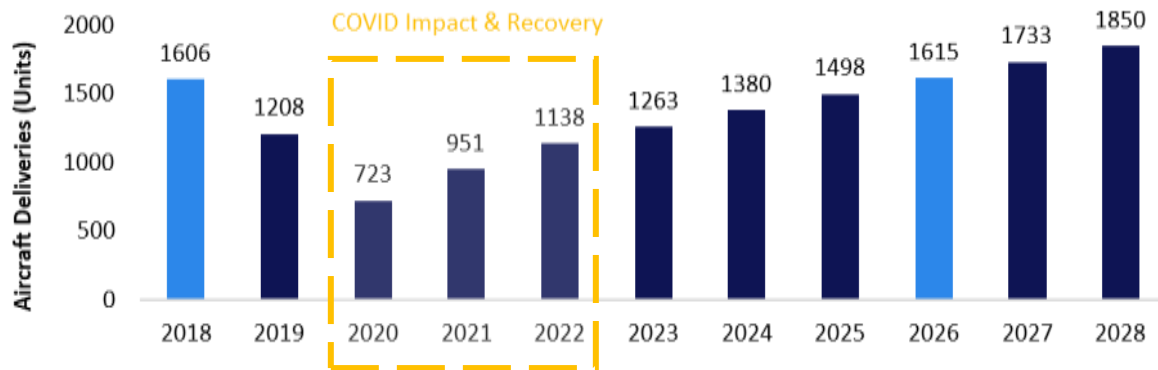
Fleet Size for Commercial Aircraft, 2023, Number of Aircraft



Source: Airbus, Boeing and Embraer report and secondary sources
 Note: These are estimates may not add up to exact fleet

The number of passenger fleet deliveries globally reached a substantial 1,606 units aircrafts in 2018, indicating a period of robust growth and investment in the global transportation sector, driven by strong air passenger demands from Asia. This was an exceptionally buoyant year. 2019 witnessed a huge fall in passenger fleet deliveries, dropping to 1,208, across narrow and wide body aircraft due to COVID. The year 2020 marked a significant disruption for the transportation sector, with passenger fleet deliveries plummeting to 723 aircraft. Cash flow issues with many airlines resulted in airlines either postponing the delivery of the new aircraft or cancelling the orders altogether. 2021 saw a partial recovery in passenger fleet deliveries to 951 aircrafts. The momentum of recovery continued into 2022, with passenger fleet deliveries further increasing to 1,138 aircrafts, driven by rebound in air passenger traffic. In 2023, the upward trajectory in passenger fleet deliveries continued, reaching 1,263 units. This underscored the sector’s recovery, supported by ongoing efforts to enhance efficiency, innovate, and meet evolving consumer needs. The aircraft deliveries are expected to reach 1,850 aircraft in 2028 owing to the increase of monthly production rates of narrow body aircraft by Airbus and Boeing.

Global Commercial Aircraft Deliveries (in Unit Volume), 2018-2028

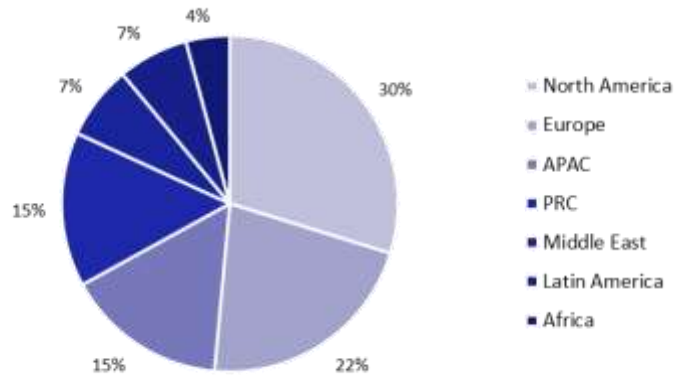


Source: Airbus, Boeing Reports

Commercial Aircraft Regional Fleet Distribution

The regional fleet distribution pattern is skewed towards developed economies, with North America and Europe accounting for 50% of the total active fleet in the world in 2022. APAC, including China and India accounted for around 30% of the global aircraft fleet in 2022. The fleet size of developing economies is expected to grow faster due to the increase in new low-cost carrier airlines entering these markets.

Regional Fleet Distribution, 2022 (Percent)



Source: LATA

The Americas maintained a substantial fleet size of 9,060 commercial aircrafts in 2022, reflecting the region's prominence as a key market for air travel. With its vast expanse and diverse economies, the Americas host a wide array of airlines catering to domestic and international routes. The robust fleet size underscores the region's demand for air transportation services. In the Americas, 4,545 aircrafts are slated to be added to the fleet, reflecting sustained demand for air travel in the region by 2040.

Eurasia, comprising Europe and parts of Asia, accounted for a fleet size of 5,920 aircrafts in 2022. This region serves as a major hub for air travel, connecting continents and facilitating trade and tourism flows. Eurasia attracts millions of passengers annually, driving demand for commercial aviation services and contributing to the region's sizable fleet size. Eurasia is set to see the addition of 4,720 aircrafts, driven by economic recovery and increasing passenger volumes by 2040.

Asia-Pacific region is the hub of the world's fastest-growing economies, with fleet size stood at 3,520 aircrafts in 2022. This dynamic region hosts a multitude of airlines serving a rapidly expanding passenger base. The region's strategic importance as a global economic powerhouse and tourism destination fuels the demand for air travel, contributing to the growth of its commercial aircraft fleet. The Asian (Asia Pacific +China) region is poised to witness the largest fleet expansion, with 11,925 aircraft slated for addition by 2042, reflecting the region's status as a global aviation powerhouse.

China, with its huge economy and growing aviation market, accounted for a fleet size of 4,000-4,500 aircraft in 2023, it is expected to add another 5,620 aircrafts. China plays a pivotal role in shaping global aviation trends and driving demand for commercial aircraft and is one of the world's fastest growing aviation markets.

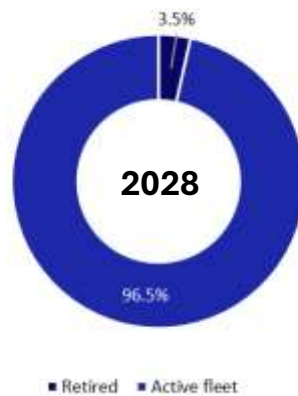
In the Africa/Middle East region, fleet size was 3,040 aircrafts in 2022. Despite facing challenges such as infrastructure limitations and geopolitical uncertainties, the region's strategic location between major continents and growing tourism industry fuel demand for air travel, supporting the expansion of its commercial aircraft fleet. In the Africa/Middle East region, 2,875 aircrafts are set to be added until 2040, signalling confidence in the region's potential for aviation growth despite challenges.

Commercial Aircraft- Fleet Retirement

It is estimated that 5,000-5,500 aircrafts would retire and be de-fleeted during the forecast period of 2024-2028. In 2028, the aviation industry anticipates a retirement rate of 3.5% for commercial aircraft. Concurrently, the active fleet is projected to comprise 96.5% of all commercial aircraft in operation, representing the vast majority of aircraft continuing to serve airlines and passengers worldwide. This distribution reflects the industry's ongoing efforts to maintain a modern, efficient, and safe fleet, balancing the retirement of older aircraft with the introduction of newer, more technologically advanced models. Most of the commercial aircraft that are removed from commercial passenger flights are usually converted into freighter to extend their life by another 5 to 10 years, depending on the aircraft. Older aircraft models like the MD80/717, A320ceo, 737NG have a faster declining rate

in the narrow body segment and models like B747, A380, B767 and A330 have a faster declining rate in the wide body segment according to Boeing.

Commercial Aircraft Fleet Retirement, 2028



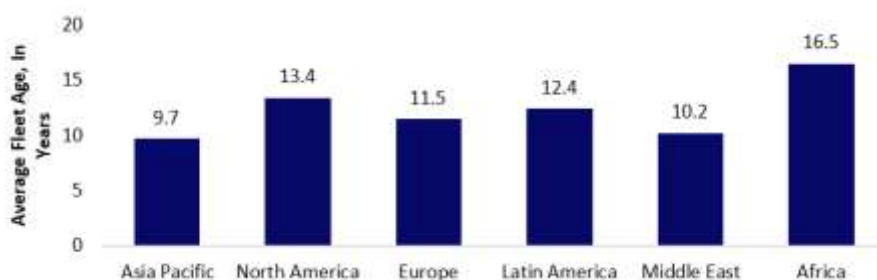
Source: <https://aviationweek.com/sites/default/files/202211/2023%20Commercial%20Forecast%20-%20Findings.pdf>

Average Age of Fleet- Commercial Aircraft

The average age of commercial aircraft fleets varies significantly across regions, reflecting diverse market dynamics, regulatory frameworks, and operational practices. The advanced economies have a matured aviation market, with a huge base of active fleet. The aircraft from the advanced economies like North America and Europe have a shorter average fleet life of 13.4 years and 11.5 years respectively due to the historical additions of fleet by the airlines in the region. In Latin America and Africa, the lack of investment availability to procure new aircraft has resulted in much higher average life of the fleet of 12.4 years and 16.5 years respectively.

The Asian region is expected to add around 11,925 aircrafts by 2042 due to demand for Low-Cost Carriers (LCC) in this marketlike Indigo, which order aircrafts in bulk. The induction of the new aircraft reduces the average age of the fleet. The age of the fleet of the Asia Pacific airline are much lesser due to the recent fleet additions in the airline industry in these regions.

Average Age of the Fleet based on region (in Years)



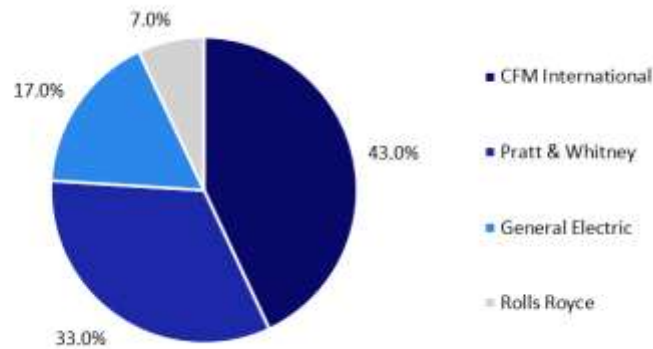
Source: Airbus and Boeing reports

Overview of different types of Engines used in Commercial Aircrafts

The narrow body aircraft have traditionally been most in demand owing to the increase in air travel for shorter connectivity for flights which last around 3.5 hours (one way). Narrow body aircraft which are the B737 and A320 have accounted for nearly 75% of the deliveries from 2018 to 2023, with a mild drop in 2019 and 2020. The narrow body aircraft are usually used by low-cost carriers, the growth of which has been a significant driver for the narrow body aircraft market.

The demand for widebody aircraft was about 20% in 2018 and have reduced in the Post COVID scenario from 2020. Regional jets and regional turbo props make up smaller segments of about 10% each and have remained stable across the study period.

Market share of Commercial Aircraft Engine in Service, 2023



Source: Order and Delivery report from OEMs

Narrow body commercial aircraft usually have a two-engine configuration, while very large aircraft like A380 and B747 have a four-engine configuration. The recent launched wide body aircraft like the B787 and the A350 have a two-engine configuration. The use of composites to reduce the weight of the aircraft with focus on environmental sustainability are the key factors which drives this market. The commercial aircraft market is dominated by CFM international which accounts for 43% of the commercial aircraft engines. CFM International is a joint venture between Safran Aircraft Engines and GE Aerospace. The next dominant player is Pratt & Whitney which accounts for 33% of the total market. These engines are typically used on the narrow body aircraft like the B737 and A320 which accounts to about approximately 75%-80% of the delivery of Airbus and Boeing.

List of Commercial Aircraft Programs and their Engine Supplier

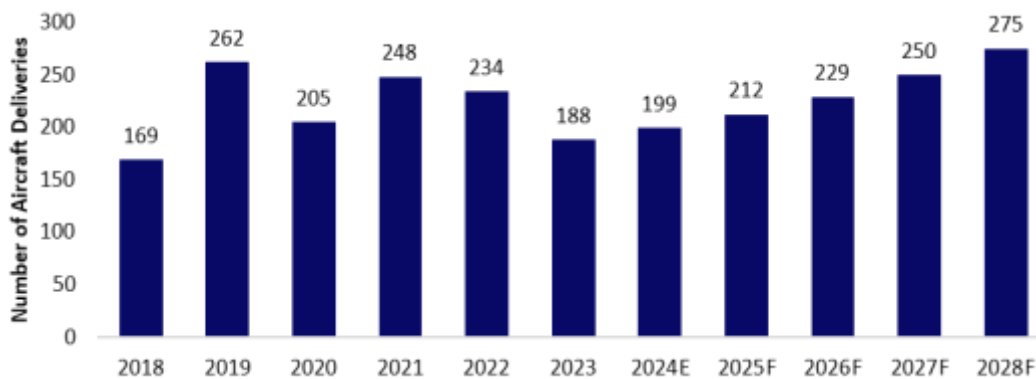
Name of the Aircraft Program	Type of Aircraft	Aircraft OEM	Engine OEM	Engine Name
E1	Narrow Body	Embraer	Pratt & Whitney	PW 1600/PW 1900
E2	Narrow Body	Embraer	Pratt & Whitney	PW 1600/PW 1900
A220	Narrow body	Airbus	Pratt & Whitney	Pratt & Whitney PW1500G
A320Family	Narrow body	Airbus	CFM International	LEAP-1A from CFM International.
A320Family	Narrow body	Airbus	Pratt & Whitney	Pratt & Whitney GTF™
A330	Wide body	Airbus	Rolls Royce	Rolls-Royce Trent 700
A330	Wide body	Airbus	Pratt & Whitney	Pratt & Whitney PW4164/8

Name of the Aircraft Program	Type of Aircraft	Aircraft OEM	Engine OEM	Engine Name
A330	Wide body	Airbus	GE Aerospace	General Electric CF6-80E1
A350	Wide body	Airbus	Rolls Royce	Rolls-Royce Trent XWB
A380	Wide body	Airbus	Rolls Royce	Rolls-Royce's Trent 900
Boeing 737	Narrow Body	Boeing	CFM International	CFM56
Boeing 747	Wide Body	Boeing	GE Aerospace	General Electric CF6
Boeing 767	Wide Body	Boeing	GE Aerospace	General Electric CF6
Boeing 777	Wide Body	Boeing	GE Aerospace	General Electric GE90
Boeing 787	Wide Body	Boeing	GE Aerospace/ Rolls Royce	The General Electric Genx

DEFENCE INDUSTRY

The total number of defence aircrafts delivered in 2023 were 188 units, which includes fighters, transport and special mission aircraft. Of these, 155 were fighter aircrafts of the F35 program delivered to the USA. The second highest delivered defence aircraft in 2023 were 22 units of the F18. The P-8 from Boeing accounted for 11 deliveries in 2023. The increase of geopolitical conflict coupled with increase in indigenous programs in countries like India and South Korea are expected to be the key drivers in this market. Countries like India are developing their own fighter jets like the HAL Tejas combat aircraft to increase the 'Make in India' drive and reduce reliance on imports. Another key trend is the indigenisation of specific components of the imported platforms seen across multiple countries in APAC.

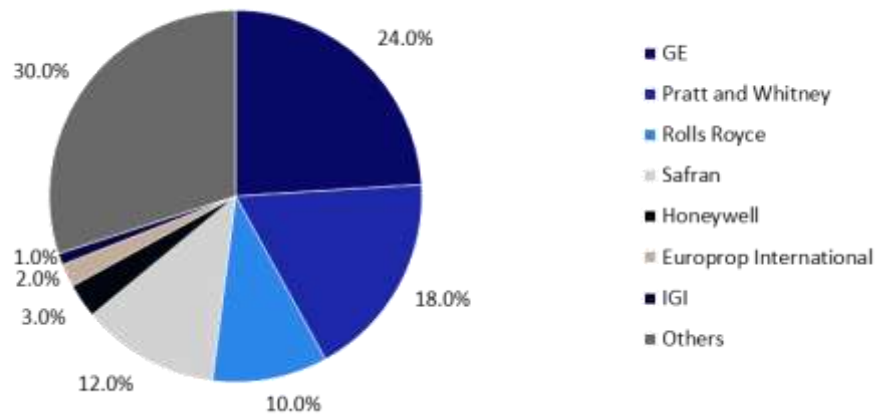
Defence Aircraft Deliveries, 2018- 2028F



Source: Deliveries estimated from Annual report of various OEs, includes 7 commonly used fighters, 8 commonly used transport aircraft and 5 commonly used special mission aircraft

Overview of different types of Engines used in Defence Aircrafts

Defence Aircraft Engine In Service, 2023



Source: Estimated from Ministry documents and OEM news

70% of the global defence aircraft engine market lies with 7 companies only in 2023 which represents a competitive market. General Electric (GE) Aviation is a significant player in the military aircraft engine market holding a 24% share in 2023. GE engines, such as the F110 and F414, power a variety of military aircraft worldwide, including fighters such as the F-15 and F/A-18. The F110 powers the new, fly-by-wire F-15EX Advanced Eagle, the fifth F-15 variant designed to replace the oldest F-15s in the U.S. Air Force fleet. It is estimated that more than 100 F-15EX multirole fighters will be purchased by the U.S. Airforce.

Pratt & Whitney accounts for 18% of the market share of defence aircraft engines and is the second largest player in the same, producing engines such as the F135, which powers the F-35 Lightning II, one of the world's most advanced fighter aircraft. Pratt & Whitney also makes engines for other military aircraft, such as the F-22 Raptor and the C-17 Globemaster III. Pratt & Whitney controls 18% of the military air engine market. Pratt & Whitney also secured the sole-source contract for F-35 engine upgrades. The program, known as the Engine Core Upgrade (ECU), is scheduled to begin with engine testing in 2026 and fielding in 2029.

Other significant players in defence aircraft engines are Safran and Rolls Royce with 12% and 10% market share respectively in 2023. Other small players are Honeywell, Europrop International and IGI with market shares between 3-1% in 2023.

List of Defence Aircraft Programs and their Engine Supplier

Name of the Aircraft Program	Type of Aircraft	Airframe OEM	Engine OEM	Engine Name
F-35	Fighter	Lockheed Martin	Pratt & Whitney	F- 135
Eurofighter Typhoon	Fighter	Eurofighter Jagdflugzeug GmbH	Rolls Royce	EJ- 2000
Rafale	Fighter	Dassault	Safran	Snecma M88
F-15 E	Fighter	Boeing	Pratt & Whitney	F100 PW 229
F/A-18	Fighter	Boeing	GE Aerospace	F414 GE 400
Gripen E	Fighter	Saab	GE Aerospace	F414 GE 39E
LCA-Tejas	Fighter	HAL	GE Aerospace	F404 IN20
C-130	Transport Aircraft	Lockheed Martin	Rolls Royce	AE 2100
A-400 M	Transport Aircraft	Airbus	Euro Prop	TP400

Name of the Aircraft Program	Type of Aircraft	Airframe OEM	Engine OEM	Engine Name
C-27 J	Transport Aircraft	Leonardo's Aircraft Division	Rolls Royce	AE 2100
C-390/ KC 390	Transport Aircraft	Embraer	International Aero Engines	V2500
C-295	Transport Aircraft	Airbus	Pratt & Whitney	PW100
A-330 MRTT	Transport Aircraft	Airbus	GE Aerospace	CF6
C-17	Transport Aircraft	Boeing	Pratt & Whitney	PW2000
KC-46	Transport Aircraft	Boeing	Pratt & Whitney	PW4062
P 8	Special Mission	Boeing	CFM International	CFM56
Embraer E-99	Special Mission	Embraer	Rolls Royce	AE3007
Global 6000	Special Mission	Bombardier	Rolls Royce	BR710A2
EC-37B	Special Mission	General Dynamics	Rolls Royce	BR710 C4-11
ERJ-145I	Special Mission	Embraer	Rolls Royce	AE 3007

MAINTENANCE, REPAIR AND OVERHAUL MARKET

The global aircraft maintenance, repair, and overhaul (MRO) market is a vital sector supporting the safety, reliability, and efficiency of commercial aircraft. As the aviation industry continues to expand, driven by increasing air travel demand and fleet modernization initiatives, the aircraft MRO market also experiences significant growth and evolution in tandem.

MRO services encompass a wide range of activities, including scheduled maintenance checks, unscheduled repairs, component replacement, and overhaul services. The key objective of the MRO is to ensure aircraft safety and compliance with stringent regulatory standards set by aviation authorities like the Federal Aviation Administration (FAA) and the European Aviation Safety Agency (EASA).

Key Trends and Business Models

There are three key business models in the commercial aircraft MRO market, they are:

- In- House MRO:** This refers to the strategies adopted by airlines to manage and maintain their aircraft fleets in-house, rather than outsourcing the work to third-party MRO providers. This approach can be beneficial for commercial air carriers that have the resources and capabilities to invest in their own infrastructure, as it allows them to control the entire maintenance process and ensure that their aircraft are maintained to the highest standards.
- Third Party MRO Service Providers:** This refers to MRO providers who can be either airline affiliated companies which provide their additional resources to other airlines, or it could be an independent MRO provider that is providing its services to an airline. Third-party MRO business models have emerged as vital components in industries reliant on complex machinery and equipment. These models offer specialized services to maintain, repair, and overhaul assets, enabling organizations to focus on core operations while outsourcing technical expertise.

- **OEM MRO Service Providers:** In OEM MRO service provider model the maintenance services are provided by the OEMs. The OEMs are predominantly present in Engine maintenance segment of the MRO.

Types of Commercial Aircraft MRO

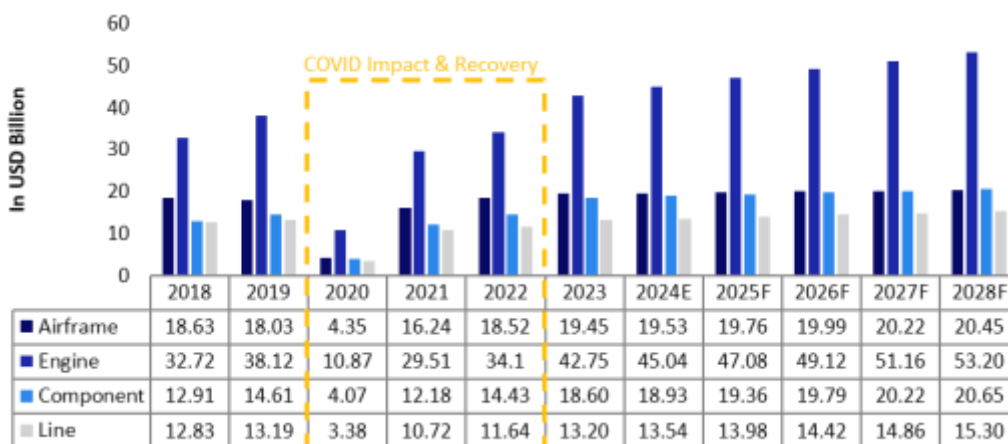
Commercial Aircraft MRO activities can be categorized into four main types: engine, airframe, line maintenance, and component maintenance, it is also referred as Check A, C and D.

- **Engine maintenance:** This involves the inspection, repair, and overhaul of aircraft engines. Engine maintenance is crucial for maintaining the performance and safety of the aircraft. It includes the replacement of worn or damaged parts, testing, and calibration of engine systems. Their typical time frame for Engine Maintenance is around 6-8 years.
- **Airframe maintenance:** This type of maintenance focuses on the aircraft's structure, including the fuselage, wings, and control surfaces. Airframe maintenance involves the inspection, repair, and replacement of structural components to ensure the airworthiness of the aircraft. The airframe maintenance is usually scheduled between 18 months to 2 years.
- **Line maintenance:** This type of maintenance is performed on the aircraft during scheduled stops, such as at airports or during flights. Line maintenance checks all operational fluid levels and minor maintenance are undertaken at the parking bay.
- **Component maintenance:** This involves the inspection, repair, and replacement of aircraft components, such as landing gear, hydraulic systems, and electrical systems. Component maintenance ensures that these critical systems function correctly and safely.

Global MRO: Market Sizing and Forecast: by MRO Type

The Engine MRO segment accounted to USD 42.75 billion or 46% of the total MRO revenue in 2023 and expected to grow to 49% by 2028 to reach USD billion 53.20 by 2028. The engine MRO market is expected to grow at a CAGR of 4.5% and is the fastest growing market. The second fastest growing market is the line maintenance market which is expected to grow at a CAGR of 3.0% during the forecast period 2023-2028F from USD 13.2 billion in 2023 to 15.30 billion in 2028. The line maintenance segment is expected to account for 14% of the total MRO market in 2028F. CFM 56 & Leap engines has come into maintenance phase increasing the number of tools needed by MRO shops. Further, establishment of new MRO shops will help increase the overall market demand from MROs. For example: Safran is establishing an aero-engine MRO facility in India, Hyderabad. This will enable new demand from such MRO and result into significant cost savings in terms of supply and logistics.

Global MRO Market, By MRO Type, 2018- 2028F



Indian MRO: Market Sizing and Forecast

The Indian airlines have been taking aircraft to Southeast Asian countries and Middle East to cater to the MRO needs, predominantly due to the taxation issues and lack of skilled labour in India. Even though the basic checks take place in India, the major MRO works are conducted outside India. The Indian MRO commercial market has experienced a rebound post the COVID-19. The market reduced to USD 0.41 billion in 2020 from USD 1.68 billion in 2019. The bankruptcy of Jet Airways in 2019 coupled with the impact of COVID-19 are the key reasons for the market to shrink in 2020. The market is expected to grow at a CAGR of 14.6% between the period 2023-2028F from USD 1.46 billion to USD 2.89 billion in 2028F.

Indian MRO Market, By MRO Type, 2018- 2028F

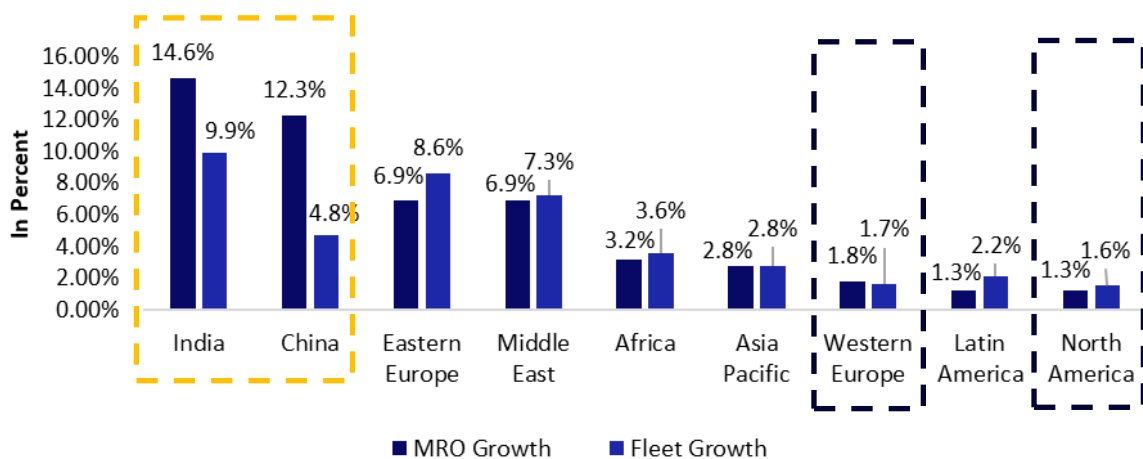


The engine MRO segment is expected to experience the fastest growth rate at 19.3% between the years 2023-2028F and is expected to grow from USD 0.63 billion in 2023 to USD 1.52 billion in 2028F. It is expected that India would need around 2,210 aircrafts between 2022-2042 to cater to growth in air passenger numbers. The increase in fleet numbers and entry of new airlines are expected to be the key drivers in the Indian MRO market.

There are no international engine MRO players in India, however with the growth of fleet, major engine manufacturers like SAFRAN are setting up their engine MRO facilities in India. This is a huge opportunity for the companies in the GSE tooling market. There are no other licensees in the Asia Pacific region creating a larger market opportunities to the GSE tooling companies in India.

Geographical shifts in Global & Regional MRO markets

Growth of MRO VS Growth of Fleet, 2023-2028F



The MRO market is matured in regions like North America and Europe. Europe stands as the second-largest market for aerospace products, notably in the aero tooling sector. Major players in aero tooling and maintenance, repair, and overhaul (MRO) sectors maintain strong footholds in the European market. The increase in demand for MRO in APAC is driven by increase in aircraft fleet. The MRO market growth has shifted from the traditional markets of Western Europe and North America to Asian countries like India and China, which is because these markets are in the growth phase in the aviation market. The high growth in these markets can be attributed to increase in travel, which in turn increased the demand for air travel. The increase in travel facilitates new players to enter the airline industry. This in turn creates an organic demand for new aircraft in the region. Western Europe and North America are more matured markets, where the growth in both fleet and MRO is in the range of 1%-2%, unlike the Indian fleet market which is expected to grow at 9.9% between 2023-2028F. The MRO market is expected to grow at 14.6% during the above-mentioned period.

Growth in MRO centres globally

The traditional MRO centres have been in Europe and North America, which were dominant in terms of the total global fleet. However, the rise in air travel in populated countries like China and India in the Asia continent has shifted the fleet dominance towards Asia. The Asian region accounts to around 33% of the global fleet. These aircraft average at around 11.6 years and the need for MRO of these aircrafts open new market opportunities for MRO suppliers in Asia. The Indian MRO market is expected to witness new entrants like SAFRAN, which is expected to set up the engine MRO facility in Hyderabad for its LEAP engines. The facility is expected to be operational by 2025 with an annual capacity of 250 engines.

Global MRO centres, 2023



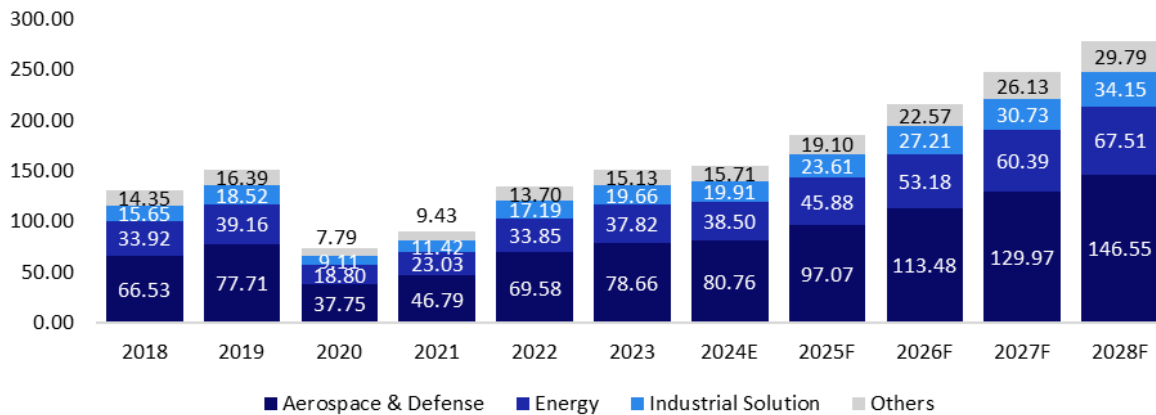
Indian MRO centres, 2023



Overview of Global Precision Tooling Market

The global precision tooling market was estimated at USD 130.45 billion in 2018 which grew to USD 151.26 in 2023. The market reduced by around 50% during the COVID period in 2020 and 2021. However, the backlog of orders in aerospace, defence industries and automotive industries coupled with the continued demand in the post COVID environment helped the precision tooling industry bounce back in 2023. The market is expected to grow from USD 154.88 billion in 2024 at an estimated CAGR of 15.8% to reach USD 278.00 billion in 2028.

Global Precision Manufacturing Tooling Market, (By USD Billion), 2018-2028F



The end user segments have been classified as Aerospace & Defence segment, Energy segment, Industrial Solutions and Others. The Aerospace and Defence end user market is expected to account to more than 50.0% of the overall market and is expected to grow at a CAGR of 16.1%, which is higher than the average market growth rate for the period 2024E-2028F.

Aerospace & Defence Precision Tooling: Aerospace and defence industries rely heavily on precision tooling to manufacture high-performance components. These components are mission critical components designed to withstand extreme conditions and ensure the safety and reliability of aircraft, spacecraft, and military equipment. Precision tooling plays a crucial role in the production of intricate parts, such as turbine blades, engines, compressor blades, and fuel nozzles, which require tight tolerances and advanced machining techniques. The precision tooling industry continues to innovate, incorporating new technologies like 3D printing to improve efficiency and reduce costs while maintaining the high standards required by these industries.

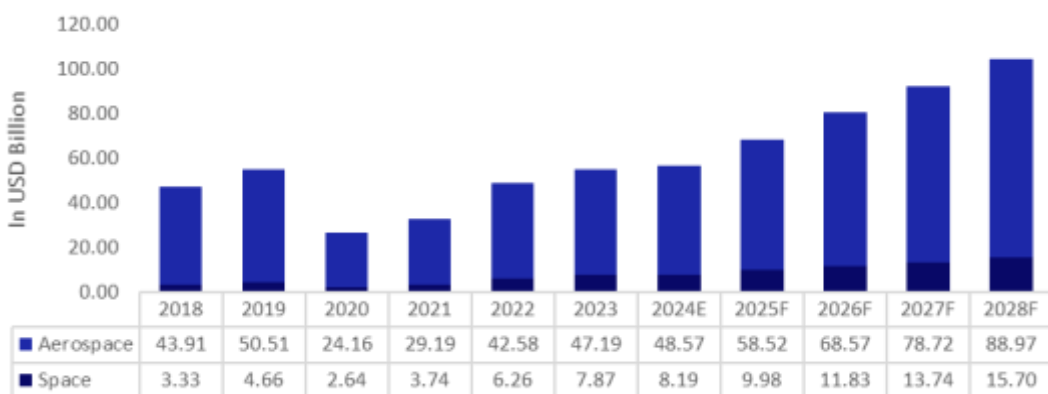
Energy Sector Precision Tooling: Precision tooling plays an important role of ensuring the efficient fabrication and maintenance of essential components in the energy sector. The precision manufactured components in the energy sector include turbine blades and drilling equipment, which needs to be optimal for performance and safety in energy production. In the nuclear segment the electromechanical components play an important part in the nuclear plant, these components are precision tooled components and are made of steel.

Industrial Solutions Precision Tooling: Industrial solutions refer to a wide range of products, services, and technologies designed to address the needs and challenges of various industries. Industrial solutions may include equipment, machinery, automation systems and maintenance and repair services. Precision tooling is integral to shop floor automation, revolutionizing manufacturing processes with efficiency and accuracy. From CNC machining to robotic assembly, precision tools ensure precise fabrication of components and seamless integration into automated systems. These tools, including fixtures, jigs, and cutting tools, enable consistent and reliable production while minimizing waste and errors. These tools are essential in industries like aerospace, defence, medical device manufacturing, and robotics, where tight specifications and high-quality production are crucial.

Overview of Aerospace Precision Tooling Market

The Aerospace market is segmented into Space and Commercial Aviation, space covers all launch vehicles and satellite systems, and commercial aviation constitutes all aircrafts produced by Airbus, Boeing and other manufacturers. The space segment for precision tooling market is estimated at USD 8.19 billion in 2024 and is expected to grow to USD 15.70 billion in 2028 at a CAGR of 17.66%. The commercial aviation segment is estimated at USD 48.57 billion in 2024 and is expected to grow to USD 88.97 billion in 2028. The privatization of the space services allowing the participation of private players are the key drivers in the space segment. The order backlogs and the plan to increase the monthly production numbers of narrow body aircraft by Airbus and Boeing. For example: Airbus plans to produce around 75 A320s a month from 2026 onwards is expected to be the key growth drivers for the commercial aviation market. Apart from these the future growth in MRO sector in countries like India and China are expected to drive this market.

Global Aerospace Segment, Precision Tooling Market, 2018-2028F



Precision tooling in the aerospace industry are used in the following:

- **Machining Components:** Precision machining tools such as CNC mills, lathes, and grinders are used to fabricate parts from materials like aluminium, steel, titanium, and composites. These tools must maintain high tolerances to meet aerospace specifications and ensure the structural integrity and aerodynamic efficiency of the final components.
- **Composite Manufacturing:** Aerospace components, such as aircraft fuselages and wings, are constructed using advanced composite materials to achieve lightweight yet durable structures. Precision tooling is

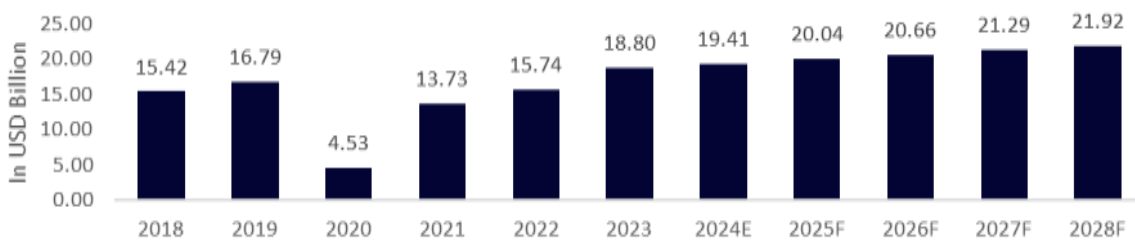
essential in the fabrication of composite parts, including molds, mandrels, and cutting tools optimized for composite materials.

- **Sheet Metal Fabrication:** Precision tooling is used extensively in the fabrication of sheet metal components for aerospace applications. Punching, bending, and forming tools are employed to shape metal sheets into complex parts, such as aircraft skins, bulkheads, and structural components, with high accuracy and repeatability.
- **Assembly and Fastening:** Precision tools play a critical role in the assembly and fastening of aerospace components. Automated riveting machines, torque wrenches, and specialized assembly jigs ensure that parts are assembled correctly and securely, meeting the stringent safety and reliability requirements of the aerospace industry.
- **Quality Assurance and Inspection:** Metrology equipment such as coordinate measuring machines (CMM), laser scanners, and optical inspection systems are used to verify the dimensional accuracy and quality of aerospace components. Precision measuring tools enable aerospace manufacturers to detect defects, deviations, and discrepancies early in the production process, ensuring compliance with strict quality standards.
- **Tooling Materials and Coatings:** Aerospace applications often require tooling materials and coatings optimized for high-temperature, high-strength, and abrasive machining conditions. Carbide, ceramic, and diamond coatings are commonly used to enhance tool life, wear resistance, and cutting performance in aerospace machining operations. Apart from the above mentioned, there may be specific instances of custom precision tooling requirement for some parts.

Overview of Global MRO Tooling Market

The MRO tooling market is expected to grow from USD 19.41 Billion in 2024E to USD 21.92 Billion in 2028F. This market is expected to grow at a CAGR of 3.1% during the period 2024E to 2028F. The MRO tooling can account for around 20% of the overall MRO market and the total GSTE can account to around 8-10% of the MRO tooling market. The other cost composition of the MRO cost are the labour and the material. The labour cost in Europe and North America are on an average 4 times the cost of labour in India, which opens a huge potential for MRO providers in India due to their huge cost advantage.

Global MRO Tooling, (By USD Billion), 2018-2028F



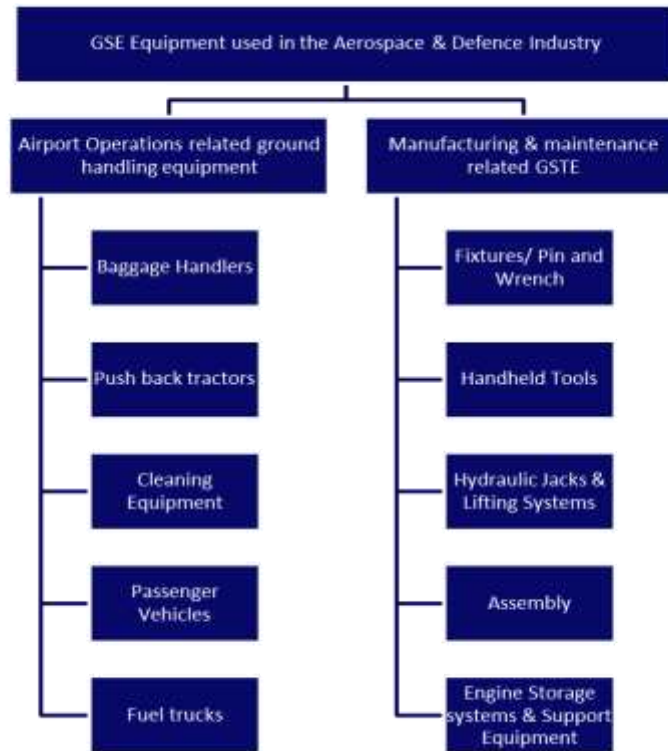
Overview of Global Ground Support Equipment Market

Airport ground support equipment (GSE) comprises an essential array of vehicles and machinery vital for the efficient functioning of airport operations. GSE plays a critical role in facilitating the safe and timely servicing of aircraft on the ground. The Ground Support Equipment vary based on their functional needs. The ground support equipment is used for tasks like guiding aircraft to and from parking positions to the taxiway, ground power units, providing crucial electricity supply to parked planes, to name a few. These are equipped with powerful engines

and manoeuvring capabilities, enable the precise positioning of aircraft for maintenance, refuelling, and boarding activities. As airports continue to evolve and expand, the role of GSE becomes increasingly vital in maintaining operational efficiency, enhancing safety standards, and ultimately delivering a seamless travel experience for passengers worldwide.

The Ground Support Tooling Equipment (GSTE) are used in manufacturing and maintenance of the aircraft.

Types of GSTE used in Aerospace & Defence Industry, 2024

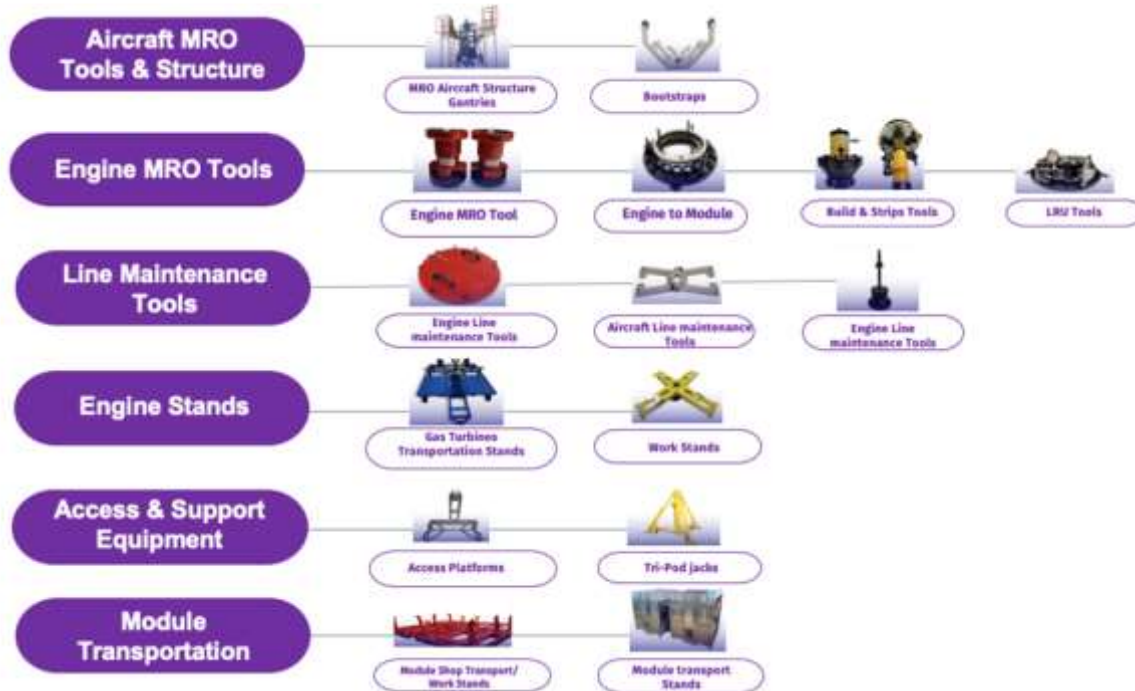


Touchpoints of GSTE in Manufacturing and MRO of Aircraft



The touch points of Ground Support Tooling Equipment providers are across three phases in both Engine and Aircraft manufacturing and maintenance. The Aero Engine tooling is used to mount the engine in Check D, it is also used in Check C when required. The Airframe tooling equipment are used in component check, Check C and Check D. The Airframe tooling and support equipment are used for any manufacturing and maintenance activity of airframe and the Aero Engine tooling and support equipment are used only for Engine related manufacturing and maintenance.

Types of Global GSTE, 2023



DEMAND For GSTE and GROWTH DRIVERS

- Growth in Air Travel:** The growth in air travel has been a transformative force in the global transportation industry, driven by factors such as increased affordability, technological advancements, and expanding global connectivity. Firstly, economic liberalization and rising disposable incomes in developing countries have fuelled a surge in air travel, particularly in Asia and the Middle East. The Indian air travel market is an example of disposable income, wherein the air travel passengers are expected to reach 300 million in 2030. Secondly, the rise of low-cost carriers has democratized air travel, making it more affordable for a wider range of passengers. This has led to the development of smaller, more efficient airports focused on budget travel, often located outside major city centres. In Europe and North America the Low Cost Carriers account to nearly 30%-35% of the total passengers carried. In India, Indigo alone accounted to 54.7% of the market in FY2023. This rapid increase in air travel has propelled the growth of aircraft maintenance, this in turn increases the tooling market of the Global airlines.
- Increase in aircraft cycles:** The aviation industry has witnessed a significant increase in aircraft cycles in recent years, driven by various factors that impact aircraft utilization and operations. An aircraft cycle refers to one complete flight operation, encompassing take off, flight, and landing. Several factors contribute to the rise in aircraft cycles, including the growing demand for air travel, expansion of airline fleets, and increased frequency of short-haul flights. With rising global prosperity and affordability of air travel, passenger numbers have surged, leading airlines to operate more flights to meet the demand. Additionally, the emergence of low-cost carriers and the liberalization of air travel markets have resulted in a proliferation of

short-haul routes, further boosting aircraft cycles. Furthermore, advances in aircraft technology and operational efficiency have enabled airlines to optimize flight schedules and increase aircraft utilization rates. Modern aircraft are designed to withstand a higher number of cycles, allowing airlines to deploy them more frequently without compromising safety or performance. Moreover, improved maintenance practices and reliability of aircraft systems have contributed to the ability to operate more flights within shorter timeframes. The increase in aircraft cycles poses both opportunities and challenges for airlines and the aviation industry.

- **Aging Aircraft Fleet:** As aircraft gets older, the maintenance cycles and the cost required for maintaining the aircraft increases. The aging of commercial aircraft fleets has become a significant concern for airlines worldwide. The average fleet age of Middle East and Asia is around 10.2 years and 9.7 years, respectively. The age of European fleet is also around 11.5 years. However, the average age of North American fleet is slightly older at 13.4 due to the aging regional jets. Asian fleet accounts to around one third of the total global fleet, which translates to a huge market opportunity in the next 3-4 years. The rising fleet age led to a rise in maintenance costs, technological obsolescence, and the need for frequent upgrades to meet evolving passenger demands and environmental regulations. To address these challenges, airlines are exploring various strategies, such as implementing predictive maintenance systems, optimizing fleet utilization, and exploring end-of-life optimization techniques.

ENERGY SECTOR OVERVIEW

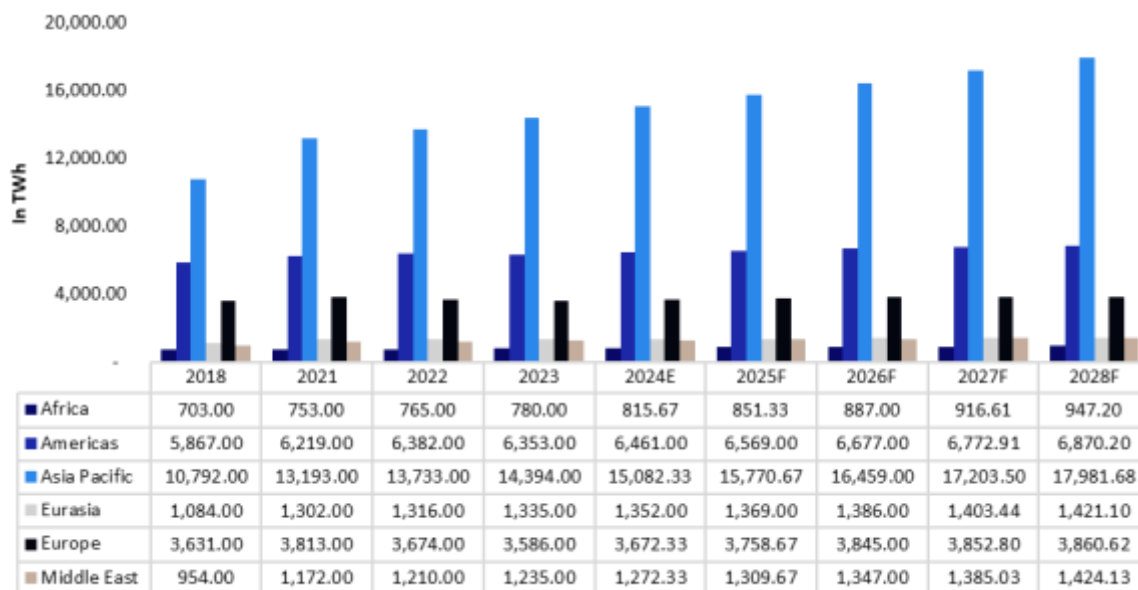
Global Outlook

Energy consumption serves as a fundamental indicator of economic development, industrial activity, and quality of life across different regions and countries. Fossil fuels, including oil, coal, and natural gas, have traditionally dominated global energy consumption due to their affordability, availability, and energy density. However, there has been a growing emphasis on renewable energy sources such as solar, wind, and hydropower in recent years, driven by concerns over climate change, energy security, and environmental sustainability.

Developed regions, such as North America and Europe, have historically accounted for a significant share of global energy consumption, propelled by advanced industrial sectors and high standards of living. In contrast, emerging economies in Asia, particularly China and India, have witnessed rapid growth in energy demand as they undergo industrialization and urbanization. This shift in energy consumption patterns has profound implications for global energy markets, geopolitical dynamics, and environmental sustainability.

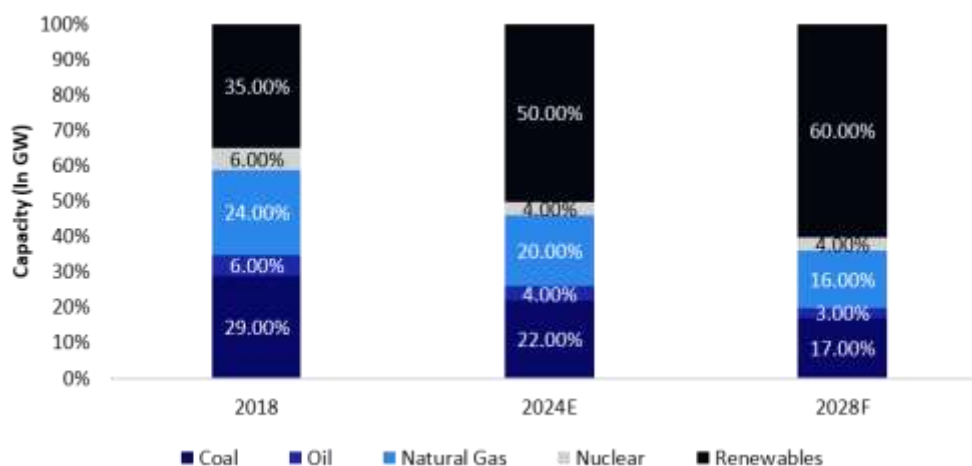
As the world seeks to address the challenges of climate change and achieve a transition towards cleaner and more sustainable energy sources, a comprehensive overview of global energy consumption serves as a roadmap for shaping the future of energy production and consumption worldwide.

Global Regional Energy Consumption, 2018- 2028F



The global energy consumption patterns vary significantly based on factors such as population density, economic development, industrial activities, and natural resource availability. Developed regions typically exhibit higher per capita energy consumption, driven by industrialization, urbanization, and advanced infrastructure. The Americas are expected to grow at a moderate CAGR of 1.6% between the period 2024-2028. In contrast, while emerging economies like Asia Pacific accelerate at a CAGR of 4.6% during the same period as they undergo industrial expansion and urban development. Regional energy consumption encompasses various sectors, including transportation, industry, residential, and commercial sectors, each with its unique patterns and drivers.

Global Energy Capacity, By Source, 2018- 2028F



Global power generation encompasses various energy sources, including coal, natural gas, nuclear, and renewables like solar and wind. While coal and natural gas remain dominant due to their affordability and reliability in 2023, renewable energy capacity is rapidly expanding, driven by environmental concerns and technological advancements. Nuclear power provides low-carbon baseload electricity but concerns over safety and waste disposal persist. Renewal energy capacity has grown from 35.0% to 50.0% in 2024E and is expected to grow to 60.0%, contributing to a more diverse and sustainable global energy mix. Solar energy being the most rapidly growing renewable power generation technology.

Nuclear Energy

Nuclear power plants harness the energy released from nuclear reactions to generate heat, which is then converted into electricity through steam turbines. Despite concerns surrounding safety and waste management, nuclear energy remains a key component of the global energy mix, particularly in countries like the United States, France, China, and Russia, which host a substantial number of nuclear reactors. These nations rely on nuclear power to meet their electricity demands while reducing greenhouse gas emissions and mitigating climate change. Moreover, nuclear energy provides energy security by diversifying the sources of electricity generation and reducing dependence on fossil fuels. However, the nuclear industry faces challenges such as high construction costs, public perception, and concerns over nuclear proliferation. Additionally, the safe disposal of nuclear waste and the decommissioning of aging nuclear plants pose significant logistical and environmental challenges. Despite these hurdles, nuclear energy continues to account to around 4% of the total installed capacity, especially as countries seek to transition towards cleaner and more sustainable energy systems to address the challenges of climate change and ensure energy security.

Global Power Generation-Nuclear (In Twh), 2018- 2028F



Global Power Capacity-Nuclear (In GW), 2018- 2028F



Nuclear power has faced stagnation in recent years due to several factors' safety concerns following accidents like Fukushima have led to increased regulatory scrutiny and public opposition, delaying the construction of new nuclear plants, and leading to the premature closure of existing ones in some countries.

There are around 168 nuclear plants in Europe and another 10 are under construction. France generates around 62.6% of the global electricity generated from nuclear power source. Europe remains divided on the topic of power generation from nuclear sources. Germany, Lithuania and Italy have completely phased out nuclear based power generation. However, some countries, particularly those seeking to reduce reliance on fossil fuels and meet

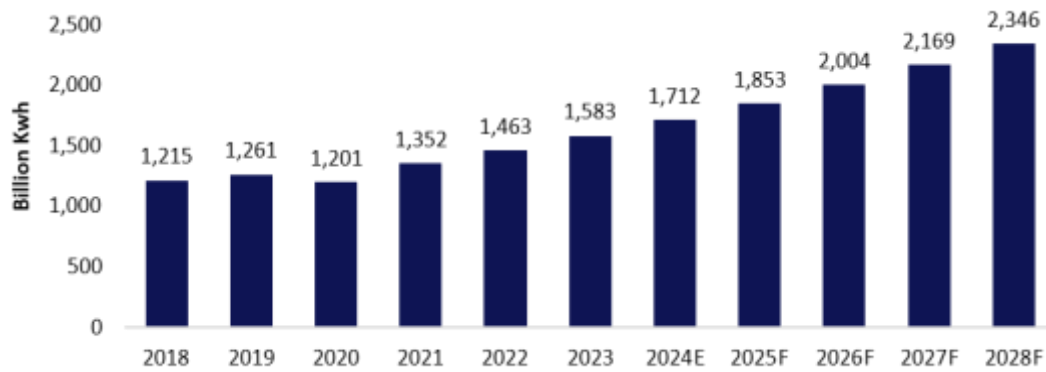
climate targets, are reevaluating their stance on nuclear power. Advanced reactor designs, such as small modular reactors (SMRs) and Generation IV reactors, offer potential solutions to safety, cost, and waste management challenges, generating renewed interest in nuclear energy.

Indian Outlook

India's power consumption is on a steep climb, fuelled by a booming economy, rising living standards, and rapid urbanization. The Indian power consumption has increased from 1,215.00 billion Kwh in 2018 to 1,582.81 billion Kwh in 2023 and is expected to further grow to 2,346.16 billion Kwh by 2028F.

The energy mix in India is skewed to Steam those accounts for around 75%-80% of the power generated. This is followed by renewable and hydro which accounts to 13% and 10%, respectively in 2023. The share of renewable energy is expected to surpass 25% by 2030 and coal fire. There is a growing focus on renewable energy sources like solar and wind. The government is actively promoting renewable energy projects due to their cost-effectiveness and environmental benefits. This focus on renewables is expected to play a crucial role in meeting India's future energy needs in a sustainable manner.

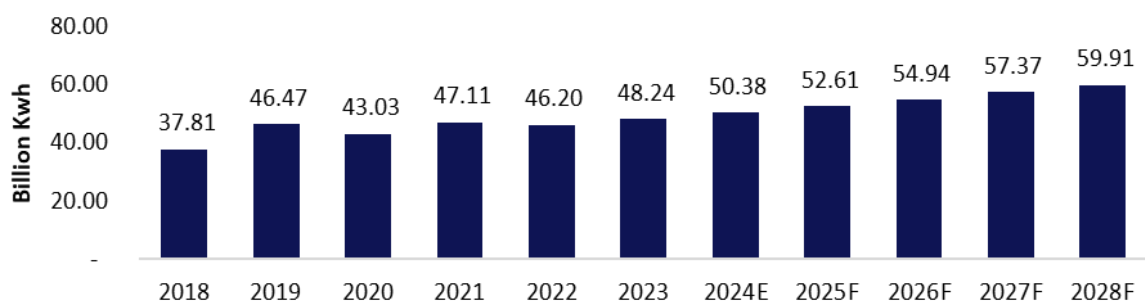
India's Power Consumption, 2018- 2028F



Nuclear Energy

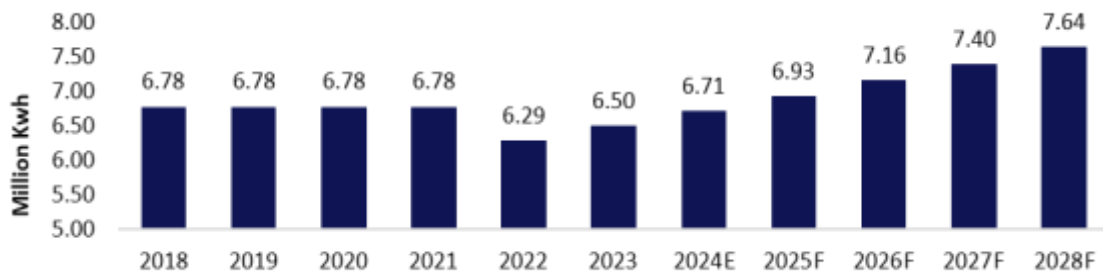
India's power generation from nuclear sources constitutes of around 2.6% of the total power generation in India. It is expected to grow from 48.24 billion Kwh in 2023 to 59.91 billion Kwh in 2028F. India is expected to use three stage programs for power generation with a combination of Pressurized Heavy Water Reactor (PHWR) and Fast Breeder Reactor (FBR). This would give the capability to grow multi fold capacity additions through uranium- plutonium route.

Nuclear Power Generation (Billion Kwh) 2018- 2028F



India nuclear power has a total installed capacity of 6.71 million Kwh in 2024E, and this is expected to grow to 7.64 million Kwh in 2028F. The Government is adding capacity into the nuclear power generation sector. Two more reactors of 1,000 MWe have been approved and is expected to be ready by 2030. These two reactors are expected to be in Kudankulam, this would increase the nuclear capacity capability to 22,480 MWe by 2030. There are around 22 operational nuclear reactors in India and another 11 nuclear stations are expected to be commissioned with a cumulative capacity of 8,700 MW. India has plans to increase nuclear power generation mix of nuclear from 3% to 10% in the future. Shifting to the nuclear energy sector, large tenders are expected from the energy and power sector for the construction of 10 new reactors within the next 8 years. The cost of one nuclear power plant could vary from USD 6 Billion to USD 10 Billion based on the capacity (For 1,100 MW) and the cost of electromechanical component in the nuclear power plant could vary from 25%-30%.

India Power Capacity-Nuclear (Million Kwh) 2018- 2028F



Major Nuclear Installations in India, 2024

Name	State	Capacity	Highlights
Kudankulam Nuclear Power Plant	Tamil Nadu	2,000 MW (2 units of 1,000 MW each)	This plant uses VVER-1000 reactors supplied by Russia and is the largest nuclear power station in India.
Tarapur Atomic Power Station	Maharashtra	1,400 MW (2 units of 540 MW and 2 units of 160 MW)	It is the oldest nuclear power plant in India, with its first units commissioned in 1969.
Rajasthan Atomic Power Station	Rajasthan	1,180 MW (8 units of varying capacities)	The first unit of this plant was commissioned in 1973, and it now has multiple reactors in operation.
Kaiga Atomic Power Station	Karnataka	880 MW (4 units of 220 MW each)	Known for its indigenous pressurized heavy water reactors (PHWR).
Madras Atomic Power Station (MAPS)	Tamil Nadu	440 MW (2 units of 220 MW each)	Located at Kalpakkam, it uses PHWR and was among the first reactors in India to be constructed indigenously.
Narora Atomic Power Station	Uttar Pradesh	440 MW (2 units of 220 MW each)	This plant is located on the banks of the Ganges River and uses PHWR technology.

Name	State	Capacity	Highlights
Kakrapar Atomic Power Station	Gujarat	440 MW (2 units of 220 MW each, with additional units under construction)	It uses PHWRs and is undergoing expansion to increase its capacity.
Kalpakkam PFBR	Tamil Nadu	500 MW (under construction, expected to be operational soon)	This plant will be a significant step for India's fast breeder reactor program.
Bhimpur Nuclear Power Plant	Madhya Pradesh	1,400 MW (proposed)	This plant is in the planning stage and will significantly boost nuclear capacity upon completion.
Chutka Nuclear Power Plant	Madhya Pradesh	1,400 MW (proposed)	Another planned project expected to add to India's nuclear power generation capability.

PRECISION ENGINEERED COMPONENTS OVERVIEW

Precision Engineered Components (PEC) are parts designed and manufactured with extremely low tolerances, typically measured in microns (one thousandth of a millimetre) and these are used in applications like aircraft engines, turbine components in the energy sector, automotive engines, fuel injection systems and nuclear power plants. This level of precision is achieved using advanced technologies and techniques, including computer numerical control (CNC) machining, micro system technology, and precision engineering machines. The production of these components involves careful consideration of various factors, such as the positioning of features, type of tooling used and load limits, to ensure long-term stability and performance.

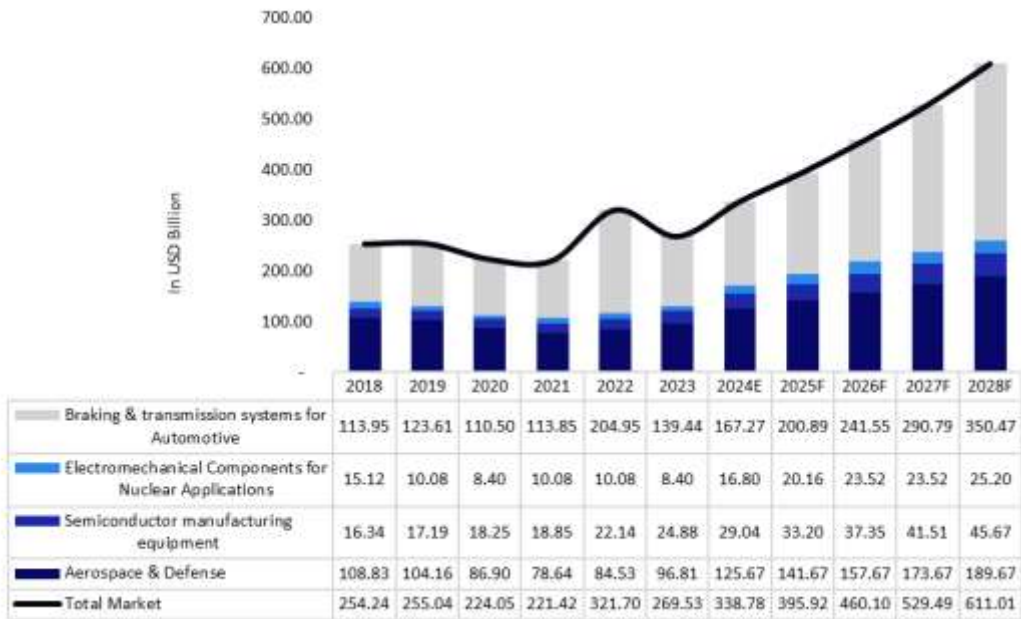
Global Outlook by PEC segment

The braking and the transmission market, comprising of Gear, Clutch, Differential and Shaft and expected to account for USD 167.27 billion in 2024E and expected to grow at a CAGR of 20.3% to USD 350.47 billion in 2028F. The overall growth for the automotive segment in the Asian region is expected to be the key driver for this market.

The Aerospace & Defence sector is the second largest sector for precision engineered components and estimated to account to around USD 125.67 billion in 2024E. It is expected to grow at a CAGR of 10.8% between the period 2024E to 2028F and reach USD 189.67 billion in 2028F. The increase in defence budgets driven by geopolitical conflicts is expected to be the key drivers for this segment during the forecast period 2024E to 2028F.

Semiconductor precision component manufacturing is expected to account to USD 29.04 billion in 2024E and is expected to grow at a CAGR of 11.99% to USD 45.67 billion until 2028F. The growth in electronics market is one of the key drivers in this market. The ongoing nuclear power plant projects are expected to drive the electromechanical subsystems for nuclear applications from USD 16.80 billion in 2024E at a CAGR of 10.1% to USD 25.20 billion in 2028F. The overall market for these segments is expected to grow at a CAGR of 15.89% and grow from USD 338.78 billion in 2024E to USD 611.01 billion in 2028F.

Global Outlook, By Segment, 2018-2028F



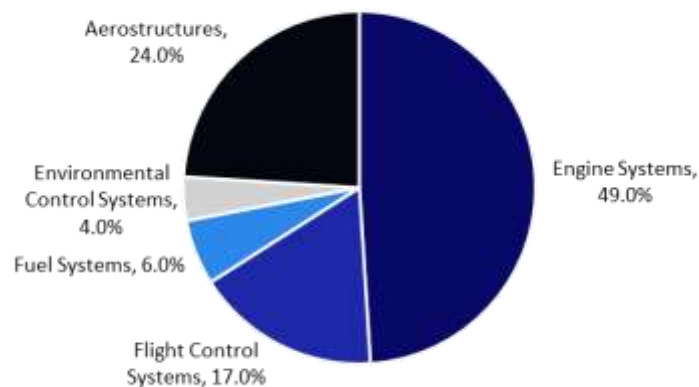
AEROSPACE & DEFENCE

The key components in the aerospace & defence segment that require precision manufacturing basis commercial aircraft include the following, that are further split to sub segments or smaller components:

- Engine Systems
- Flight Control Systems
- Fuel Systems
- Environmental Control Systems
- Aerostructures

Out of the above mentioned, precision components manufactured for engines are the most expensive due to the type of tooling and the type of material used for manufacturing engines – typically titanium, aluminium and other specialized alloys.

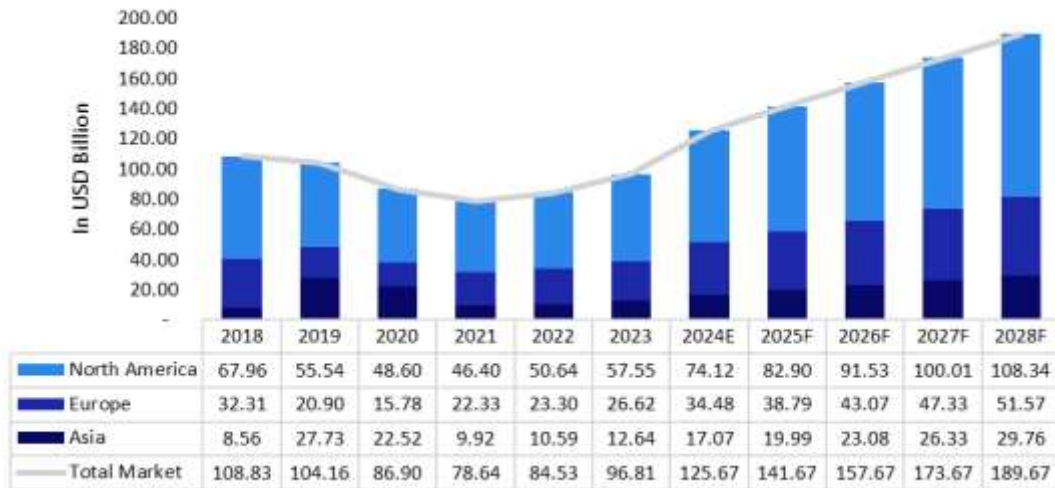
Sub-Component Cost Percentage breakup as a percentage of PEC in an commercial aircraft, 2023



The majority of the precision manufacturing components in the aerospace & defence sector exists in North America and Europe representing the most mature markets for PEC globally. The North American market is

expected the major share of 59.0% of the overall aerospace and defence segment, in 2024E. In terms of growth rates, Europe is a close second even as its relative size is 27.4% that of North America in 2024E. This is due to the presence of manufacturing plants of Boeing and Airbus and their related suppliers in North America and Europe, respectively.

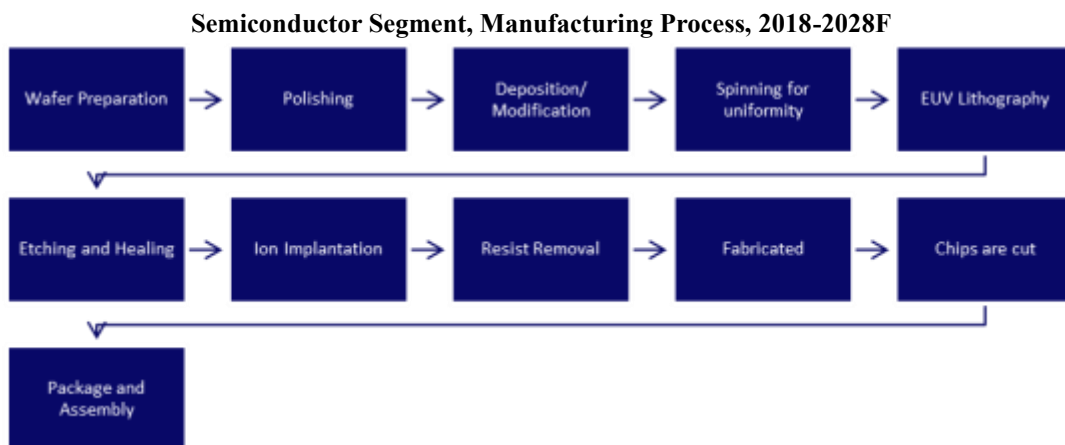
Precision Manufactured Components for Aerospace & Defence Segment, By Geography, 2018-2028F



The Aerospace & Defence industry is governed by companies in North America and Europe, the market is matured there with a well-developed supply chain. The companies based in countries like US, France and Germany supply majority of defence platforms to other countries. The Latin American market and the Asian market is in its growth phase driven by countries like India, China and Brazil. Most of the countries in Middle East are investing into aerospace & defence capabilities. Middle East and Africa are in their introduction phase.

SEMICONDUCTOR MANUFACTURING EQUIPMENT

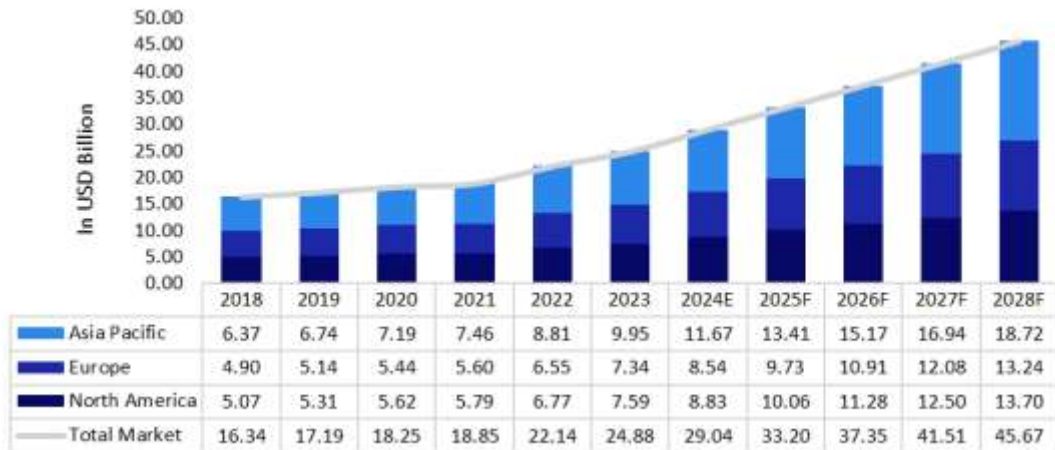
The semiconductor industry is vital to modern electronics, and it is facing recent supply shortages due to surging demand and geopolitical tensions. Countries are vying for dominance in chip production, with China aiming to lessen reliance on foreign suppliers.



Asia Pacific region is the largest chip manufacturer in the world, accounting for around 66.5% of the Global semiconductor production during the period 2024E to 2028F. Asian countries with strong capabilities in semiconductor manufacturing include Taiwan, South Korea, China and Japan. This is followed by Americas which account to around 36.1% of the overall market during in 2024E.

In semiconductor manufacturing equipment market, North America and Europe have ~ equal share in 2024E and Asia has a higher market share in this segment. Semiconductor manufacturing equipment market is estimated at USD 29.04 Billion in 2024E and is expected to grow at a CAGR of 11.99% - to USD 45.67 billion in 2028F. Asia is expected to grow at a CAGR of 12.5% and is the fastest growing region. The market size for deposition chambers in chip manufacturing equipment market is estimated at around 5%-10% of the semiconductor manufacturing equipment market.

Semiconductor Manufacturing Equipment, PEC Market, By Geography, 2018-2028F



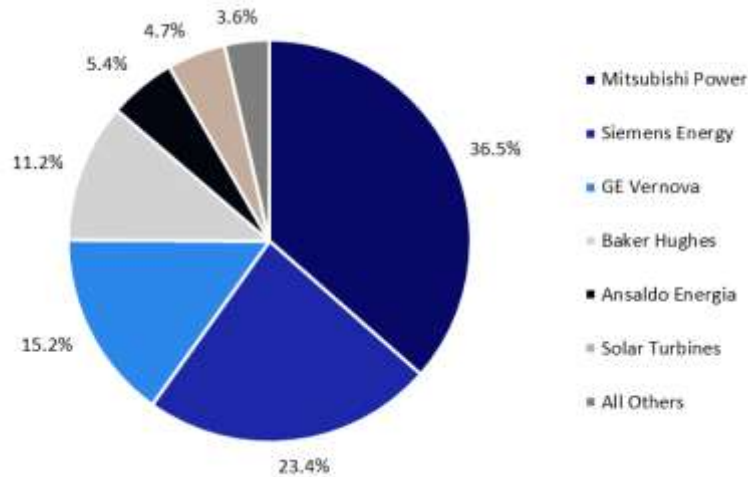
The semiconductor manufacturing equipment- precision component manufacturing market is in its maturity stage in Asia, Europe and North America. In Asia the market is driven by countries like Japan and China. India is an emerging market in the precision components for chip manufacturing industry. Europe and North America have pioneered the equipment manufacturing for Semiconductor industry, which creates an organic demand for precision manufactured components in these regions.

ENERGY & POWER EQUIPMENT (GAS TURBINE, ELECTROMECHANICAL SUB-SYSTEMS)

GAS TURBINE

The intricate manufacturing of a gas turbine engine involves a multi-stage process demanding high precision and high-quality control standard. The global gas turbine market is a vital part of the energy sector, driven by the increasing demand for efficient power generation and the global shift towards cleaner energy sources. Gas turbines are pivotal in converting natural gas or liquid fuels into mechanical energy, which is then used to generate electricity or power industrial equipment. This versatility makes them essential in various industries, including power plants (Hydro, Nuclear, Wind etc..), aviation, and oil & gas. The key players in the Gas Turbine industry are Mitsubishi Power, Siemens and GE. The market share breakdown based on MW for 2023 is shown in the figure below. The overall market for Gas Turbines is estimated at around USD 20.34 billion in 2023 and is expected to grow to USD 25.67 billion by 2028F at a CAGR of 4.65%. Majority of the market demand is estimated to be from Europe, which is expected to account to 40%, North America and China is expected to account to 40% (cumulative). The rest of the regions are expected to account to 20% of the overall market.

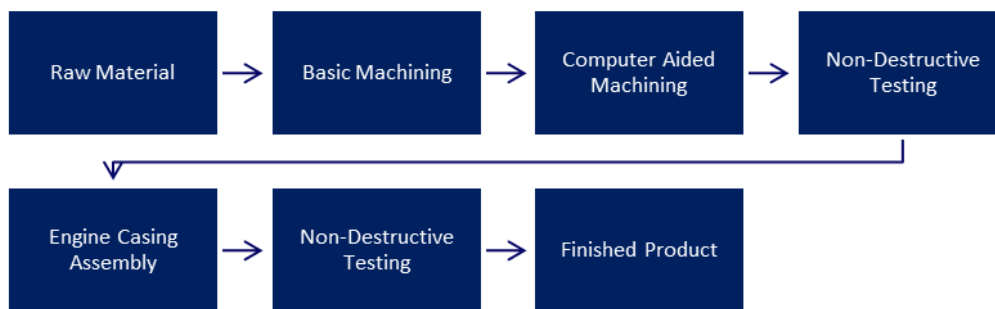
Market Share of Gas Turbine, By MW, 2023



The tooling market for Gas Turbine manufacturing is estimated at USD 0.46 Billion in 2024E and is estimated to grow to USD 0.64 billion at a CAGR of 6.85%. Firstly, specialized components like compressor blades and turbine discs are manufactured from high-temperature alloys. These components undergo computer-aided machining, ensuring precise geometries crucial for efficient airflow. Subsequently, rigorous inspections, including non-destructive testing, verify the integrity of each part. Next, the precision components are assembled within an engineered casing. Advanced welding techniques create robust yet lightweight structures. Finally, the assembled engine undergoes rigorous testing, simulating real-world operating conditions to ensure optimal performance and safety before deployment in power generation or propulsion applications.

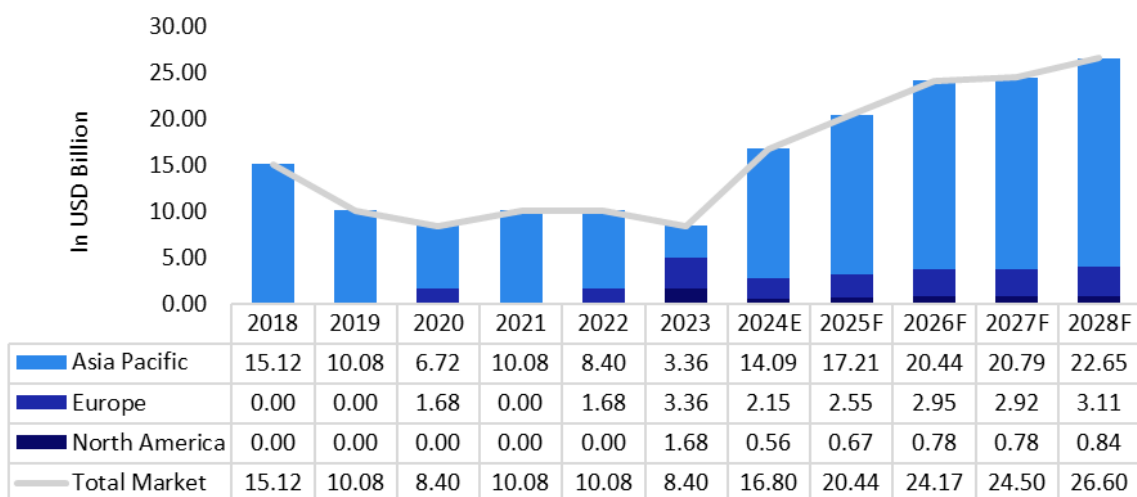
ELECTROMECHANICAL COMPONENTS in NUCLEAR POWER PLANTS

Nuclear Segment (Electromechanical Parts), Manufacturing Process, 2018-2028F



The precision manufacturing for nuclear energy plants also involves the production of high-quality, complex components that are crucial for the safe and efficient operation of nuclear power facilities. These companies utilize CNC machining, gun drilling, BTA (Boring and Trepanning Association) drilling, and 5-axis vertical machining centres, to produce components like fuel channel end fittings, liner tube assemblies, feeder pipes, reactivity adjustment mechanisms, shield plug assemblies, to name a few. The key material used are stainless steel and carbon steel. Asia Pacific is the largest market for Electromechanical components for nuclear segment accounting to 84.0% of the market during the period 2024E to 2028F.

Electromechanical Components for Nuclear Segment, By Geography, 2018-2028F



The market is in a matured phase in the component manufacturing of Energy & Power equipment, which includes nuclear power equipment. The companies in North America and Europe are in their matured phase, however companies from Asian region, especially India and China are continuously enhancing their manufacturing capability. India relies on imports for certain key components and technologies to build its nuclear power plants due to limited domestic capabilities. India imports enriched uranium fuel, reactor pressure vessels, steam generators, and turbine generators from countries like Russia, France, and the United States.

COMPETITIVE ANALYSIS

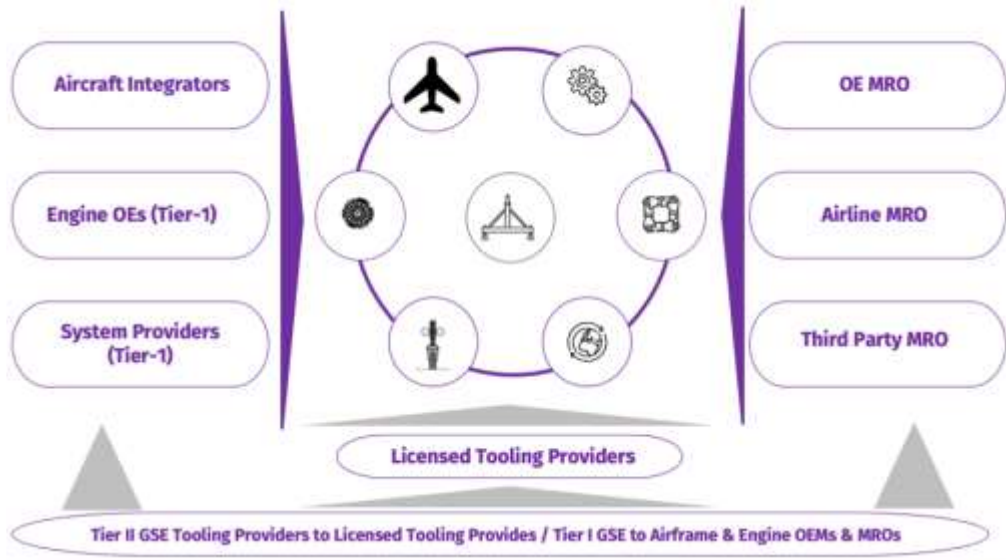
Overview of Market Structure

Aerospace & Defence GSTE

The Indian Aerospace & Defence GSTE market is driven by domestic and international demand. The low manufacturing costs offered by Indian companies is one of the key success factors when competing with global products. The aircraft integrators and Engine original equipment manufacturers use specific tools from selected companies, called licensees with multiple tooling providers across aircraft or engine programs for the same company.

The Indian Aerospace & Defence GSTE market landscape is a blend of imports and domestic players. For Example: High-tech engine stands are often sourced internationally, while simpler models are increasingly manufactured locally. The demand of the equipment is from private companies that produce aerostructures for Aircraft Integrators, MROs and Government DPSUs.

Market Structure, Aerospace & Defence GSTE Market

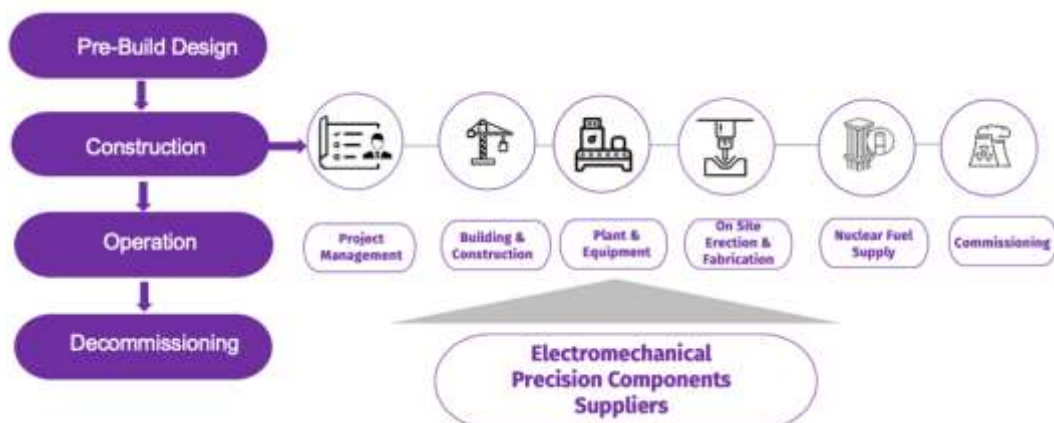


Energy and power equipment (gas turbine, electromechanical sub-systems)

Electromechanical subsystems are crucial in nuclear applications, offering precision, reliability, and safety. These subsystems integrate mechanical components with electrical controls to perform essential functions in nuclear reactors and related facilities. Key areas of application include control rod mechanisms, coolant system pumps, and valve actuators. Control rod mechanisms, vital for regulating the nuclear reaction, rely on electromechanical drives to insert or withdraw control rods, adjusting the reactor's power output.

These subsystems must endure extreme conditions such as high radiation, pressure, and temperature, demanding robust materials and precise engineering. Advanced sensors and feedback systems are integrated to monitor performance and ensure prompt response to operational anomalies. Redundancy and fail-safe features are often incorporated to enhance reliability and safety, preventing catastrophic failures.

Market Structure, Electromechanical Subsystems for Nuclear Applications

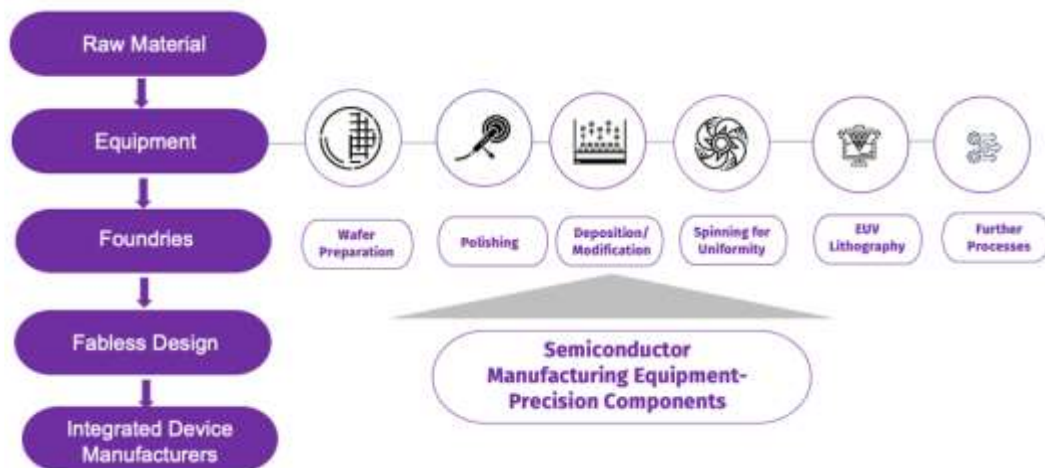


Semiconductor Manufacturing Equipment

Semiconductor manufacturing equipment plays a crucial role in the production of precision components, essential for creating advanced electronic devices. These sophisticated machines facilitate various stages of semiconductor fabrication, including deposition, lithography, etching, and metrology. Precision components in this context refer

to the intricate parts and assemblies required to ensure the accurate and efficient operation of semiconductor manufacturing equipment. These components are designed with exacting standards to maintain the ultra-clean environments necessary for semiconductor production, where even the smallest contaminants can affect performance. High precision is paramount in this industry, as the tolerances for semiconductor components are measured in nano meters. Equipment such as photolithography machines, chemical vapor deposition (CVD) systems, and etchers must operate with exceptional accuracy to create the fine features on semiconductor wafers.

Market Structure, Semiconductor Manufacturing Equipment



Key Players in the market

The players have been selected based on two key capabilities, (a) their precision manufacturing capability across similar industry indicated by product mix and (b) their offering in ground support tooling equipment used for manufacturing in the aerospace & defence industry, precision engineered manufacturing capability, prototyping capability and digital manufacturing.

Product Mix, Volume VS Value

	Low Volume	Medium Volume	High Volume
Low Mix			Automotive Precision Manufactured Parts
Medium Mix			Aerospace & Energy PEC
High Mix	Ground Support Tooling Equipment for Aerospace & Defence Segment	Semiconductor Machinery Equipment Market	

Following are the key players based on the above approach:

- **Azad Engineering Limited** is based in Hyderabad, Telangana. It Specializes in manufacturing high precision engineering components. The company's core manufacturing focuses on precision forging and machining in aerospace, defence, energy, and oil and gas industries. Japan, USA and France accounts to the key countries of export.
- **Dynamic Technologies Limited** is an Indian precision engineering company based in Bangalore, India and have manufacturing facilities and subsidiaries in US, UK and Germany. The company operated in three

segments namely the hydraulics, metallurgy and the aerospace and defence segment. The aerospace and defence segment accounts to nearly 33% of the overall revenue of the company. Dynamic Technologies' clients include Airbus and Boeing, for the supply of critical components.

- **MTAR Technologies Limited**, a precision engineering company, is a renowned player in the industry, specializing in the manufacturing of mission-critical precision components. It was established in 1970, and works closely in the Indian Civilian Nuclear Power program, Indian Space program, Indian Defence, Global Defence, and Global Clean Energy sectors. The company's services include precision machining, assembly, testing, quality control, and specialized fabrication.
- **Paras Defence & Space Technologies Ltd.** is a prominent Indian company specializing in defense engineering and space technologies, with over 40 years of experience. A key player in the Make in India initiative, it focuses on designing, developing, and manufacturing a variety of defense products across four primary sectors: Defence & Space Optics, Defence Electronics, EMP Protection Solutions, and Heavy Engineering. As the only Indian manufacturer of infrared optics in large volumes, Paras Defence plays a vital role in critical defense and space programs. With advanced facilities and a strong emphasis on R&D, the company employs over 600 professionals dedicated to enhancing India's defense capabilities and national security.
- **Data Patterns (India) Limited**, founded in 1998 and headquartered in Chennai, Tamil Nadu, is a key player in the defense and aerospace electronics sector. This vertically integrated company serves the indigenous defense products industry in India and has a proven track record of delivering high-reliability products. Data Patterns is noted for its capability to execute complex programs swiftly. Its diverse portfolio includes COTS Boards, ATE and Test systems, Space Systems, and Radio Frequency and Microwave solutions, designed for rugged applications and automatic test equipment platforms. Recognized for their quick turnaround times, Data Patterns continues to uphold its reputation in the defense and aerospace electronics industry.
- **Jaivel Aerospace Private Limited** is a privately held company founded in 1998 and it specializes in aerospace manufacturing. The company offers manufacturing engineering solutions and smart tooling to provide a competitive advantage to leading manufacturing organizations
- **TechEra Engineering (India) Limited** is based in India and offers manufacturing engineering solutions and smart tooling to its clients. The company focusses in Aerospace, Medical and Energy segments. The product portfolio includes jigs, fixtures, assembly tooling, ground support equipment and maintenance, repair, and overhaul (MRO) tooling. The top three customers of the company account to 55.42% of their revenues as of 31st December 2023.
- **Jendamark India Private Limited**, a distinguished entity in the Indian manufacturing landscape, emerged in 2010 as a private limited company. It was initially known as Techcellancy Engineering Pvt Ltd, the company transitioned to its current form in 2015. The company's core offerings span a wide spectrum, including automation systems, aerospace tooling, and pallets for engine assembly, catering to the intricate needs of the automotive and aerospace industries. The company's association with the Jendamark global brand has helped the company to be a direct supplier to Original Equipment Manufacturers (OEMs) in the automotive sector
- **Jaisara Tooling Systems Private Limited**, headquartered in Hyderabad, Telangana, India, specializes in the design, manufacture, and supply of tooling solutions for the commercial aircraft sector. It is one of the tooling suppliers for aircraft engine overhaul and production, aircraft accessory tooling, and Passenger-to-Freighter (PTF) conversion tooling. Clientele of Jaisara include Pratt & Whitney (USA), Air India, Indian Airlines, SNECMA (Safran Group, France), Chengdu Aerotech (China) and the engine division of Hindustan Aeronautics Limited (India).

- Unimech Aerospace and Manufacturing Limited** is a global high precision engineering solutions company specializing in manufacturing of complex products with “build to print” and “build to specifications” offering, which involves, machining, fabrication, assembly, testing and creating new products basis the specific requirements of our clients for the aerospace, defence, energy and semi-conductor industries. Founded in 2016 and headquartered in Bangalore, India, the company has rapidly grown to become a trusted supplier to major Original Equipment Manufacturers (OEMs) and their approved licensees. It has established itself as a leading manufacturer of complex tooling, mechanical assemblies, electro-mechanical turnkey systems and precision components, widely used in the aeroengine and airframe tooling for production, MRO and line maintenance activities. Over 90% of the company's sales are exports, with the US and Europe being its largest markets. Unimech Aerospace delivers end-to-end solutions in conceptualization, design, assembly, and manufacturing of highly precise and economical engine handling and ground support equipment. Their clientele includes top aircraft global OEMs, top aero engine global OEMs and their licensees. From the Energy sector, NPCIL and other top global OEMs are their clients. Their defense clients include Brahmos and in the semi-conductor equipment manufacturing segment, the top global OEMs are their clients.

Competitive Analysis of Players

Companies which offer both GSTE and precision component manufacturing capability are expected to experience higher growth for the next ten years. The offset obligations coupled with the expected growth of aerospace & defence manufacturing is the key reason for the expected growth. Similarly, companies with a revenue mix of domestic and export clients are expected to witness higher margins. Production profiles geared towards deposition chambers, test rigs, frames, stands and other sub systems for semiconductor manufacturing, which is are expected to grow in India, driven by Atmanirbhar. The product mix also plays a major role in the profit margins, companies with complex products have limited volumes and higher profit margins. GSTE is also a segment with low volumes and higher profits.

Competitive Analysis of Key Players, FY2024

	 AZAD	 DYNAMIC TECHNOLOGIES	 MTAR	 Paras Defence	 DATA PATTERNS	 unimech	 JAIVEL	 JENDAMARK	 JAISARA	 TechEra
	Azad Engineering Limited	Dynamics Technologies Limited	MTar	Paras Defence	Data Patterns	Unimech	Jaivel Aerospace Private Limited	Jendamark India Private Limited	Jaisara Tooling Systems Pvt Ltd	TechEra Engineering India Limited
Aerospace & Defense	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Energy (Including Nuclear)	✓	✓	✓	X	X	✓	X	X	X	X
Oil & Gas	✓	✓	✓	X	X	✓	X	X	X	X
Ground Support Tooling Equipment	X	X	X	X	X	✓	X	✓	✓	✓
Semiconductor Equipment/ Components	X	✓	✓	X	X	✓	X	X	X	X
Majority of revenue from export market	✓	X	✓	X	X	✓	NA	NA	NA	✓

Unimech has a portfolio that caters to the widest breadth of product coverage from A&D, Energy, Oil & Gas, PMC as well as GSTE. Azad Engineering, Dynamic, MTAR service the A&D, Energy, Oil & Gas, Precision Manufacturing industry but do not provide any ground support equipment. Jaivel, Techera, Jendamrk, Jaisara provide A&D and PMC but not to O&G and Energy.

Product Offerings of Key Players

The product offerings of the key players are predominantly in the areas of aerospace & defence tooling and precision component manufacturing. GSTE is lucrative in terms of margins, compared to the precision component manufacturing market. This is directly linked to the expertise and the equipment required to manufacture the end product. Unimech is one of the companies which is well positioned in both Aerospace & Defence GSTE and precision component manufacturing in India catering to global OEMs and their approved licensees. The growth in fleet, which is expected to drive the aircraft MRO market and the push by the Government to set up semiconductor manufacturing facilities in India are expected to act as key drivers for Unimech and other relevant players in the next ten years. Unimech offer a unique dual capability to their customers i.e., “build to print” and “build to specification”, which distinguishes Unimech from their peers.

Product Offering of Key Players, FY2024

	 AZAD	 DYNAMIC TECHNOLOGIES	 MTAR	 Paras Defence	 DATA PATTERNS	 unimech	 JAIVEL	 JENDAMARK	 JAISARA TOOLING SYSTEMS	 TechEra
	Azad Engineering Limited	Dynamics Technologies Limited	MTar	Paras Defence	Data Patterns	Unimech	Jaivel Aerospace Private Limited	Jendamark India Private Limited	Jaisara Tooling Systems Pvt Ltd	TechEra Engineering India Limited
Aircraft MRO Tools and Structure	X	X	X	X	X	✓	X	✓	✓	✓
Engine MRO Tools	X	X	X	X	X	✓	X	✓	✓	✓
Line Maintenance Tools	X	X	X	X	X	✓	X	✓	✓	✓
Engine Stands	X	X	X	X	X	✓	X	✓	✓	✓
Module Transportation	X	X	X	X	X	✓	X	✓	✓	✓
Precision Manufacturing Capability	✓	✓	✓	✓	✓	✓	NA	✓	X	✓

Only four companies, namely Techera, JendaMark, Unimech and Jaisara manufacture Aircraft MRO, engine MRO, Line main, engine stands, module transportation tooling/assemblies/fabrications.

Global companies like Safran are expected to set up their MRO facilities in India, thereby driving the demand for MRO tooling equipment. Apart from Safran, the helicopter division of Airbus is expected to setup its second FAL in collaboration with TASL. The other drivers include the growth in nuclear power installations in the Energy and Power sector and the growth in procurement of precision and assembly structures from Global corporations across the World and in India across industries.

Competitive Benchmarking

The companies shortlisted for benchmarking are based on their product offerings, companies which produce precision engineered components in the sectors like Automotive, Aerospace & Defence, Electronics and Energy and Power segment.

Precision Engineered components include critical components that are manufactured with low tolerances. The electromechanical components in the nuclear power plants and the components like the deposition chamber in the semiconductor production process are examples of precision engineered component. The volumes in precision engineered component depends on the industry in which the competitor is present.

The metallic parts in the airframe and aeroengine is also precision manufactured, with high end metals. An engine cost could vary from USD 15 million to 30 million depending on its segment. The storage of these engines are done on Ground Support Tooling Equipment, which are OEM prescribed designs to store or hold engine stands. GSTE certification is a long complex process with multiple levels of design approvals by the licensees. The complexity involved in this industry helps the market participants with higher margins. The GSTE market is a low volume high margin business.

Competitive Benchmarking, FY2024



Unimech operates in precision engineering manufacturing across nuclear energy and semiconductor industry and aerospace & defence tooling manufacturing. It has the highest market growth and high product mix for the peer set considered for analysis. Apart from these, the company has also positioned itself as a prominent player in the component prototyping market. Unimech specializes in the manufacturing of complex tooling, mechanical assemblies, and precision components for various industries, including Aerospace & Defence, Energy, Space, Industrial and Semiconductor. The products and services of Unimech include Airframe and gas turbine tooling, Engine MRO, airframe MRO, and line maintenance tooling, Complex electro-mechanical assemblies and structural fabrications, Precision components and assemblies and Global manufacturing solutions. Unimech is a key link in the global supply chain for global aerospace, defence, semi-conductor and energy OEMs and their licensees for the supply of critical parts like aero tooling, ground support equipment, electro-mechanical sub-assemblies and other precision engineered components. Unimech supplies to 4 out of the 6 approved licensees, globally, who are responsible for manufacturing tooling equipment for aero engines used in narrow body and wide body civil aircrafts.

Majority of the revenues of Unimech Aerospace is from the Aero-tooling equipment segment, where the company offers ground support tooling equipment for OEMs and MROs. Unimech has established itself as an approved supplier for various industry leaders in aerospace, defence, semi-conductor and energy sectors. The tooling equipment includes airframe tooling, engine stands, engine tooling and ground support equipment to name a few. The two key drivers for Unimech Aerospace in India and the Global markets are the growth in aircraft orders and the growth in aircraft maintenance. The unique capability of Unimech to deal with complex components has helped the company gain marquee OEMs and their approved licensees as their clients. Unimech is a leading exporter of aerospace components, with exports significantly contributing to the overall revenue. Majority of the company's revenue is from export orders to regions like Europe and North America. Given the complex production process, and lengthy approval process from clients, it is difficult for a new entrant to set up the facilities for manufacturing of products supplied by Unimech. Apart from this, once the customer has on boarded a vendor fulfilling their requirements, it becomes difficult for customers to shift to another vendor, which poses a high entry barrier for competitors or potential new entrants.

Financial Benchmarking of Key Players

The revenues of the companies in the Indian Machine Tooling and Precision Components Market varies based on the scope of their offering and the industries supplied to. Companies with precision component manufacturing capabilities tend to have a higher revenue compared to companies offering only tooling solutions. Similarly,

companies in aerospace & defence engine tooling will have an organic tooling offering to the energy generation sector due to the similarity in turbine offerings.

Financial Benchmarking of Key Players, FY2024

	 AZAD	 DYNAMIC TECHNOLOGIES	 MTAR	 Paras Defence	 DATA PATTERNS	 unimech	 JAIVEL	 Jendama	 JAISARA	 TechEra
	Azad Engineering Limited	Dynamics Technologies Limited	MTar	Paras Defence	Data Patterns	Unimech	Jaivel Aerospace Private Limited	Jendama India Private Limited	Jaisara Tooling Systems Pvt Ltd	TechEra Engineering India Limited
Headquarters	Hyderabad	Chennai	Hyderabad	Navi Mumbai	Chennai	Bengaluru	Ahmedabad	Pune	Hyderabad	Pune
Company Type	Public	Public	Public	Public	Public	Private	Private	Private	Private	Private
Revenue from operations (INR Mn)	3407.71	14293.3	5807.52	2535.00	5198	2087.75	NA	717.35	NA	NA
EBITDA	1165.88	1594.1	1,127	510.60	2216.2	791.85	NA	52.52	NA	NA
EBITDA Margin	34.2%	11.2%	19.4%	20.1%	42.6%	37.9%	NA	7.4%	NA	NA
PAT	585.8	1218.1	561.13	300.30	1817	581.34	NA	23.74	NA	NA
PAT Margins	17.2%	8.5%	9.7%	11.8%	35.0%	27.9%	NA	3.3%	NA	NA
ROCE	14.1%	8.3%	10.3%	7.4%	15.5%	54.4%	NA	6.0%	NA	NA
ROE	9.1%	18.2%	8.3%	6.8%	13.7%	53.5%	NA	6.9%	NA	NA
Working Capital Days	271	107	266	414	432	117	NA	125	NA	NA
FATR	1.44	2.32	1.84	1.57	4.02	5.16	NA	4.14	NA	NA
Key Industries	Power, Aerospace, Oil & Gas, Automobile Industries	Aerospace, Automotive, Hydraulic, Security Assemblers	Space, Nuclear, Defence, Aerospace, Marine	Defense, Space Research, Electronics	Engineering Services, Cabling, Testing, Space	Aerospace, Defense, Power generation, Semiconductor	Aerospace, Energy & Medical	Automation Aerospace	Aerospace	Aerospace, Energy & Medical

Source: Website, Annual reports

- Aerospace & defence segment is more profitable compared to automotive sector due to the stringent requirement and the high-quality standards in the industry.
- Unimech is the fastest growing company, having recorded the highest revenue growth with a CAGR of 139.7% between FY 2022 - 2024, and has achieved one of the highest EBITDA and PAT margins amongst the listed peers. Unimech has recorded the highest ROCE and ROE in FY2024 amongst the listed peers.

Comparison of Revenue from Operations of Key Players

Unimech is the fastest growing company, having has recorded the highest revenue growth in terms of CAGR between the period FY2022 and FY2024, the CAGR of Unimech is 139.7% between the above-mentioned period.

Revenue (INR million)	FY2022	FY2023	FY2024	CAGR FY2022-FY2024
AZAD Engineering Limited	1,944.67	2,516.75	3,407.71	32.4%
Dynamic Technologies Limited	12,533.70	13,157.70	14,293.30	6.8%
MTAR Technologies Limited	3,220.06	5,737.51	5,807.52	34.3%
Unimech Aerospace & Manufacturing Limited	363.49	941.66	2,087.75	139.7%

Revenue (INR million)	FY2022	FY2023	FY2024	CAGR FY2022- FY2024
Paras Defence	1,825.62	2,224.26	2,535.00	18.0%
Data Patterns	3108.50	4534.5	5198.00	29.0%
Jaivel Aerospace Private Limited	53.21	92.87	NA	NA
Jendamark India Private Limited	592.84	721.92	711.89	12.0%
Jaisara Tooling Systems Pvt Ltd	1.32	0.00	NA	NA
TechEra Engineering India Limited	71.78	264.34	NA	NA

Source: Website, Annual reports

Note: Information for private companies are not completely available

NM – Not Meaningful

Comparison of Export vs Domestic Sales of Key Players

The key players in this market generate their sales through domestic and export customers, domestic customers are easier to acquire due to various reasons like proximity of sale, cultural overlaps, physical presence, to name a few. However, exporting the product made in India is a complex task which needs high quality of the product and process documentation in line with the requirements of the OEMs. Companies with higher export tend to have higher margins due to the higher cost of the product in export sale. The United States holds substantial importance as a market for aerospace and precision components and assemblies, with Unimech primarily serving clients within the United States. Europe stands as the second-largest market for aerospace products, notably in the aero tooling sector. Major players in aero tooling and maintenance, repair, and overhaul (MRO) sectors maintain strong footholds in the European market.

Sales	2022		2023		2024	
	Domestic Sales	Export Sales	Domestic Sales	Export Sales	Domestic Sales	Export Sales
AZAD Engineering Limited	21.9%	78.1%	19.6%	80.4%	13.0%	87.0%
Dynamics Technology Limited	25.5%	74.5%	23.5%	76.5%	NA	NA
MTAR Technologies Limited	37.3%	62.7%	20.0%	80.0%	NA	NA
Unimech Aerospace & Manufacturing Private Limited	8.94%	91.06%	4.80%	95.20%	2.36%	97.64%

	2022		2023		2024	
Sales	Domestic Sales	Export Sales	Domestic Sales	Export Sales	Domestic Sales	Export Sales
Paras Defence	87.3%	12.7%	84.2%	15.8%	NA	NA
Data Patterns	87.9%	12.1%	84.0%	16.0%	93.8%	6.2%

Source: Website, Annual reports and Frost & Sullivan

Note: Information for private companies and few of the above companies are not completely available

Comparison of EBITDA of Key Players

The EBITDA of Unimech grew highest at 220.2% CAGR between the years FY2022 - 2024.

EBITDA (INR Million)	FY2022	FY2023	FY2024	CAGR FY2022- FY2024
AZAD Engineering Limited	622.68	722.78	1165.88	36.8%
Dynamatic Technologies Limited	1692.3	1812.6	1594.1	-2.9%
MTAR Technologies Limited	944	1,540	1,127	9.2%
Unimech Aerospace & Manufacturing Limited	77.26	345.63	791.86	220.2%
Paras Defence	519	567	511	-0.8%
Data Patterns	1410.4	1718.1	2216.2	25.4%
Jaivel Aerospace Private Limited	22.55	35.03	NA	NA
Jendamark India Private Limited	62.37	73.96	52.52	NM
Jaisara Tooling Systems Pvt Ltd	-3.99	-4.95	NA	NA
TechEra Engineering India Limited	-37.66	40.90	NA	NA

Source: Website, Annual reports

Note: Information for private companies are not completely available

EBITDA= Revenue from operations -Total Expense + Finance Cost + Depreciation & Amortization

NM – Not Meaningful

Comparison of EBITDA Margins of Key Players

The EBITDA Margins of Unimech accounted to 37.9% in FY2024 which is the second highest amongst the key players.

EBITDA Margins	FY2022	FY2023	FY2024
AZAD Engineering Limited	32.0%	28.7%	34.2%
Dynamatic Technologies Limited	13.5%	13.8%	11.2%
MTAR Technologies Limited	29.3%	26.8%	19.4%
Unimech Aerospace & Manufacturing Limited	21.3%	36.7%	37.9%
Paras Defence	28.4%	25.5%	20.1%
Data Patterns	45.4%	37.9%	42.6%
Jaivel Aerospace Private Limited	42.4%	37.7%	NA
Jendamark India Private Limited	10.52%	10.2%	7.4%
Jaisara Tooling Systems Pvt Ltd	-302.3%	NA	NA
TechEra Engineering India Limited	-52.5%	15.5%	NA

Source: Website, Annual reports

Note: Information for private companies are not completely available

EBITDA Margin = EBITDA/Revenue from Operations

NM – Not Meaningful

Comparison of PAT of Key Players

Unimech has experienced the highest CAGR growth in PAT of around 314.0%, which is more than 3X times higher than its closest competitor. The PAT of Unimech grew from INR 33.92 million in FY2022 to INR 581.34 million in FY 2024.

PAT (INR Million)	FY2022	FY2023	FY2024	CAGR FY2022-FY2024
AZAD Engineering Limited	294.57	84.73	585.8	41.0%
Dynamatic Technologies Limited	320.6	427.9	1218.1	94.9%
MTAR Technologies Limited	608.74	1,040.75	561.13	-4.0%
Unimech Aerospace & Manufacturing Limited	33.92	228.13	581.34	314.0%
Paras Defence	271.00	359.00	300.30	5.3%

PAT (INR Million)	FY2022	FY2023	FY2024	CAGR FY2022- FY2024
Data Patterns	940	1240	1817	39.0%
Jaivel Aerospace Private Limited	7.75	17.77	NA	NA
Jendamark India Private Limited	30.51	34.40	23.73	NM
Jaisara Tooling Systems Pvt Ltd	-0.08	-0.11	NA	NA
TechEra Engineering India Limited	-62.87	13.05	NA	NA

Source: Website, Annual reports and Frost & Sullivan

Note: Information for private companies are not completely available

PAT = Total Income – Total Expenses – Taxes

NM – Not Meaningful

Comparison of PAT Margins of Key Players

Unimech has experienced the second highest PAT Margin of around 27.85% in FY2024, the PAT Margin of the company was 24.2% in FY2023.

PAT Margins	FY2022	FY2023	FY2024
AZAD Engineering Limited	15.1%	3.4%	17.2%
Dynatomic Technologies Limited	2.6%	3.3%	8.5%
MTAR Technologies Limited	18.9%	18.0%	9.7%
Unimech Aerospace & Manufacturing Limited	9.3%	24.2%	27.85%
Paras Defence	14.8%	16.2%	11.8%
Data Patterns	30.2%	27.3%	35.0%
Jaivel Aerospace Private Limited	14.57%	19.14%	NA
Jendamark India Private Limited	5.15%	4.76%	3.33%
Jaisara Tooling Systems Pvt Ltd	-5.76%	NA	NA
TechEra Engineering India Limited	-87.59%	4.94%	NA

Source: Website, Annual reports

Note: Information for private companies are not completely available

PAT Margin = PAT/Total Sales

Comparison of ROCE of Key Players

The Return on Capital Employed (ROCE) is the highest for Unimech at 54.4% for the financial year 2024, it was also the highest for the financial year 2023 at 42.9%.

ROCE	FY2022	FY2023	FY2024
AZAD Engineering Limited	15.4%	11.0%	14.1%
Dynamatic Technologies Limited	10.0%	9.6%	8.3%
MTAR Technologies Limited	13.0%	17.7%	10.3%
Unimech Aerospace & Manufacturing Limited	10.3%	42.9%	54.4%
Paras Defence	10.1%	10.6%	7.4%
Data Patterns	23.1%	14.0%	15.5%
Jaivel Aerospace Private Limited	5.0%	11.0%	NA
Jendamark India Private Limited	13.9%	15.0%	6.04%
Jaisara Tooling Systems Pvt Ltd	-45.6%	-109.1%	NA
TechEra Engineering India Limited	-30.4%	9.1%	NA

Source: Website, Annual reports

Note: Information for private companies are not completely available

EBIT/Capital Employed

EBIT: EBITDA – Depreciation & Amortization

Capital Employed: Equity attributable to shareholders + Long term debt + short term debt

Comparison of ROE of Key Players

The Return on Equity (ROE) is the highest for Unimech at 53.5% for the financial year 2024, it was also the highest for the financial year 2023 at 46.7%.

ROE	FY2022	FY2023	FY2024
AZAD Engineering Limited	24.5%	4.2%	9.1%
Dynamatic Technologies Limited	8.4%	7.9%	18.2%
MTAR Technologies Limited	12.0%	18.0%	8.3%
Unimech Aerospace & Manufacturing Limited	12.3%	46.7%	53.5%
Paras Defence	7.2%	8.7%	6.8%

ROE	FY2022	FY2023	FY2024
Data Patterns	16.4%	10.6%	13.7%
Jaivel Aerospace Private Limited	7.07%	13.94%	NA
Jendamark India Private Limited	10.60%	10.67%	6.86%
Jaisara Tooling Systems Pvt Ltd	0.22%	0.32%	NA
TechEra Engineering India Limited	-64.3%	11.78%	NA

Source: Website, Annual reports

Note: Information for private companies are not completely available

ROE= Net Income/Shareholder's Equity

Comparison of Working Capital Days of Key Players

The working capital days for Unimech was 117 days, which was the lowest in FY2024

Working Capital Days	FY2022	FY2023	FY2024
AZAD Engineering Limited	864	962	1028
Dynamatic Technologies Limited	84	125	140
MTAR Technologies Limited	584	436	434
Unimech Aerospace & Manufacturing Private Limited	140	275	117
Paras Defence	471	484	600
Data Patterns	597	645	777
Jaivel Aerospace Private Limited	423	NA	NA
Jendamark India Private Limited	444	4	125
Jaisara Tooling Systems Pvt Ltd	NA	NA	NA
TechEra Engineering India Limited	132	91	NA

Source: Website, Annual reports

Note: Information for private companies are not completely available

Working Capital Days= Inventory days + Trade receivables days – Trade payables days

Trade Receivable days is calculated as Trade receivable outstanding at the end of the year divided by Revenue from operations for the year multiplied by 365

Trade Payable days is calculated as Trade payables outstanding at the end of the year divided by Total Purchases made for the year multiplied by 365

Inventory days is calculated as Inventory outstanding at the end of the year divided by Total Cost of Goods Sold multiplied by 365

Comparison of Fixed Asset Turnover of Key Players

The fixed asset turnover ratio of Unimech was 5.16 in FY2024, which is the highest amongst the key players.

FATR	FY2022	FY2023	FY2024
AZAD Engineering Limited	1.47	1.39	1.44
Dynamic Technologies Limited	2.21	2.37	2.32
MTAR Technologies Limited	1.78	2.36	1.84
Unimech Aerospace & Manufacturing Private Limited	NA	3.51	5.16
Paras Defence	1.26	1.59	1.57
Data Patterns	7.89	5.81	4.02
Jaivel Aerospace Private Limited	0.24	0.43	NA
Jendamark India Private Limited	6.12	7.97	4.14
Jaisara Tooling Systems Pvt Ltd	0.75	0.00	NA
TechEra Engineering India Limited	1.07	3.23	NA

Source: Website, Annual reports

Note: Information for private companies are not completely available

Fixed Asset Turnover ratio= Revenue from Operations/Average Fixed Assets

Fixed assets: Property, plant & equipment + Right of use assets

COMPANY SPECIFIC THREATS AND CHALLENGES

Threats

- Heavy dependency on the Aerospace Segment:** The revenues of the company heavily depend on the aerospace segment, the ongoing issues in the production of narrow body aircraft from Boeing could hamper the revenues from the sale of equipment to OEMs. However, the sale to MROs could increase due to the additional checks that might be required on specific model of aircraft from Airbus and Boeing.


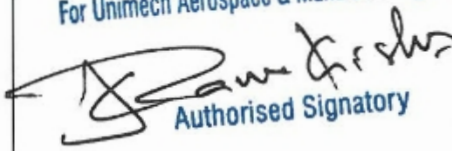
- **Lack of guaranteed revenue flow:** Unlike a continuous production line, the revenue of Unimech is dependent on highly specialized work based on the client requirement. In case of a Tier 1 or Tier 2 aircraft program supplier, the revenues are guaranteed based on the delivery plan for the year. In case of Unimech, the revenue flow is PO based than program based.
- **Customer Concentration:** The segment concentration skewed towards the Aerospace segment and the customer concentration focussing on a few customers in the industry is a multi-dimensional challenge. Globally, there are limited licensees who are approved by major OEMs for supplying aero-tooling products which results into a customer concentration for the players like Unimech operating within this segment.

Challenges

- **PEC Manufacturing:** The company needs to focus on the PEC manufacturing which is a strong area for some of the companies which are used in peer comparisons. PEC manufacturing helps companies to grow exponentially due to the stronger dependency on each other at the component level. In case of PEC, the supplier is a part of the flying part or non-flying part of the value chain, which is more promising than a support equipment player.
- **Delivery Time & First Time Right:** "First time right" manufacturing is a quality control philosophy aimed at eliminating defects and reducing waste by ensuring that products are manufactured correctly the first time. In case of standardised products, it is easier to achieve "First time right". However, in case of Unimech the products are highly customized and is a key challenge to ensure "First time right" to ensure timely delivery of the product.

Letter of Agreement:

By signing this agreement both parties commit to the project as laid out in its entirety in the proposal dated **March 19 2024** and the terms and conditions outlined in this document

Engagement Title	Unimech - Industry Research Report
Invoicing Value	INR 32.00 Lacs + applicable taxes
Invoicing Terms	<ul style="list-style-type: none"> • 40% on signed acceptance of the engagement letter • 30% on the submission of the draft report • 30% on the submission of the final report
Payment Terms	Due Now
Whether PO is mandated by client before sending the invoice	NO
Parties to this Contract:	
Frost & Sullivan (India) Private Limited ASV Hansa, No. 53 Greams Road Thousand Lights, Chennai – 600 006, Tamil Nadu Phone: 91.44.61606666 Fax: 91.44.42300369 CIN-U74140TN1999PTC079226 GSTIN*: 33AAACF4252A1ZE	Unimech Aerospace & Manufacturing Pvt.Ltd #543,14 th Cross, 7 th Main, 4 th Phase , Peenya Industrial Area,Bangalore-560058. GST Details: 29AABCU9719Q1ZC TAN Details: BLRU04066G
Signature:  <p>Shylesh Narayanan Digitally signed by Shylesh Narayanan Date: 2024.03.20 21:28:29 +05'30'</p>	Signature: For Unimech Aerospace & Manufacturing Pvt. Ltd.  Authorised Signatory
Name: Shylesh Narayanan	Name: Ramakrishna Kamojhala
Title: Vice President & Country Head – South Asia	Title: Director
Date: 20th March 2024	Date:

F R O S T & S U L L I V A N

Unimech - Industry Research Report



March 19, 2024

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Frost & Sullivan: Introduction

Founded in 1961, we are a global company with 40+ offices on 6 continents. Frost & Sullivan has the broadest industry coverage of any company in the world - covering 10 key industries, 35 sectors, and 300 markets. As the market leader in growth consulting, we deliver a global perspective that companies need to be successful in a truly global economy.





Frost & Sullivan's focus is to help companies achieve real and sustainable growth. Our market intelligence, customized growth consulting, growth strategies and IPO support, enable CEOs and their growth teams to identify growth opportunities, effectively evaluate which have the highest probability for success, and create highly effective collaborative teams that deliver results.

Frost & Sullivan works closely with companies and their management teams to accelerate growth and achieve best-in-class position in growth, innovation, and leadership. The company's Growth Partnership Service provides the CEO and the CEO's Growth Team with disciplined research and best practice models to drive the generation, evaluation, and implementation of powerful growth strategies. Frost & Sullivan leverage's over 47 years of experience in partnering with Global 1000 companies, emerging businesses, and the investment community.



- i. Market Intelligence Services
- ii. Growth Consulting Services
- iii. Growth Implementation Services

Our Expertise

 <p>Experience</p>	<ul style="list-style-type: none"> • 60 years of proven global experience • Trusted partner of investors, Corporates & governments
 <p>Coverage</p>	<ul style="list-style-type: none"> • Industry convergence through comprehensive coverage • Global footprint to match clients' needs
 <p>Analytics</p>	<ul style="list-style-type: none"> • Innovation Generator™ driving six analytical perspectives • Proprietary growth tools & frameworks
 <p>Best Practices</p>	<ul style="list-style-type: none"> • Growth Pipeline Engine™ and Companies to Action™ • Ten Growth Processes: best practices foundation

Client Impact

<ul style="list-style-type: none"> • FUTURE GROWTH POTENTIAL: Maximized through collaboration
<ul style="list-style-type: none"> • GROWTH PIPELINE: Continuous flow of Growth opportunities
<ul style="list-style-type: none"> • GROWTH STRATEGIES: Proven Best Practices
<ul style="list-style-type: none"> • INNOVATION CULTURE: Optimized Customer Experience • ROI & MARGIN: Implementation Excellence • TRANSFORMATIONAL GROWTH: Industry Leadership

Frost & Sullivan Global Reach:

What makes Frost & Sullivan unique?

- **Focused Exclusively on Growth** – Frost & Sullivan works with clients to develop innovative growth strategies based on market intelligence, best practices, and industry thought leadership.
- **Broadest Industry Coverage of any Company Globally** – Today more than ever it is essential that companies look at more than just their own industry. Economic shifts and emerging technologies are creating both competition and growth opportunities every day and successful companies must look at a number of industries and markets in which to build successful growth strategies.
- **Global Team of Analysts and Consultants** – With over 1,800 industry analysts and consultants in 40 offices covering 80 countries, Frost & Sullivan is well positioned to ensure clients have a timely understanding of global and regional industries and markets. We offer global support, coverage, and perspectives allowing clients to effectively operate in today's global marketplace.
- **Industry and Career Focus** – Frost & Sullivan understands that executives need more than just industry information; they need to capture best practices about ways to make their contribution to their companies more effective. By researching and capturing best practices, bringing together industry thought leaders with the most encompassing market intelligence.
- **360 Degree Perspective** – Frost & Sullivan's proprietary approach integrates 7 key research methodologies to significantly enhance the breadth and accuracy of decision-making capabilities.
- **From Market Research, IPO Support to implementation of marketing programs-** Building on our comprehensive research base covering market, technology, economic and customer research-Frost & Sullivan works closely with clients to create successful integrated marketing programs to enhance our clients' brand, create powerful demand generation programs and support revenue generation programs. Continuous Market Monitoring – Frost & Sullivan produces a market information database that is considered one of the best collections of high technology information, market research, and intelligence in the world. Our leading industry analysts add to this daily from our global research offices.

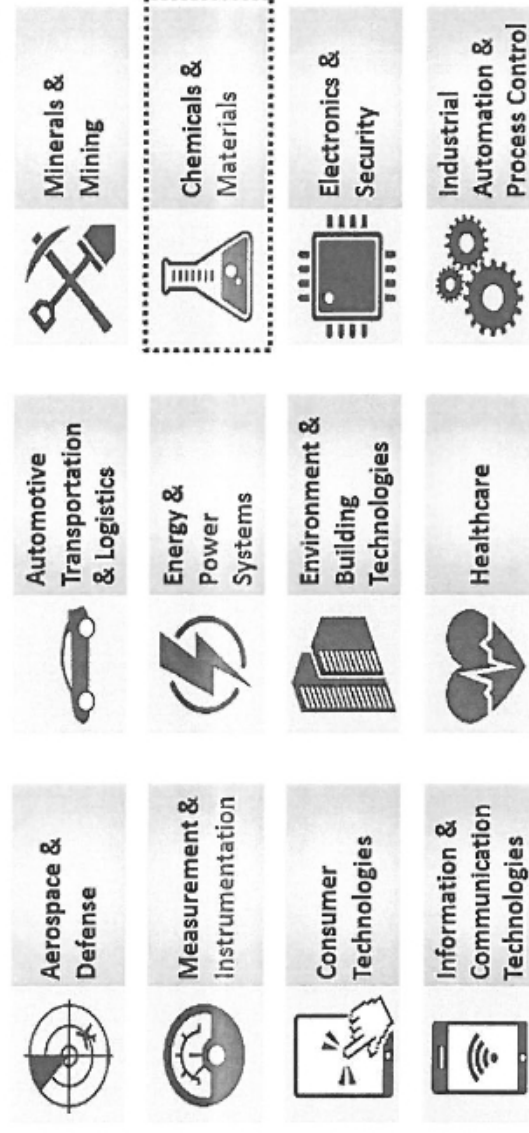
Industries & Markets

Frost & Sullivan gives our clients visibility to the most extensive range of growth opportunities, because we have the broadest industry and market research coverage of any company globally. With over 1,800 analysts and consultants on the ground in markets around the globe - we are your global partner.

Our proprietary methodology helps us track multiple industries seamlessly and provide our clients with information of their industries and also their support and servicing industries. Our Methodology enables a client to have

- Continuous access to leading global research that encompasses economic, technology, industry, competitive, customer, and best practices information to make critical growth decisions
- Market information and analysis across a broad industry spectrum that ensures clients maintain a close eye on their markets, as well as complementary and converging markets
- Access to global Industry Analysts and Thought Leaders to personally discuss critical growth issues and gain a more in-depth perspective on the markets
- Real-time technology intelligence, including emerging and disruptive technologies, new R&D breakthroughs, and technology forecasting and impact analysis
 - Comprehensive analysis of key growth markets to provide clients with financial, marketing, and business development information on current trends and issues that impact investment and financial decisions

Our Industry Coverage



Project Background

Unimech is known for being a global and specialist manufacturer supplying complex tooling, mechanical assemblies, structural fabrications, and precision components for companies in the aerospace, defense, power generation, and semiconductor sectors

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 - a. Focus on the UDAN scheme – initial outlay and current progress including some literature around planned pipeline as well.
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 1. Aerospace
 2. Defence
 3. Industrial solutions
 4. Others

8. Overview of Aero Engine tooling Market

Classification of Aero engines into different types of Passenger Aircraft and Defence Aircraft

Section to include market sizing between 2018-2028E

9. Passenger Aircraft Aero Engine Tooling
 - I. Split between Narrow body & wide body passenger aircraft
 - o manufacturers
 - o types of engine
 - o market share of that engine within the segment
 - o List of Licensee's manufacturing tooling & ground support equipment for aircraft and aero engine manufacturers

Defence Aircraft Aero engine tooling

- I. Split between Transport & Fighter aircraft
 - o manufacturers
 - o types of engine
 - o market share of that engine within the segment

- o List of Licensee's manufacturing tooling & ground support equipment for aircraft and aero engine manufacturers

10. Global Overview of airframe tooling market

- a. Commentary on global & domestic airframe tooling market
- b. Trend and outlook (market size in USD mn) on the global airframe tooling market between 2018 – 2028
 - i. Sizing done by classification of airframe by different types of Passengers, Commercial and Defence Aircrafts
 - 1. Within passenger aircrafts – further split by narrow body & wide body aircraft airframe tooling

11. Global Overview of GSE (Ground service equipment) & MRO Tooling

- a. Commentary on global & domestic GSE & MRO Tooling market
 - i. How growth in domestic GSE & MRO Tooling is tied to Number of airports globally (historical + projections)
 - ii. Growth in MRO centres globally
 - iii. Demand for GSE and growth drivers
- b. List of Manufacturers & their market share of top 3
- c. Trend and outlook (market size in USD mn) for the GSE & MRO tooling market between 2018-2028
 - i. Key trends in GSE & MRO Tooling market

12. Global overview of Precision Engineered Components for Aerospace & Defence, Semiconductor manufacturing equipment, electromechanical subsystems for nuclear applications, braking & transmission systems.

- a. Overview & commentary on the segments mentioned above
- b. Trend and outlook on market sizes for each of the segments mentioned above in USD mn split between 2018-2028E
 - i. Split between Geographies
 - a. North America
 - b. Europe
 - c. Asia Pacific – specific focus on India
 - d. Latin America
 - e. Others

13. Peer Analysis

(4-5 peers to be finalized) – comparison to be done on data available in public domain -

- i. Company profile
- ii. Geographical presence
- iii. Financial parameters
- iv. Operating parameters
- v. Product portfolio

- vi. Market share in each key segment viz. aero-engine tooling, airframe tooling, Tooling for industrial gas turbines, complex assembly manufacturing solutions
- vii. Keyclientele – Best Effort basis

Comments marked in red are not possible to obtain

Timelines:

6-7 Weeks from the date of signing of the LoA

- On completion, specific chapters will be shared by F&S for client feedback
- The project will commence 3 days from receipt of confirmation

Commercials

INR 32.00 Lacs + Applicable Taxes

Invoicing Terms:

- 40% on signed acceptance of the engagement letter
- 30% on the submission of the draft report
- 30% on the submission of the final report

Payment Terms:

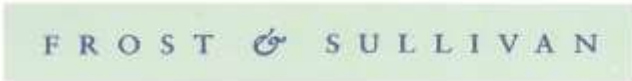
- Due now

Terms & Conditions:

- All invoices are due upon receipt. Unpaid invoices not paid within 30 days will be subject to a 1.5 percent late fee per month past due.
- Any change in the scope or content of work from that stated in the project scope will be reflected in a change of work order, agreed upon by both the Client and Frost & Sullivan. The revised scope may reflect additional billing as required and may result in a revised invoice or be reflected in a time and expenses billing. This additional work will begin only when the change order signed by the Client is received by Frost & Sullivan.
- The stated project fee includes the delivery to the Client at the project's completion of electronic copies of the research deliverables for this project in PowerPoint, Word or Excel formats.
- Frost & Sullivan will undertake on update within the scope of study based on query coming in from client to one or two sections of the study based on recent updates that has been published in the public domain within a period of 120 days from the date of delivery of the report. Any updates exceeding the above will be reviewed by Frost & Sullivan with additional cost.
- Frost & Sullivan retains the right to use market related knowledge from this project as part of its ongoing research, with the exception of confidential materials that provide or relate to Client information, customized metrics and strategic recommendations developed specifically for the Client in the context of this project.
- Written deliverables may be reproduced in printed and electronic format for distribution within the client organization. Any part of this report that is used in public domain communications (e.g.

press releases) be reviewed and approved by Frost & Sullivan prior to their publication. This is to assure that any data or conclusions are presented in the proper context, to avoid any misunderstanding by the reader or audience, and to ensure the accuracy of the data.

- Neither the Client nor its parent or any subsidiary organization will actively solicit to employ any Frost & Sullivan employee connected to this project for a period of 12 months following project completion. Should such an event occur, The Client agrees to damages of two times the person's annualized salary, due and payable immediately to Frost & Sullivan.
- Frost & Sullivan will always strive to provide first-rate work. However, there is no representation of certainty, express or implied, by Frost & Sullivan, except in the case of demonstrable negligence on the part of Frost & Sullivan. This is because the markets we study have varying degrees of fragmentation. The Client acknowledges this and accepts this point. The Client waives any claim to actual, consequential, or punitive damages against Frost & Sullivan based on their reliance on Frost & Sullivan's work, except in the case of demonstrable negligence on the part of Frost & Sullivan.
- Some data may be considered proprietary or sensitive by companies and/or individuals to be interviewed or surveyed, and they may be unwilling to divulge any given piece of information or data to Frost & Sullivan. All research and analysis will therefore be executed on a "best efforts" basis.
- The Client shall have 10 business days following the final presentation of the project results to request clarifications or submit questions that are reasonable and within the original scope of the project. Additional work beyond the scope of the project or the 10 business days will be billed on a time and expenses basis.
- The Client may terminate this agreement provided there is a reasonable basis and that an agreement is signed in writing by both parties. Work on the engagement will cease on the day that the request to terminate is received by Frost & Sullivan. The Client agrees to pay Frost & Sullivan
 - a pro rata fee for tasks accomplished plus related direct expenses incurred prior to termination
 - a cancellation penalty of 10% of the full contract value,
 - Any costs Frost & Sullivan has incurred and/or any non-refundable portion of committed costs incurred prior to Frost & Sullivan receiving the engagement termination request.
 - Termination charges will be invoiced to the Client and must be paid in full immediately.
- Frost & Sullivan shall not be liable for delays or failures in performing its obligations resulting from any cause beyond Frost & Sullivan's reasonable control. In the event of any material delay, Frost & Sullivan will notify the Client and specify the revised schedules as soon as practicable.
- Both parties must agree upon any change, extension or reduction in the scope of the project in writing. The revised scope will be reflected via either a revised letter of engagement or a time and expenses billing, which will reflect additional billing as required to complete additional work.
- The Client may request Frost & Sullivan to make additional presentations of results of this project beyond what has been specified in the project scope. Frost & Sullivan will bill the Client on a time and expenses basis, including preparation, presentation and time.
- All of our material is by default written in English, unless it has been specifically agreed in the context of the project definition that our material would be written in another common language. In case the Client wishes to have our material translated in an additional language all translation costs will be charged to the Client.



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www.frost.com
CIN No: U74140TN1999PTC079226

Date: August 17, 2024

To

The Board of Directors

Unimech Aerospace & Manufacturing Limited

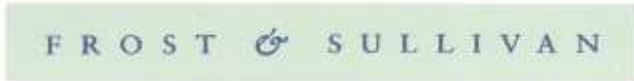
538, 539, 542 & 543, 7th Main of Peenya IV Phase Industrial Area,
Yeshwanthpur Hobli,
Bangalore, North Taluk - 560058,
Bangalore, Karnataka, India
("The Company")

Dear Sir/Ma'am,

Re: Proposed initial public offering of equity shares of Rupees 5 each ("Equity Shares") of Unimech Aerospace & Manufacturing Limited (the "Company" and such initial public offering, the "Offer")

With reference to the captioned matter, we hereby accord our no-objection and our consent to the inclusion/ reproduction of our name our name, Frost & Sullivan (India) Private Limited in relation to the Report (*as defined hereinafter*), to our report titled "*Overview of Global Tooling & PEC Market*" dated August 17, 2024 (the "**Report**") and its contents or any extract thereof, being included in any document issued by the Company in connection with the Offer, including the draft red herring prospectus ("**DRHP**") intended to be filed by the Company with the Securities and Exchange Board of India (the "**SEBI**") and any relevant stock exchange(s) where the Equity Shares are proposed to be listed (the "**Stock Exchanges**"), and the red herring prospectus ("**RHP**") and the prospectus ("**Prospectus**") that the Company intends to file with the Registrar of Companies, Bangalore, Karnataka (the "**RoC**") and with the SEBI and the Stock Exchanges, and in any publicity material, research report, press release, presentation any other document to be prepared, issued or filed for any purpose, including in any international supplements of the foregoing, preliminary international wrap, international wrap, publicity material, press/media releases, road show investor presentation(s), annual reports, research reports or marketing material prepared by the Company and its advisors in connection with the Issue (collectively, the "**Offering Materials**") in the future as well. In this regard, we confirm that no, inter alia, consent, approval, or permission will be required by the Company in the future in connection with using our name and/ or contents of the Report, in full or in part. We confirm that all information contained in the Report has been obtained by us from sources believed by us to be true and reliable and after exercise of due care and diligence by us. We further confirm that we have, where required, obtained requisite consent in relation to any information used by us in the Report..

We also give our consent to include this letter of consent and the Report as part of the section titled "*Material Contracts and Documents for Inspection*" as material document in the DRHP, RHP and the Prospectus which will be available to the public for inspection in relation to the Issue from the date of the DRHP until the Bid/Issue Closing Date and may be accessed online on the Company's website through a link provided in the Offering Materials. We also consent to disclose the date of our appointment for the purpose of preparing/ commissioning the Report, in the Issuing Materials. and authorize you to make the Report available for inspection in accordance with applicable law. We have no objection with you sharing the Report, or any extract thereof, with any or judicial authority, as required by law, or regulation in relation to the Offer or pursuant to an order passed by any such regulatory or judicial authority.



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We confirm that we are not, and have not in the past, been engaged or interested in the formation, or promotion, or management, of the Company. Further, we are an independent agency and neither the Company, nor its directors, promoters, KMPs, SMPs and any subsidiary, nor the book running lead managers to the Offer (as listed in Annexure A), is a related party to us as per the definition of “related party” under the Companies Act, 2013 and the Securities and Exchange Board of India (Listing Obligations and Disclosure Requirements) Regulations, 2015, each as amended, as on the date of this letter.

We further confirm that there are no further consents, permissions, approvals or intimation required by the Company and its advisors in connection with using our name for reproducing the information contained in the Report in full or in part, in any Issuing Materials, provided that it is ensured that disclaimer (as provided below) is also reproduced with such Issuing Materials.

We declare that we do not have any direct/ indirect interest in or relationship with the Company or its promoters, directors or key managerial personnel or senior management (as listed in Annexure A) as of the date of this letter, and also confirm that we do not perceive any conflict of interest in such relationship/ interest while issuing this Report. We confirm that we and our associates do not hold any Equity Shares of the Company.

We also confirm that we will provide the BRLMs the backup data used in the report in a Data book along with the requisite consents for usage of information / data used by us in our Report and will participate in due diligence calls in relation to the Report, if and when requested. Further, we consent to the Report and our consent being hosted on the website of the Company, being made available to the public on such website and a link to such Report being disclosed in the Offer Documents.

We confirm that all information contained in the Report has been obtained by us from sources believed by us to be true and reliable and after exercise of due care and diligence by us. We further confirm that we have, where required, obtained requisite consent in relation to any information used by us in the Report.

We further confirm that the above information in relation to us is true, correct and fair and there is no untrue statement or omission which would render the contents of this certificate misleading in its form or context.

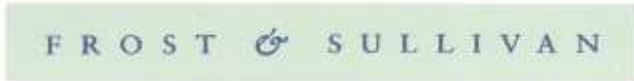
We represent that our execution, delivery and performance of this consent have been duly authorized by all necessary actions (corporate or otherwise).

We also agree that such disclosures would be made only as deemed fit by the Company and the book running lead managers appointed in relation to the Offer (the “BRLMs”).

This letter does not impose any obligation on the Company to include in any Offering Material all or any part of the information with respect to which consent for disclosure is being granted pursuant to this letter.

We hereby consent to this certificate being disclosed by the Book Running Lead Managers, if required (i) by reason of any law, regulation or order of a court or by any governmental or competent regulatory authority, or (ii) in seeking to establish a defense in connection with, or to avoid, any actual, potential or threatened legal, arbitral or regulatory proceeding or investigation.

This letter may be relied upon by the Company, the book running lead managers and the legal advisors in relation to the Offer. This letter may be delivered or furnished to any governmental or regulatory authority, as may be required. Further, we also authorize you to deliver this letter of consent to the RoC pursuant to the provisions of Section 26 and



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32 of the Companies Act, 2013 and rules and regulations made thereunder, or SEBI, Stock Exchanges or pursuant to an order passed by such regulatory or judicial authority or otherwise.

We undertake to inform you promptly, in writing, of any changes within our knowledge, to the above information until the Equity Shares commence trading on the Stock Exchanges, pursuant to the Offer. In the absence of such communication from us, the above information should be considered as updated information until the Equity Shares commence trading, on the Stock Exchanges, pursuant to the Offer.

We agree to keep the information regarding the Offer, your request and this consent strictly confidential.

All capitalized terms referred to herein, unless specifically defined therein, shall have the meanings ascribed to them in the Offering Materials.

You agree and undertake not to misrepresent, make any changes to, obliterate or tamper with the Report or present any part thereof out of context or in violation of applicable laws and regulations, if any. Further, you acknowledge and agree that the extent permissible under applicable law, Frost & Sullivan (India) Private Limited does not accept responsibility for the Offer Documents or any part thereof except in respect of and to the extent of the Report reproduced or included in the Offer Documents subject to the below stated disclaimer. You also agree to reproduce the Report on an 'as is where is basis' clearly mentioning the document source & date of release, and to ensure that the Report consisting of charts/graphs also contains the relevant texts explaining the charts/graphs.

Given below is the disclaimer to be used in the Offering Materials.

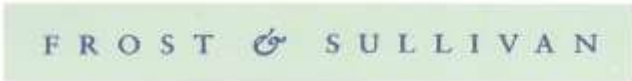
“Overview of Global Tooling & PEC Market has been prepared for the proposed initial public offering of equity shares by Unimech Aerospace & Manufacturing Limited (the “Company”).

This study has been undertaken through extensive primary and secondary research, which involves discussing the status of the industry with leading market participants and experts, and compiling inputs from publicly available sources, including official publications and research reports. Estimates provided by Frost & Sullivan (India) Private Limited (“Frost & Sullivan”) and its assumptions are based on varying levels of quantitative and qualitative analyses, including industry journals, company reports and information in the public domain.

Frost & Sullivan has prepared this study in an independent and objective manner, and it has taken all reasonable care to ensure its accuracy and completeness. We believe that this study presents a true and fair view of the industry within the limitations of, among others, secondary statistics and primary research, and it does not purport to be exhaustive. The results that can be or are derived from these findings are based on certain assumptions and parameters/conditions. As such, a blanket, generic use of the derived results or the methodology is not encouraged

Forecasts, estimates, predictions, and other forward-looking statements contained in this report are inherently uncertain because of changes in factors underlying their assumptions, or events or combinations of events that cannot be reasonably foreseen. Actual results and future events could differ materially from such forecasts, estimates, predictions, or such statements.

In making any decision regarding the transaction, the recipient should conduct its own investigation and analysis of all facts and information contained in the prospectus of which this report is a part and the recipient must rely on its own examination and the terms of the transaction, as and when discussed. The recipients should not construe any of the



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contents in this report as advice relating to business, financial, legal, taxation or investment matters and are advised to consult their own business, financial, legal, taxation, and other advisors concerning the transaction.”

Yours faithfully,

For and on behalf of Frost & Sullivan (India) Private Limited




Authorized Signatory

Name: Robin A Joffee

Designation: Partner and Managing Director - MEASA

Place: Dubai

Cc:

Anand Rathi Advisors Limited
11th Floor, Times Tower, Kamla Mills Compound,
Senapati Bapat Marg, Lower Parel
Mumbai 400 013,
Maharashtra, India

Equirus Capital Private Limited
1201, C Wing, Marathon Futurex,
N.M. Joshi Marg, Lower Parel
Mumbai 400 013,
Maharashtra, India
(together the “Book Running Lead Managers” or “BRLMs”)

Legal Advisors to the Company
Trilegal
One World Centre
10th Floor, Tower 2A &2B,
Senapati Bapat Marg,
Lower Parel (West),
Mumbai 400 013 Maharashtra

Legal Advisors to the BRLMs

J. Sagar Associates
27th Floor, One Lodha Place,
Lower Parel (West),
Mumbai – 400 013
Maharashtra, India

Annexure A

List of Co. Board of Directors

<u>Sr. No.</u>	<u>Name of Director</u>	<u>Director Identification Number</u>	<u>Designation</u>	<u>Start Date</u>
1	Anil Kumar P	07683267	Chairman and Managing Director	September 1, 2018
2	Ramakrishna Kamojhala	07004517	Whole-time Director and Chief Financial Officer	July 31, 2017
3	Mani P	08042129	Whole-time Director	September 1, 2018
4	Rajanikanth Balaraman	07894421	Whole-time Director	July 31, 2017
5	Preetham S V	07683268	Whole-time Director	December 17, 2016
6	Mukund Srinath	00025017	Independent Director	July 3, 2024
7	Ashok Tandon	06534280	Independent Director	July 3, 2024
8	Vidya Rajarao	07878459	Independent Director	July 3, 2024
9	Pavan Krishnamurthy	00579613	Independent Director	July 3, 2024
10	Sridhar Ranganathan	07637826	Independent Director	July 3, 2024